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Volume 7 (6 issues) will be published in 2020 pISSN: 2349-8471, eISSN: 2455-6238

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INDIAN JOURNAL OF ANESTHESIA AND ANALGESIA

May – June 2020
Volume 7 Number 3

Contents

Editorial

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(2): 657–658

Pulmonary Aspiration During Extubation

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Introduction

Pulmonary aspiration is the inhalation of oro-pharyngeal or gastric contents into the larynx and the respiratory tract. Mendelson described the potential consequences of abolished airway reflexes under anaesthesia and the subsequent aspiration of gastric contents, known as Mendelson's syndrome. Pulmonary aspiration occurs 1 in 900 to 1 in 10000 cases of general anaesthesia administered. Mortality rate of patients who had aspiration ranges from 0 to 4.6%. The incidence of aspiration under anaesthesia is greater with higher ASA status and emergency surgery.

Prevention of pulmonary aspiration is one of the main goals of anaesthetic practice. Problems associated with extubation is often more common than those occuring at intubation. Aspiration of solid matter can cause hypoxia by physical obstruction, whereas aspiration of acidic gastric fluid can cause pneumonitis with progressive dyspnoea, hypoxia, wheeze, patchy collapse with consolidation in the chest radiograph. The risk of morbidity and mortality increases with bronchial exposure to greater volumes and acidity of the aspirated material.

Mechanism to prevent pulmonary aspiration

The gastro-oesophageal junction, upper oesophageal sphincter, and protective laryngeal reflexes are the physiological mechanisms to prevent aspiration, which are attenuated during general anaesthesia. The acute angle between the oesophagus and stomach assists the lower oesophageal sphincter (LOS) in protecting the oesophagus from gastric acid reflux. Reinforced by crura of the diaphragm, LOS resting pressure exceeds gastric pressure creating a physiological barrier to gastro-oesophageal reflux, known as the barrier pressure. During general anaesthesia, reflux may occur because this barrier pressure is reduced by the relaxation of the LOS caused by drugs such as anticholinergics, opioids, and anaesthetic agents.

Reflux of gastric contents into the oesophagus occurs in both healthy individuals and those with gastro-oesophageal reflux disease (GORD) when the LOS transiently relaxes in the absence of swallowing. Protective upper airway reflexes like cough and laryngospasm are attenuated by reduced levels of consciousness including emergence from general anaesthesia. Elderly patients are particularly prone to aspiration as they have less active airway reflexes.

Most anaesthetic techniques attenuate the protective physiological mechanisms that prevent regurgitation and aspiration. Inadequate depth of anaesthesia or unexpected responses to surgical stimulation may evoke gastrointestinal motor responses, such as gagging or recurrent swallowing, increasing gastric pressure above LOS pressure facilitating reflux. This can extend to varied extent during extubation and recovery period.

Risk factors for pulmonary aspiration

Patient factors: Full stomach (Emergency surgery, inadequate fasting time, gastrointestinal obstruction), delayed gastric emptying (diabetes mellitus, chronic kidney disease, trauma, opioids, pregnancy, morbid obesity), higher ASA status. *Surgical factors:* Upper gastrointestinal surgery, lithotomy or head down position, laparoscopy. *Anaesthetic factors:* Light anesthesia, supra-glottic airways, positive pressure ventilation, difficult airway, airway device (First generation supraglottic device).

Pathology of the gastrointestinal tract delays gastric emptying, and impairs the function of the LOS. These effects are compounded in emergency surgery and lithotomy position. In pregnancy, the gravid uterus displaces the stomach, altering the angle between the oesophagus and stomach. This is exacerbated by maternal obesity, multiple pregnancy, and polyhydramnios. Higher concentrations of progesterone reduce barrier pressure further by relaxing the LOS, whilst decreased concentrations of the peptide hormone motilin delays gastric emptying.

Process of extubation

An unprotected airway, light depth of anaesthesia, and other predisposing risk factors for aspiration significantly increase the risks of aspiration.When deciding to extubate one must consider

(a.) was there any difficulty in controlling the airway?

(b.) what is the risk of pulmonary aspiration?

Preparation for extubation

This includes recovery from neuromuscular blockade, hemodynamic stability, normothermia

and adequate analgesia. Ventilation with 100% oxygen and alveolar recruitment maneuvers should be considered in appropriate cases. Pharyngeal and tracheal suctioning, removal of throat pack and placement of bite block if needed should be done in deep plane of anaesthesia. A bite-block often ensures a secure airway through the tracheal tube during emergence. Oropharyngeal airways are not recommended as bite blocks as they can cause dental damage. Instead a rolled guaze may be inserted between the molars. Alternatively, the tracheal tube may be left *in situ* with cuff deflated, so that patients can breathe around it if the tube is bitten during emergence. A nasal tracheal tube withdrawn to the nasophrynx can be used as a nasal airway during emergence. Gastric insufflations can increase the risk of pulmonary aspiration after extubation and can impede with ventilation. If needed, orogastric tube may be used to deflate the stomach before extubation. Application of positive pressure just before cuff deflation can help to expel the secretions collected above the endotraheal tube cuff. Inspection of the pilot balloon for cuff deflation is necessary to prevent vocal cord trauma during extubation. Before extubation, everything should be ready for emergency reintubation in case the situation demands.

Awake versus deep extubation

The decision should be taken weighing the risks and benefits of the individual scenario. Awake patient is able to maintain a patent airway without aspiration due to the pharyngeal muscle tone and airway reflexes. Extubation under deep anaesthesia decreases cardiovascular stimulation and reduces the incidence of coughing and straining on the tube, but has the risk of hypoventilation and pulmonary aspiration if regurgitation of gatric content or vomiting occurs. Children show greater incidence of upper airway complications with awake extubation due to increased airway reactivity. In children, extubation in the recovery position while still anaesthetized is a common practice.

Position at extubation

The sniffing position is the standard for extubation, as the patient is optimally positioned for airway management. Extubating in left lateral, head-down position can be used in those with high risk for aspiration as it maintains airway patency by keeping the tongue away from the posterior pharyngeal wall. Laryngoscopy and reintubation is easy in this position for the experienced anaesthesiologists. Extubation in supine position provides the relative ease of reintubation in this position. A semi-upright position facilitates spontaneous respiration and diaphragmatic expansion, aids in effective cough reflex, increases functional residual capacity (FRC) and encourages lymphatic drainage and reduction of airway oedema. Recent practice guidelines for patients with obstructive sleep apnoea recommend semi-upright, lateral or any non-supine position for extubation and recovery. Extubation in prone position may be necessary after some procedures like spinal surgery. After reversal of neuromuscular block, spontaneous regular ventilation has to be achieved after which anaesthesia is discontinued and extubation performed with eyes open or on purposeful movements.

Timing of extubation

Extubation is usually carried out at end-inspiration when the glottis is fully open to prevent trauma and laryngospasm. Direct laryngoscopy, suctioning of the posterior pharynx, administration of 100% oxygen, ventilation to aid washout of inhalation agents, and positive pressure breath at extubation to prevent atelectasis are routine manoeuvres before extubation.

Management of aspiration

This is directed to supportive treatment and organ support. Anaesthesiologist should have a high index of suspicion to recognize aspiration should it occur. Trachea should be suctioned once the airway is secure, ideally before positive pressure ventilation to prevent the distal displacement of aspirated material. Aspiration will more commonly affect the right lung because the right main bronchus is more vertical than the left. Early chest radiograph will show consolidation in up to 75% of cases and early bronchoscopy may help prevent distal atelectasis if particulate matter has been aspirated. Aspiration may lead chemical pneumonitis, bacterial pneumonia, or adult respiratory distress syndrome requiring mechanical ventilation. Antibiotics should only be used if pneumonia develops. There is no evidence that steroids reduces mortality or improves outcome.

Conclusion

The process of extubation is a critical part of airway management. Although emphasis is usually on the problems encountered during intubation, potential life threatening complications can occur during extubation. Prevention of pulmonary aspiration and timely recognition of risk factors with prompt management of aspiration if it occurs is needed for a safe anaesthetic outcome.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(2): 659–663
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.1

A Comparative Study Between Bupivacaine and Ropivacaine in Caudal Block in Paediatric Age Group (0 To 8 Years) in Unilateral Groin Surgeries

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Abstract

Introduction: Pain is an unpleasant subjective sensation which can only be experienced though not fully expressed especially in children.The regional anaesthetic techniques significantly decrease post operative pain and systemic analgesic requirements. Caudal route was chosen for this study as it is one of the simplest and safest techniques in paediatric anaesthesia with a high success rate. *Aim:* Aim of the study is to compare between 0.25% bupivacaine and 0.2% ropivacaine in caudal block in paediatric age group (0 to 8 years) in unilateral groin surgeries. *Materials and Methods*: It is a randomized controlled study comparing bupivacaine and ropivacaine in caudal epidural analgesia for lower abdominal and genital surgeries. Patients were allocated by random number table in two groups of 30 patients each to receive 0.25% Bupivacaine (Group B) 1ml/kg or 0.2% Ropivacaine (Group R) 1ml/kg for caudal block. *Results:* No significant differences were observed among haemodynamic parameters throughout intraoperative period. Mean pain scores were more in Bupivacaine group however the difference was not statistically significant. Motor power was low in both the groups in first hr postoperatively and significantly low in Bupivacaine group in second hour, low but comparable in 3rd hr i.e. Ropivacaine group attained full motor power by 3rd hr and Bupivacaine group by 4th hr. Mean duration of sensory block in Ropivacaine group was 86.6 ± 10.2 min and in Bupivacaine group was 90.96 ± 7.29 min-not statistically significant. Mean duration of analgesia in Ropivacaine group was 5.38 ± 0.71 hrs and Bupivacaine group was 5.01 ± 0.8 hrs –not statistically significant. *Conclusion:* Local anaesthetic Ropivacaine may prove to be a better alternative to Bupivacaine via caudal epidural route in Paediatric patients in urogenital surgeries.

Keywords: Not Provided

How to cite this article:
Pasham Abbaiah Rontala Saraiah. A Comparative Study Between Bupivacaine and Ropivacaine in Caudal Block in Paediatric Age Group (0 To 8 Years) in Unilateral Groin Surgeries. Indian J Anesth Analg. 2020;7(3):659–663.

Introduction

The concept of postoperative pain relief and its utilization in the paediatric age group has improved dramatically over the recent years. The various methods of providing pain relief have some side effects which prohibit their use in children for eg.,

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Received on 18.02.2020, **Accepted on** 16.03.2020

narcotics, because of their respiratory depression, the other analgesics which cannot be given for sometime after general anaesthesia due to the fear of vomiting and aspiration, the fear of needles in the case of parenterally administered analgesics.[1]

Caudal block is usually done after the introduction of general anaesthesia and is used as an adjunct to intraoperative anaesthesia as well as postoperative analgesia in children undergoing surgical procedures below the level of the umbilicus. Caudal analgesia can reduce the amount of inhaled and IV anaesthetic administration, attenuate the stress response to surgery, facilitate rapid, smooth recovery, and provides good immediate postoperative analgesia.[2] In order to

Decrease perioperative analgesic requirements after single shot caudal epidural blockade, various additives, such as morphine, fentanyl, clonidine and ketamine with local anaesthetics have been investigated.[4]

Materials and Methods

The present study is, a randomized controlled study comparing bupivacaine and ropivacaine in caudal epidural analgesia for lower abdominal and genital surgeries was undertaken at Gandhi hospital, Hyderabad. After obtaining approval for the study from Institutional Ethics Committee, written consent was obtained from all the patients.

Inclusion criteria: Patients selected for the study were between age groups 0 to 8 years, ASA grade I and II cases scheduled for urogenital operations such as urethroplasty, herniotomy, orchidopexy.

Exclusion criteria: Children with nuero muscular diseases, with skelet al deformity problems, local infections, mental retardation, allergy to the drugs used in the study, with suspected coagulopathy.

Patients were allocated by random number table in two groups of 30 patients each to receive 0.25% Bupivacaine (Group B) 1ml/kg or 0.2% Ropivacaine (Group R) 1ml/kg for caudal block.

A resting preanaesthestic pulse rate, blood pressure and respiratory rate were recorded. Patients were fasted for 4 hours and pre medicated with oral Midazolam 0.5mg/kg 30 minutes before surgery. After applying standard monitors, general anaesthesia was induced with Thiopentone 5 mg/kg , sevoflurane and Nitrous oxide in oxygen via mask. An intravenous cannula was secured and Lactate Ringers solution was infused to provide fluid during surgery. Injection Atropine 0.02mg/kg was administered intravenously as pre medicant. Endotracheal intubation was facilitated by administering injection vecuronium bromide 0.1 mg/kg intravenously. After securing Endotracheal tube, patients were placed in left lateral position.

Procedure: Under aseptic precautions, a short beveled 22 G needle was introduced in caudal epidural space, after conforming the space 1 ml/kg of local anaesthetic agents 0.25% Bupivacaine (Group B) or 0.2% Ropivacaine (Group R) was administered slowly. After deposition of the drug in epidural space, patients were placed in supine position and anaesthesia was maintained by 1% of Halothane, 60% of Nitrous oxide in oxygen and top up doses of vecuronium bromide ($1/5^{th}$ of the loading dose of 0.1mg/kg). Baseline heart rate ,mean arterial pressure recorded before incision and after incision at 5, 10, 20, 30, 60, and 90 min of surgery, residual neuromuscular blockade was reversed and patients were transferred to the post operative ward. Using the paediatric observations FLACC, pain scale with its 0-10 score range, each patients pain intensity was assessed at the end of surgery and then every 30 min interval until the patient became fit to discharge from postoperative ward.

If the FLACC, pain scale was 4 or more , rectal Paracetomol 20 mg/kg was administered. Motor block was assessed on awakening using a four point Bromage scale. Observations were continued for 24 hours.

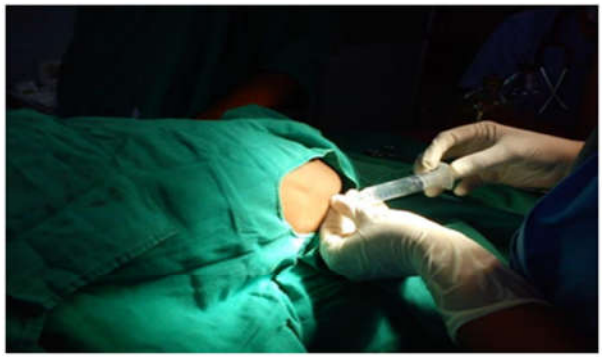

Fig. 1. Performing Caudal Block

The Statistical software namely Open Graphpad was used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc. Descriptive statistical analysis had been carried out in the present study. Results on continuous measurements were presented on Mean ± SD and results on categorical measurements were presented in Number (%). Significance was assessed at 5% level of significance.

Student t test (two tailed, independent) had been

used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Leven's test for homogeneity of variance had been performed to assess the homogeneity of variance. . Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups. Significant (p value: $0.01 < p < 0.05$)

Results

Table 1 : Comparison of type of surgeries.

Name of Surgery	Group B	Group R
Hernia Repair	17	14
Orchidopexy	8	8
Hypospadias	5	8

Table 2: Patient characteristics and clinical parameters.

Variable (Mean +/- Stdev)	Group B	Group R	p Value
Age (In Years)	4.63+/-1.75	4+/-1.96	0.19
Weight (In Kg)	11.2+/-1.95	10.76+/-2.28	0.42
Gender M:F Ratio	26:4	25:5	1(Fischers Exact Test)
Baseline Heart Rate (Beat per min)	104.16+/-8.57	103.33+/-10.26	0.72
Baseline Map	70.73+/-4.98	69.03+/-5.27	0.20

Table 3: Haemodynamics during surgery.

	B Group		Standard deviation for R group		Standard deviation for B group		p Value	
	HR	MAP	HR	MAP	HR	MAP	HR	MAP	HR	MAP
Base line	103.33	69.03	104.16	70.73	10.26	5.27	8.57	4.98	0.19	0.72
After incision 5min	100	68.03	100.47	71.23	8.46	4.79	4.72	5.17	0.79	0.159
10 min	98.3	66.7	97.16	68.53	7.63	4.54	4.55	4.76	0.48	0.15
20 min	96.76	66	96.36	68.06	7.80	4.45	4.52	5.69	0.8	0.08
30 min	95.86	66.2	95.3	67.3	8.16	4.28	4.51	4.31	0.74	0.32
60 min	95.73	65.96	94.03	66.93	7.03	3.82	5.02	4.27	0.28	0.35
End of surgery	95.4	65.26	93.66	66.76	6.74	4.15	4.30	4.11	0.23	0.16

Table 4: Post operative pain scoring in two groups FLACC score.

Duration After Operation	Group R		Group B		p Value
	Mean	SD	Mean	SD	
O hour	0.1	0.30	0.13	0.34	0.71
2 hour	1.06	0.44	1.46	0.5	0.08
4 hour	2.56	0.77	2.7	0.65	0.44
6 hour	4.46	0.68	4.86	0.97	0.86
8 hour	6.16	1.23	6.2	0.92	0.88

The calculated p value is > 0.05, So this is statistically not significant. there were no differences between the two groups in age, gender, baseline blood pressure and heart rate (Table 2).

The p value calculated by student 't' test. p value is > 0.05, hence it is not statistically significant. The preoperative, intraoperative and postoperative haemodynamic changes between the groups were comparable and were not statistically significant and therapeutic interventions were not required (Table 3).

The quality and duration of postoperative pain relief did not differ significantly between the two groups (p > 0.05). Lack of analgesia was not found in any patients during surgery and there is no haemodynamic response to initial incision. Postoperative pain score was comparable in two groups. Average pain scores were less in group R but the difference was not significant (Fig. 2).

Patients showed some amount of motor weakness in both groups immediately after surgery. But after two hours almost normal motor power was recorded in Ropivacaine group. Motor

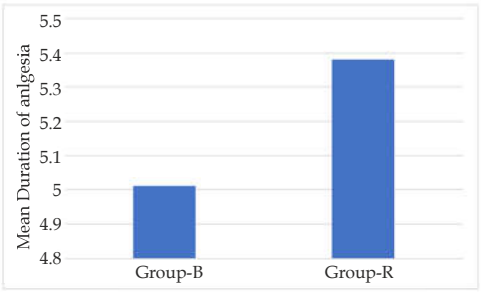

Fig. 2: Comparison of duration of analgesia

Table 5: Motor Power Scale in present study

Muscle Tone Muscle Power (Flexion)	Flaccid 0 Unable	Hypotonia 1 Partial	Normal 2 Normal
Ankle	0	1	2
Knee	0	1	2
Thigh	0	1	2
Ability to stand	0	1	2

Table 6: Assessed Motor Power in present study

Motor Power	Ohr	1hr	2hr	3hr	4hr
Group B	1 ± 0	1 ± 0	1.2 ± 0.4	1.9 ± 0.3	2 ± 0
Group R	1 ± 0	1.3 ± 0.46	1.4 ± 0.49	2 ± 0	2 ± 0
p Value		0.007	0.086	0.07	

recovery was significantly slow in Bupivacaine group in first 2hrs (Table 5).

No episodes of any clinically significant postoperative complications were recorded (Table 6).

Discussion

Children not only feel pain of same intensity as adults[1] but also, pain is associated with serious consequences, including harmful neuroendocrine responses, disrupted eating and sleep cycle and increased pain perception in subsequent painful experiences.[3,4] In addition, the invention of different pain scales has improved pain assessment in Paediatric patients and thereby, aiding in better Paediatric pain management. Control of postoperative pain is important in paediatric patients because poor pain control may result in increased morbidity and mortality. If acute pain is left untreated or not treated properly, it can also progress to chronic pain.[4] Caudal anaesthesia is the most common regional procedure to approach the extradural space in Paediatric group. It combines the advantages of being a fairly simple technique and high success rates.[35] Caudal block is usually placed after the induction of general anaesthesia and is used to provide adjunct intraoperative anaesthesia as well as postoperative analgesia in children undergoing surgical procedures below the level of the umbilicus. Caudal analgesia can reduce the amount of inhaled and IV anaesthetic administration, attenuate the stress response to surgery, facilitate a rapid, smooth recovery, and provide good immediate postoperative analgesia. Caudal block usually provide analgesia for approximately 4-6 hrs. Bupivacaine (an amide local anesthetic) has provided reliable anaesthesia and analgesia. Ropivacaine is also an amide local anaesthetic, and in adults it produces pain relief similar to that of bupivacaine with a motor block that is slower in onset, less intense, and shorter in duration. Moreover, animal studies have shown that ropivacaine appears to be less cardiotoxic than bupivacaine.[5]

Although bupivacaine is a racemic mixture of *R*-and *S*-enantiomers, ropivacaine is the first local anaesthetic to be prepared as a pure *S* -enantiomer.[1] It has been shown that block of the inactivated state of the cardiac sodium and potassium (hKv1.5) channels is stereoselective, with *R* - bupivacaine being more potent than *S* -bupivacaine. In clinical

practice, *S* -bupivacaine, which exhibits a lower affinity for sodium and potassium (hKv1.5) cardiac channels, may be a less cardiotoxic alternative to racemic bupivacaine.[6] Also, results of animal research have demonstrated that *R* -bupivacaine is more toxic than the *S* - enantiomer.[7] Bupivacaine provides reliable and long lasting post operative analgesia when given via caudal route but has more motor blockade and cardiotoxicity. Top priorities for successfully discharging patients of day care surgeries are the four A's: Alertness, Analgesia, Ambulation and Alimentation. Excessive pain, nausea and vomiting and fatigue will delay the discharge. The success of fast tracking depends on effective pain management by simple techniques.[8] Motor blockade resulting from caudal block is very distressful to children in the postoperative period and delays hospital discharge. Hence, Ropivacaine a more suitable agent for caudal epidural analgesia especially in day care surgery Pharmacokinetic studies by Khudsen et al.[9] of Ropivacaine show that 1ml/kg of 0.2% Ropivacaine by caudal block produces a maximal plasma concentration of 0.72+ 24 mg/L, which is much lower than the maximal tolerated plasma concentration of Ropivacaine in adult volunteers (2.2 + 0.8 mg/l). Habre et al.[10] reported that maximum plasma concentration of Ropivacainewas achieved at 2 hours following caudal block which is much later than for Bupivacaine (29 + 3.1) in children. Another reason of using 0.2% Ropivacaine is to avoid motor blockade in postoperative period. Low concentrations and large volumes are the key to obtaining differential block in children because of the small diameter of A-Delta and C-fibres and small distance between nodes of Ranvier. Results of present study show that a single shot caudal injection of Ropivacaine provides reliable and long lasting analgesia in paediatric patients following lower abdominal and perianal surgery. In this series, 1ml/kg of 0.2% Ropivacaine or 0.25% Bupivacaine was used for single shot caudal analgesia.

Limitations

Ultrasound hasn't been used to place caudal block which improves the safety and efficacy of the technique. Plasma concentrations of Ropivacaine and Bupivacaine has not been measured, however no signs of local anaesthetic toxicity were observed. 24 hr postoperative analgesic requirements were not quantitated, which are more predictive of efficacy of the drugs in comparision.

As the sample size is small, it cannot be concluded that the results of the present study are definitive and more trials are required before the results become conclusive

Conclusion

From the present study, it is concluded that both Bupivacaine and Ropivacaine are safe and similarly efficacious via caudal route for postoperative analgesia for urogenital procedures in Paediatric patients and Ropivacaine group had recovered the motor power early. Prolonged duration of analgesia was noted with Ropivacaine.No signs of local anaesthetic allergy and toxicity were observed. Thus the local anaesthetic Ropivacaine may prove to be a better alternative to Bupivacaine via caudal epidural route in Paediatric patients in urogenital surgeries.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 664–670
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.2

Effect of Nalbuphine as Adjuvant to Bupivacaine for Ultrasound-Guided Popliteal Nerve Block: A Prospective Randomised Comparative Clinical Study

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Abstract

Introduction: Popliteal nerve block is a useful technique for ankle and foot surgeries as it avoids complications in elderly who are prone for hemodynamic changes leading to increased morbidity and mortality. There is advantage of early post operative mobility which is essential in orthopaedic surgeries and absence of post dural puncture headache. Nalbuphine is a derivative of 14-hydroxymorphine which is a strong analgesic with mixed k agonist and μ antagonist action.The primary aim of study is to evaluate effect of adding Nalbuphine to Bupivacaine in popliteal nerve block in terms of onset and duration of sensory and motor blockade and duration of analgesia. *Study Design:* A prospective randomised comparative clinical study. *Materials and Methods:* After obtaining institutional ethical committee clearance. Sixty patients between 18 -70 years of either sex with ASA status I, II, III posted for ankle and foot surgeries were grouped randomly into two groups using simple sealed envelope method with 30 in each group. After getting informed consent from patients detailed pre anaesthetic evaluation was done on previous day of surgery. Group A received 20ml of Bupivacaine with 1ml of normal saline and group BN received 20ml of Bupivacaine with 1ml of 10mg Nalbuphine. Data presented as mean and standard deviation. The t-test was used to examine the differences between means. Statistical significance was accepted for a $p < 0.05$. *Results: Sensory blockade:* In our study we found that Group BN patients who received Nalbuphine as additive provided faster onset of sensory level blockage with mean time of onset value being 11.8 ± 2.4 (in mins) compared to Group A where mean value was 15.20 ± 1.80 (in mins) . The results were statistically significant with a p value of <0.001**. The duration of sensory level block in Group BN who received Nalbuphine as additive was 760 ± 23.3 compared to Group A where mean value was 552 ± 19 with statistically significant p value of <0.001**. *Motor blockade:* In our study we found that Group BN patients who received Nalbuphine as additive provided faster onset of motor level blockage with mean time of onset value being 14.7 ± 1.5 (in mins) compared to Group A where mean value was17.6 ± 1.1(in mins) . The results were statistically significant with a p value of <0.001**. The duration of motor level block in Group BN was 573 ± 20.6 compared to Group A where mean value was 438 ± 18.4 with statistically significant p value of <0.001**. *Conclusion:* This study demonstrates that addition of 10 mg nalbuphine to bupivacaine in popliteal nerve block in patients undergoing ankle and foot surgeries decreases time of onset of anaesthesia, shows significant increase in duration of sensory and motor blockade and also increases the post operative analgesia.

Keywords: Popliteal nerve block; USG guided; Bupivacaine nalbuphine.

How to cite this article:

Prajwal Venugopal, Preethi Narendra B, Usha Nandhini, et al. Effect of Nalbuphine as Adjuvant to Bupivacaine for Ultrasound-Guided Popliteal Nerve Block: A Prospective Randomised Comparative Clinical Study. Indian J Anesth Analg. 2020;7(3):664–670.

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Received on 27.01.2020, **Accepted on** 29.02.2020

Introduction

Regional anaesthesia techniques are used frequently as an alternative to general anaesthesia in ambulatory orthopaedic and surgical procedures For ankle and foot surgeries, particularly in patients thought unsuitable for central neuraxial block popliteal nerve block is a reliable technique. It avoids complications in elderly patients who are particularly prone for hemodynamic changes leading to increased morbidity and mortality[1]. It is associated with advantage of early post operative mobility which is essential in orthopaedic surgeries. Another advantage of popliteal nerve block over central neuraxial block is its avoidance of post dural puncture headache, making it an ideal technique for ambulatory surgeries. It can be used more readily in the presence of minor degree of coagulopathy or after head injury where central neuraxial block is relatively contraindicated[1].

Long acting local anaesthetics (LA) are commonly used for popliteal nerve block as they provide prolonged post operative analgesia and bupivacaine is the most commonly used LA for this purpose. The analgesic duration after peripheral nerve blockade with bupivacaine is longer than[2] or the sameas the duration of analgesia provided by ropivacaine.[3] Furthermore, bupivacaine is less expensive compared to levobupivacaine or ropivacaine.

Nalbuphine is a derivative of 14-hydroxymorphine which is a strong analgesic with mixed k (kappa) agonist and μ(mu) antagonist action with its analgesic effect been found to be equal to that of morphine but unlike it has a ceiling effect on respiration. Nalbuphine has the potential to maintain or even enhance μ-opioid based analgesic effect while simultaneously mitigating the μ-opioid side effects.[4]

The primary aim of this study is to evaluate the effect of adding Nalbuphine to Bupivacaine in popliteal nerve block in terms of onset of sensory and motor blockade, duration of sensory and motor blockade and duration of analgesia.

Materials and Methods

The study was a hospital based prospective, randomised , comparative clinical study. The study population consisted of 60 patients aged between 18-70 years of either sex with ASA physical status I, II and III, posted for elective ankle and foot surgeries who met the predefined inclusion and exclusion criteria. The study was conducted from April 2017 to January 2019 in RajaRajeswari Medical College and Hospital, Kambipura Bangalore after obtaining a clearance from the institutions ethical clearance committee and a written informed consent from all the patients included in the study. The patients were randomly divided into two groups using simple sealed opaque envelope method with 30 patients in each group (n = 30). Group A received 20ml of Bupivacaine with 1ml of normal saline and Group BN received 20ml of Bupivacaine with 1ml of 10mg Nalbuphine.

Selection of Patients

Inclusion Criteria

1. ASA physical status I, II and III of either sex
2. Aged between 18-70 years
3. Admitted for Ankle and Foot surgeries.

Exclusion Criteria

1. Patients with known hypersensitivity or contraindications to the study drugs
2. Infection at the site of block
3. Patients with advanced renal, hepatic, respiratory or cardiac diseases
4. Patients with severe coagulopathy
5. Pregnant patients
6. Patients with neurological, psychiatric or neurovascular disorders
7. Patient with alcohol/drug abuse
8. Patient refusal

Methodology of Study

After obtaining institutional ethical committee clearance, 60 adult patients aged be- tween 18-70 years of either sex with ASA physical status II and III, posted for ankle and foot surgeries were grouped randomly into two groups using simple sealed envelope method with 30 patients in each group. (n = 30). An informed consent was obtained from all patients and detailed pre anaesthetic evaluation was done on the previous day of surgery.

All patients were nil per orally for 6 hours for solids and 2 hours for liquids prior to surgery. Tab Alprazolam 0.25mg and Tab Ranitidine 150 mg was given on the previous night of surgery. Anaesthesia machine was checked and all the drugs and equipments necessary for emergency resuscitation was kept ready. On receiving the patient in operating room, a wide bore intravenous line was secured with 18 gauge (G) cannula.

Monitoring for electrocardiography (ECG), heart rate (HR), arterial pulse saturation (SpO_2) and non invasive blood pressure (NIBP) was done for all patients.

The sciatic nerve is considered a nerve bundle with two separate nerves: tibial and common peroneal. These two components eventually diverge 5–10 cm proximal to the crease of the popliteal fossa. The injection of local anaesthetic must occur within the sciatic nerve sheath that contains both components of the nerve. The injection is ideally accomplished at the position where both components of the nerve are within the sheath but slightly separated by adipose tissue, allowing for safe placement of the needle between them[6]. The patient was placed in the lateral position and beginning with the transducer in the transverse position at the popliteal crease, the popliteal artery was identified, aided with colour Doppler US when necessary, at a depth of approximately 3–4 cm. Just superficial to the popliteal artery the popliteal vein accompanies it. The biceps femoris muscles and the semimembranosus and semitendinosus muscles are visualised on either side of the artery. A hyperechoic, oval structure with a honeycomb pattern is seen superficial and lateral to the vein which is the tibial nerve[6,7].

To visualise the tibial and peroneal nerves the transducer should be slid proximally as they come together to form the sciatic nerve before its division. This junction usually occurs at a distance 5–10 cm from the popliteal crease but may vary in different patients. After negative aspiration for blood, test solution (20ml of 0.5% bupivacaine with either 1ml Normal Saline or 1ml 10mg Nalbuphine) was injected. Time of completion of injection was taken as time zero. Test drug was prepared and loaded in two 10ml syringes with one syringe having either 1ml Normal Saline or 1ml 10mg Nalbuphine by an anaesthesiologist who is not involved in the study. All the blocks were performed by the same investigator.

Immediately following popliteal nerve block patients were placed in supine position. Sensory block was assessed by pin prick test using 27G blunt needle every 5 minutes for the onset of block on the dorsal and plantar aspects of the foot and sensation was categorised as[8];

0 = sharp (normal sensation as of contra lateral limb)

1= dull (pin prick perceived as pressure)
2 = absent (complete loss of awareness of pinprick)

Motor block was assessed every 5 minutes for the onset by assessing plantar or dorsiflexion at the ankle and was graded as[8];

0 = normal power

1 = reduced power

2 = complete motor block

Onset of sensory and motor block, duration of blocks, quality of block were observed and noted.

Patients were assessed for hemodynamic parameters every 5 minutes till the complete onset and also at the end of surgery . Patients were monitored for any signs and symptoms of cardiovascular (changes in heart rate, rhythm) and central nervous system toxicity. They were also monitored for signs of hypersensitivity reactions to local anaesthetic drugs. Patient satisfaction with the anaesthetic technique was recorded by asking the patient and surgeon to assess the block as : very good, good, medium or poor. In the post operative period, the pain was assessed by Visual Analogue Score and at a score of >4, patients were given analgesics like inj. Tramadol 50mg or inj. Diclofenac 75mg and the study concluded at this point.

Authors do not have financial gain from any of the products used and the study is not sponsored by any company.

Sample Size of Estimation

Data was collected and entered in MS Excel and analysed using SPSS version 2.0. Descriptive statistics includes frequencies, percentage and mean standard deviation. Student t-test will be used to test the significant differences between the two groups. The sample size is calculated using the following formula[9]:

$n = 2 (Z_{\alpha} + Z_{1-\beta})^2 * \sigma^2, \Delta^2$

where ‗n' is the required sample size.

For Z_{α}, Z is a constant (set by convention according to the accepted α error)

α-error =5%, therefore Z_{α} is 1.96

For $Z_{1-\beta}$, Z is a constant (set by convention according to power of the study)

Power of the study is 80%, therefore $Z_{1-\beta}$ is 0.8416

σ is the standard deviation (estimated) which is 0.55

Δ the difference in effect of two interventions which is required (estimated effect size),

Which is 0.4 in our study, keeping in mind the difference in effect of two interventions are 40%.

By applying the formula,

$n = 2 (Z_{\alpha} + Z_{1-\beta})^2 * \sigma^2, \Delta^2$

$n = 2 (1.96 + 0.8416)^2 * (0.55)^2 (0.4)^2$

Therefore, n = 29.6

29.6 patients will be required in each group according to the calculation. Therefore, we will be recruiting 30 patients in each group.

Statistical Methods[10,11,12,13]

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. The following assumptions on data is made, Assumptions:

1. Dependent variables should be normally distributed,

2. Samples drawn from the population should be random, Cases of the samples should be independent

Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters.

Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, Non-parametric setting for Qualitative data analysis. Fisher Exact test used when cell samples are very small.

Significant figures

+ Suggestive significance (p value: $0.05 < p < 0.10$)

* Moderately significant (p value: $0.01 < p \leq 0.05$)

** Strongly significant (p value: $p \leq 0.01$)

Statistical software: The Statistical software namely SPSS 18.0, and R environment ver.3.2.2 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

Results

Demographic Data

Seventy two patients were assessed for study , eight did not meet the inclusion criteria and 4 declined the block. 60 patients of either sex, belonging to ASA I, ASA II and ASA III undergoing elective ankle and foot surgeries were included in the study. All the patients were administered popliteal nerve block and were randomised into two groups: Group A and Group BN, to receive either 20ml of Inj Bupivacaine 0.5% with 1ml Normal Saline or 20ml of Inj Bupivacaine 0.5% with 1ml 10mg Nalbuphine respectively. There were no statistically significant differences between these groups in demographics and ASA grading.

Pre-Operative Vitals

The mean heart rate in Group S was 93.60 ± 11.11 and Group M was 86.20 ± 6.71. This was found to be statistically significant, with a p value of 0.003**. The mean SBP in Group S was 138.67 ± 22.97 and Group M was 140.80 ± 22.44. This was found to be statistically insignificant, with a p value of 0.717. The mean DBP in Group S was 89.33 ± 17.63 and Group M was 90.73 ± 14.81. This was found to be statistically insignificant, with a p value of 0.740 . The mean SpO_2 in Group L was 99.50 ± 0.90 and Group B was 99.67 ± 0.55. This was found to be statistically insignificant, with a p value of 0.381.

Post-Operative Vitals

The mean heart rate in Group S was 89.60 ± 10.65 and Group M was 81.27 ± 5.98. This was found to be statistically significant, with a p value of <0.001**. The mean SBP in Group S was 126.73 ± 23.51 and Group M was 131.53 ± 23.66. This was found to be statistically insignificant, with a p value of 0.434 . The mean DBP in Group S was 81.48 ± 14.68 and Group M was 85.13 ± 12.56. This was found to be statistically insignificant, with a p value of 0.316. The mean SpO_2 in Group L was 98.30 ± 0.90 and Group B was 98 ± 0.80. This was found to be statistically insignificant, with a p value of 0.177.

Table 1: Onset and duration of sensory block

	Group A	Group BN	*p* value
Onset of sensory block (in mins)	15.2 ± 1.8	11.8 ± 2.4	< 0.05
Duration of sensory block	552 ± 19	760 ± 23.3	< 0.05

Table 2: Onset and duration of motor block

	Group A	Group BN	*p* value
Onset of motor block (in mins)	17.6 ± 1.1	14.7 ± 1.5	< 0.05
Duration of motor block (in mins)	438 ± 18.4	573 ± 20.6	< 0.05

Discussion

In the field of anaesthesia there have been drastic changes with respect to inventions of various techniques and anaesthetic drugs however an

effective way to control pain postoperatively has still not been established. Various studies with unexplored techniques are now being done in an attempt to find the best methods for adequate anaesthesia and analgesia. We did a study titled "Effect of Nalbuphine as Adjuvant to Bupivacaine for Ultrasound-Guided Popliteal Nerve Block: A Prospective Randomised Comparative Clinical Study".

In our hospital based prospective, randomised comparative clinical study conducted on 60 patients undergoing Ankle and Foot surgeries at RajaRajeswari Medical College and Hospital between the time period from April 2017- January 2019, we randomised the patients by a simple sealed envelope method into Group A who received 20ml of Inj Bupivacaine 0.5% and 1ml of normal saline and Group BN who received 20ml of Inj Bupivacaine with 1ml 10mg Nalbuphine.

Popliteal nerve block for ankle and foot surgeries was found to be an excellent alternative to General and Spinal anaesthesia in achieving good intra operative conditions, longer post-operative analgesia with minimal adverse events.

Anaesthesia for Ankle and Foot Surgeries

Regional anaesthesia techniques are used frequently as an alternative to general anaesthesia in Ankle and Foot surgery. These surgeries are accompanied by pain for the first few days following surgery. Opioid based postoperative pain management can lead to inadequate pain relief and is accompanied by side effects.[1] Popliteal nerve block is a useful technique for ankle and foot surgeries, particularly in patients thought unsuitable for central neuraxial block. It also avoids complications in the elderly patients who are particularly prone for haemodynamic changes leading to increased morbidity and mortality.

Studies by Ayman A. El Sayed et al.[1]; Singelyn FJ, Gouverneur JM, Gribomont BF et al.[14] and R. Arcioni et al.[8] have shown an added advantage of popliteal nerve block in early post operative mobility which is essential in surgical procedures. It was determined that as a safe and reliable alternative to more common forms of anaesthesia for surgery below the knee and popliteal nerve block avoids post dural puncture headache, making it an ideal technique for ambulatory surgeries and can be used more readily after head injury where central neuraxial block is relatively contraindicated

In our study, we used a single injection lateral approach popliteal nerve block for all the patients posted for ankle and foot surgeries. It increased the patient's comfort and success rate, also decreased the adverse events.

Nalbuphine has been studied as an adjuvant to local anaesthetics in epidural, caudal, and intrathecal anaesthesia. Despite its known benefits for pain control very little data is available for its effects as an adjuvant to lower limb peripheral nerve blocks especially popliteal nerve block.

Nalbuphine is a synthetic mixed opioid agonist-antagonist with analgesic properties. Although its exact mechanism has not been fully delineated, it is hypothesized that upon administration, nalbuphine binds to kappa receptors in the central nervous system (CNS), thereby inhibiting the release of neurotransmitters that mediate pain, such as substance P.[15] Additionally, nalbuphine exerts post-synaptic inhibitory effects on interneurons and output neurons of the spinothalamic tract, responsible for transporting nociceptive information. Compared to other opioid agents that stimulate mu receptors, nalbuphine antagonises mu receptors, thereby potentially producing less intense respiratory depression.[9]

This study demonstrates that addition of 10 mg nalbuphine to bupivacaine in popliteal nerve block in patients undergoing ankle and foot surgeries decreases time of onset of anaesthesia, showssignificant increase induration of sensory and motor blockade and also increases the post operative analgesia.

Sensory blockade

In our study we found that Group BN patients who received Nalbuphine as additive provided faster onset of sensory level blockage with mean time of onset value being 11.8 ± 2.4 (in mins) compared to Group A where mean value was 15.20 ± 1.80 (in mins). The results were statistically significant with a p value of <0.001**. The duration of sensory level block in Group BN who received Nalbuphine as additive was 760 ± 23.3 compared to Group A where mean value was 552 ± 19 with statistically significant *p* value of <0.001**. With this result we can conclude that patients in Group BN had statistically significant more duration of sensory block when compared to Group A.

Our results were comparable to a study conducted by Mohamed Abdelhaq et al.[4] where addition of Nalbuphine prolongs the duration of action of sensory block when added to Inj Bupivacaine in Supra Clavicular Brachial Plexus Block.

In comparison to the study conducted by Gupta K, Jain M et al.[16] the addition of Nalbuphine to Bupivacaine in our study had a faster onset of action of sensory block.

Motor blockade

In our study we found that Group BN patients who received Nalbuphine as additive provided faster onset of motor level blockage with mean time of onset value being 14.7 ± 1.5(in mins) compared to Group A where mean value was17.6 ± 1.1(in mins). The results were statistically significant with a *p* value of <0.001**. The duration of motor level block in Group BN was 573 ± 20.6 compared to Group A where mean value was 438 ± 18.4with statistically significant *p* value of <0.001**. With this result we can conclude that patients in Group BN had statistically significant more duration of motor block when compared to Group A.

Our results were in agreement with a study conducted by Mohamed Abdelhaq et al.[4] where addition of Nalbuphine prolongs the duration of action of motor block in supraclavicular brachial plexus block.

Post Operative pain by VAS

Post operative pain, was measured by Visual Analogue Scale at intervals of 30 mins, at 2hrs, at 4hrs, at 6hrs, at 8hrs, at 12hrs and at 24hrs. For up to 6 hours after surgery the VAS for both the groups were similar with the values not being statistically significant. VAS was assessed again at 8 hours after surgery where Group A showed a mean VAS of 1.28 ± 0.45 and Group BN showed a mean VAS of 1.00 ± 0.00. This was statistically significant with a *p* value of 0.002**. At 12 hrs after surgery, Group A showed a mean VAS of 1.93 ± 0.37 and Group BN recorded a mean VAS of 1.07 ± 0.37. This was statistically significant with a *p* value of <0.001**. However, VAS assessed at 12 hours after surgery for both the groups were not statistically significant.

Analgesic requirement

In our study, the means of assessing postoperative analgesia was the time to first analgesic administration, the total amount of analgesic consumed in the first 24 hour period after surgery and the VAS at different time in first 24 hour. In both the groups all 60 patients did not ask for analgesia post operatively, since we assessed for pain only at rest and not on movement. Both the groups had excellent post operative analgesia with mean VAS scores of <4 even at 24 hours after surgery .

Rangel Vde O et al.[17] showed that the approach for tibial and common fibular nerves with single puncture in the popliteal fossa using peripheral nerve stimulator is a good option for anaesthesia and analgesia for foot surgeries.

Gallardo J et al.[18] conducted a study which showed that VAS evaluation had a significant improvement in pain control in the group with the popliteal block after 6, 12, 18, and 24 hours post surgery, with pain levels peaking and being most different between 6 and 12 hours post surgery and also exhibited a significantly lower consumption of morphine and a greater degree of patient satisfaction.

We completely agree with Gallardo J et al.[18] because in our study VAS evaluation had a significant pain control in both groups up to 12 hours and patients from both the groups showed a high rate of satisfaction with the procedure and demonstrated a good discharge disposition. No significant difference in satisfaction could be detected between the 2 groups in the study. We also did not observe any anaesthesia related complications in all the 60 patients who underwent popliteal nerve block for the proposed surgical procedures.

Limitations

1. The small sample size is a limitation of this study, however performing the blockade with the patient awake and with the use of a nerve stimulator explains the absence of neurological problems and the few complications reported in the literature
2. Plasma levels of nalbuphine doses used were safe and effective. We need to find minimal doses in order to optimise the doses effectively for the adjuvants.
3. An apparent disadvantage of popliteal nerve block was longer intervention duration, which could easily be resolved by performing the intervention in the patient premedication room.

Conclusion

This study demonstrates that addition of 10mg Nalbuphineto Bupivacaine in popliteal nerve block in patients undergoing ankle and foot surgeries :

1. Decreases time of onset of anaesthesia
2. Shows significant increase in duration of sensory and motor blockade
3. Increases the post operative analgesia

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 671–678
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.3

Comparative Study of the Effect of Adding Dexmedetomidine versus Fentanyl to Intrathecal Bupivacaine on Spinal Block Characteristics in Endo-Urological Procedures

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Abstract

Background and Aim: Various studies have been done on addition of various adjuncts to spinal local anaesthetics to improve as well as to increase the time of spinal anesthesia and analgesia, so that the total dose of local anaesthetics could be decreased. Present study was done with an aim to evaluate the relative efficacy of dexmedetomidine and fentanyl with 0.5% hyperbaric bupivacaine intrathecally in Endo-urological procedures. *Material and Methods:* Total 80 patients of ASA grade I and II, between 18 to 70 years were scheduled for different Endo-urological surgeries including Turp, Turbt, End To End Urethroplasy,Suprapubic Cystolithotrity/Suprapubic Cystolithotomy And Urs (Lower ureteric stone) and RIRS were included in the study. Patients were allocated into 2 groups, each of 40 patients, each received a total volume of 3.5ml which contained dose of 15mg (i.e. 3ml) 0.5% hyperbaric bupivacaine combined either Dexmedetomidinne or Fentanyl. After noting baseline parameters the patients were monitored using continuous electrocardiography (lead II), heart rate, non-invasive blood pressure, and continuous pulse oximetry. *Results:* The changes in mean heart rate between two groups were significant statistically after 60 minutes of spinal anaesthesia, which showed more fall in heart rate in patients of group-D than group-F. The changes in mean arterial pressure were also statistically significant between the two groups after 75 minutes of spinal anaesthesia, which showed more fall in patients of group-D. Intra–operative hypotension requiring treatment was also observed more in group-D patients (12.5%) compared to group-F (2.5%). *Conclusion:* Dexmedetomidine is a good option to fentanyl in spinal anesthesia as it significantly prolongs duration of sensory and motor block and increase the duration of analgesia, it causes hypotension and bradycardia which are easily reversible and without any untoward adverse events.

Key words: Bradycardia, Dexmedetomidine, Fentanyl, Hypotension

How to cite this article:
Prakash Rajkumar Sadhwani, Jigar Panchal. Comparative Study of the Effect of Adding Dexmedetomidine versus Fentanyl to Intrathecal Bupivacaine on Spinal Block Characteristics in Endo-Urological Procedures. Indian J Anesth Analg. 2020;7(3):671–678.

Introduction

Neuraxial blockade with spinal anaesthesia is the preferred technique in most of the urological procedures as it creates excellent operating conditions (muscle relaxation), causes least hemodynamic changes as the amount of drug required is less and absence of manipulation of airway and last but the most important, it provides excellent intra and postoperative analgesia to the

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Received on 29.01.2020, **Accepted on** 29.02.2020

patient. Though it has above advantages various studies have been done to improve the quality of analgesia in procedures that cause visceral pain for which higher dose may be requiredto increase the level of sensory blockade which may lead to hemodynamic changes that may have unfavourable effects on patients with hypertension and diabetes.

Various studies have been done on addition of various adjuncts to spinal local anaesthetics to improve as well as to increase the time of spinal anesthesia and analgesia, so that the total dose of local anaesthetics could be decreased. Many of them have successfully concluded that adjuncts do decrease the dose of spinal local anesthetics, improve the quality of analgesia and duration as well and lastly also increase duration of motor block. So with adjuncts procedures more than 2-3 hours, even complex one could be done easily without additional requirement of different modality of anesthesia.

Various urological procedures such as Transurethral resection of prostate (TURP), Transurethtral resection of bladder tumour, End To End Urethroplasty, ureteroscopic retrieval of stone (URS) for lower ureteric stone and Suprapubic cystolithotrity (SPCL) are frequently done under regional anaesthesia. A dose of fentanyl 20-30 microgram (µg) as adjunct to spinal anesthesia produces faster block onset time, improved intraoperative analgesia and decrease incidence of intraoperative nausea and vomiting in obstetric patients.[1]

Dexmedetomidine is a relatively selective alpha-2 agonist with sympatholytic, sedative, analgesic and amnestic properties. It is indicated for the short-term sedation of patients needing mechanical ventilation in intensive care unit.[2] Recent reports have been published describing dexmedetomidine as a useful adjunct in both regional and general anaesthesia. A few case studies have demonstrated successful use of dexmedetomidine as a replacement of opioids, in whom airway compromise was a concern. A thorough understanding of the drug will help anaesthesia provider to use dexmedetomidine as a sole drug or as an adjuvant.[2,3,4]

The following study of comparing 2 drugs (fentanyl and dexmedetomidine) as adjuncts to local anaesthetic bupivacaine in spinal anaesthesia for above mentioned Endo-urological procedures which is least studied till now, will find differences in hemodynamic variables and also in analgesia duration and any complications or side effect.

Present study was done with an aim to evaluate the relative efficacy of dexmedetomidine and fentanyl with 0.5% hyperbaric bupivacaine intrathecally in Endo-urological procedures.

Material and Methods

Total 80 patients of ASA grade I and II, between 18 to 70 years were scheduled for different Endo-urological surgeries including Turp, Turbt, End To End Urethroplasy,Suprapubic Cystolithotrity/ Suprapubic Cystolithotomy And Urs (Lower ureteric stone) and RIRS were included in the study.

Exclusion criteria

Patients with coagulation abnormalities, severe cardiac or renal disease, mental disturbances, neurological diseases, deformities of spine or local anaesthetic allergies were excluded from the study.

Sample size were calculated for the paired statistical analysis with student t-test using power and sample size program PS version 3.0.7, with level of confidence = 95% and Power = 0.87, n' came out to be 40 for each group. Sampling technique was done as Probability sampling, with randomization by envelope method, 80 patients were randomly divided into two groups of 40 each.

Patients were allocated into 2 groups, each of 40 patients, each received a total volume of 3.5ml which contained dose of 15mg (i.e. 3ml) 0.5% hyperbaric bupivacaine combined either Dexmedetomidinne or Fentanyl, as follows:

Group D: (3ml of 0.5% hyperbaric bupivacaine + 0.5ml of 10 µg dexmedetomidine)

Group F: (3ml of 0.5% hyperbaric bupivacaine +0.5ml of 25 µg fentanyl)

After noting baseline parameters the patients were monitored using continuous electrocardiography (lead II), heart rate, non-invasive blood pressure, and continuous pulse oximetry. 18 gauge IV cannula was inserted at the forearm level; NS was administered as bolus of 10 ml/kg for 15 min before subarachnoid block to all patients. Drug filled syringe was given to the performing anaesthetist,who along with the person collecting data was blinded. Spinal anaesthesia was performed at L3-L4 interspace (L2-L3 space in case of failure) with the patient in sitting position by using a 25 gauge quincke needle. Free flow of cerebrospinal fluid was verified before injection of anaesthetic solution, which was administered without aspiration.

Criteria of Block

Onset of sensory block: sensory block was assessed

every 60 seconds by pinprick method. At the T10 level failure to perceive pain on prick wastaken as the onset of sensory block

Onset of motor block: Motor block was assessed by using the modified bromage scale.

Bromage Scales

Grade-0: No block – full flexion of knee and feet

Grade-I: Partial block-just able to flex knee but full flexion of feet.

Grade-II: Almost complete block – unable to flex knee but complete

Flexion of feet possible

Grade-III: Complete block: unable to flex knee and feet.

The duration of spinal anaesthesia was calculated from the time of spinal injection to the time taken for two level sensory regressions from the peak block height. Time of sensory regression to S1 level and time to complete motor resolution was recorded from the time of spinal injection. The intensity of pain was also recorded every 30 minutes in the postoperative period using a VAS, explained to the patient preoperatively, and graded on a scale of 0 to 10 and when the VAS score was > 4 rescue analgesia was given in the form of intravenous tramadol 1.5 mg/kg slowly over 2 minutes and further dose if required will be 1mg/kg.

Adverse effects of intrathecal opioids, if any were recorded. The presence of urinary retention could not be assessed, as most of the patients had an indwelling catheter. Nausea and vomiting, if present, were treated with ondansetron 4mg intravenous while post-operative pruritus was controlled with 4mg of oral chlorpheniramine maleate.

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA).

Descriptive statistics included computation of percentages, means and standard deviations. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

This study "Comparison of effect of adding dexmedetomidine versus fentanyl to intrathecal bupivacaine on spinal block characteristics in urological procedures" was carried out in patients admitted at Muljibhaipatel Urological Hospital, Nadiad.

Observations made in 80 patients undergoing various urological procedures routinely done under spinal anaesthesia. This was a double blind case control study. The study population was divided in two groups of 40 each. Group D was the group of patients receiving 10µg of dexmedetomidine with 15mg of hyperbaric bupivacaine(0.5%) and another group F received 25µg of fentanyl with 0.5% 15mg of hyperbaric bupivacaine.

There was no significant difference between the two groups with respect to age, Ht. and Wt. (Table 1).

Table 1: Age (Years), Ht. (cm) and Wt (Kg) of study participants

	Group D	Group F	*p* value
Age (Mean ± SD)	51.97 ± 13.77	55.17 ± 12.75	0.2507
Wt (Mean ± SD)	70.07 ± 10.27	67.45 ± 11.53	0.2859
Ht (Mean ± SD)	168.47 ± 6.12	167.52 ± 7.12	0.5245

Table 2: Comparison of sex ratio between group D and group F

Sex	Group-D	Group-F	Total
Male	38	40	78
Female	2	0	2
Total	40	40	80

Table 3: Sensory Blockade among both groups

Sensory Blockade	Group D	Group F	*p* value
Time of onset of sensory block at T10 level (MIN) Mean + SD	8.775 ± 0.2920	8.850 ± 0.2943	0.8569
Mode of peak sensory height (mean)	T7 (7.075 ± 0.12)	T7 (7.050 ± 0.11)	0.8829
Time to reach peak sensory level (min) Mean + SD	15.025 + 2.281	14.625 + 2.192	0.4263

No significant difference was found between both gender ($p > 0.05$) (Table 2).

The table 3 shows that the mean time of onset of sensory block at T10 level in both Group-D (8.77min) and Group-F (8.85min) were almost similar and hence there was no significant difference between both groups. The difference in duration of anaesthesia (as indicated from time for 2 segment sensory regression below the peak sensory level) was more in Group-D (126min) as compared to Group-F (117min) which was statistically significant (Table 3).

Table 4: Motor Blockade among both groups

Motor Blockade	Group-D	Group-F	*p* value
Time of onset of motor block (bromage 1) (min.) Mean + SD	2.625 + 0.8378	2.325 + 0.5256	0.0587
Time to reach grade 3 motor blockade(min) Mean + SD	9.1 + 2.687	9.6 + 1.446	0.3043

Table 5: Recovery of motor Blockade

Recovery of Blockade	Group-D	Group-F	*p* value
Time to complete motor regression (min) Mean + SD	289.75 + 35.76	250.75 + 23.68	< 0.0001

Table 6: Duration of analgesia (i.e Time for rescue analgesia after spinal block) and dose required in 1st 24 hours

Parameters	Group-D	Group-F	*p* value
Time of rescue analgesia(MIN)	573.6 ± 64.16	454.4 ± 27.90	0.085
Total dose required(mg)	125.0 ± 8.287	132.8 ± 8.139	0.5081

Table 7: Heart rate comparison of Group-D and Group-F(1st 180 min)

Time	Group-D (mean + SD)	Group-F (mean + SD)	*p* value
Pre-operative	94.525 + 13.125	93.625 + 13.638	0.7644
5 min	92.625 + 12.790	93.475 + 13.860	0.7764
10 min	90.65 + 13.05	91.55 + 14.178	0.7685
15 min	87.375 + 13.028	89.425 + 14.274	0.5043
20 min	84.375 + 12.862	86.975 + 14.323	0.3778
30 min	81.175 + 12.596	83.80 + 14.396	0.3882
45 min	77.75 + 12.661	82.025 + 14.790	0.1689
60 min	75.55 + 12.772	82.175 + 14.392	0.0325
75 min	75.125 + 12.035	81.05 + 13.642	0.0428
90 min	73.85 + 11.705	80.95 + 13.939	0.0133
105 min	72.575 + 10.592	80.35 + 13.37	0.0052
120 min	72.525 + 10.884	79.65 + 12.823	0.0091
150 min	72.825 + 10.595	79.60 + 12.105	0.0094
180 min	72.15 + 9.317	79.9 + 11.22	0.0021

The onset of motor block in Group-D was though prolonged then Group-F, but the difference was not quite significant statistically (Table 4).

There was a statistically significant difference between the two groups, in the time taken to completely recover from motor blockade, being longer in group-D then Group-F (Table 5).

In the present number of patients required in Group- D and Group-F was 14 and 16 respectively (out of 40 patients in each group). Comparing their mean showed that time of rescue analgesia was longer in Group–D (573 min) than Group-F (454min), though they are not statistically significant (Table 6).

The changes in mean heart rate between two groups were significant statistically after 60 minutes of spinal anaesthesia, which showed more fall in heart rate in patients of Group-D than Group-F. Mean fall in heart rate in Group-D and Group-F was 22 and 14 respectively. Hence fall in heart rate was seen more with Group-D patients, which was ≥ 20% and in Group-F was ≤ 15% of baseline heart rate (Table 7).

Table 8: Mean Arterial Blood Pressure comparison of Group-D and Group-F of 1st 180minutes

Time	Group-D (mean + SD)	Group-F (mean + SD)	*p* value
Pre-operative	110.47 + 12.63	108.57 + 12.17	0.4952
5 min	106.025 + 11.75	104 + 11.28	0.6359
10 min	102 + 11.578	101.675 + 10.376	0.8949
15 min	98.95 + 12.12	98.87 + 10.21	0.9762
20 min	96.15 + 12.19	95.47 + 10.39	0.7906
30 min	94.075 + 11.865	93.175 + 10.706	0.7227
45 min	92.875 + 11.765	91.975 + 9.068	0.7026
60 min	90.475 + 11.989	92.85 + 8.254	0.3057
75 min	89.725 + 10.837	94.50 + 9.416	0.0387
90 min	89.525 + 11.207	94.95 + 9.538	0.0224
105 min	88.925 + 10.709	95.925 + 9.88	0.0003
120 min	88.425 ± 9.83	96.75 ± 9.97	0.0003
150 min	87.575 + 8.878	98.8 + 9.368	0.0001
180 min	85.825 + 9.055	98.125 + 8.913	<0.0001

Table 9: Respiratory rate comparison of Group-D and Group-F

Time	Group-D (mean + SD)	Group-F (mean + SD)	*p* value
Pre-operative	13.6 ± 0.16	13.2 ± 0.16	0.9999
5 min	13.8 ± 0.11	13.33 ± 0.15	0.0170
10 min	13.3 ± 0.07	13.13 ± 0.17	0.3701
15 min	12.9 ± 0.15	12.9 ± 0.17	0.9999
20 min	12.85 ± 0.15	12.8 ± 0.17	0.8314
30 min	13.0 ± 0.07	12.73 ± 0.17	0.1506
45 min	13.2 ± 0.09	13.23 ± 0.17	0.9000
60 min	13.1 ± 0.13	13.33 ± 0.16	0.2858
75 min	13.5 ± 0.17	13.3 ± 0.14	0.3925
90 min	13.5 ± 0.14	13.3 ± 0.14	0.50
105 min	13.9 ± 0.11	13.23 ± 0.18	0.03
120 min	13.3 ± 0.10	12.9 ± 0.15	0.02
150 min	13.05 ± 0.12	12.7 ± 0.15	0.088
180 min	13.88 ± 0.11	13.7 ± 0.13	0.3254

The changes in mean arterial pressure were also statistically significant between the two groups after 75 minutes of spinal anaesthesia, which showed more fall in patients of Group-D (Table 8).

Respiratory depression was not observed in either group and comparison between both was not significant statistically either (Table 9).

Table 10: (a and b): Intra-operative bradycardia and hypotension that required treatment with atropine and ephedrine respectively their total doses required

Atropine dose (mg)	Bradycardia (total number of patients requiring treatment)		*p* value
	Group-D	Group-F	
0.3	5 (12.5%)	2(5%)	0.006
0.6	2(5%)	0(0%)	
Total	7(17.5%)	2(5%)	

Ephedrine dose (mg)	Hypotension (total number of patients requiring treatment)		*p* value
	Group-D	**Group-F**	
6	1(2.5%)	0(0%)	0.01
12	4(10%)	1(2.5%)	
Total	5(12.5%)	1(2.5%)	

Intra-operative bradycardia requiring treatment was observed more in group-D patients. 7 patients in Group-D and 2 patients in Group-F required atropine and p-value of 0.006 was obtained on applying chi-square test for comparing the percentage of patients having bradycardia in both groups, hence statistically significant and requirement of dose in both group were similar (0.3mg) and were not significant statistically (p = 0.4589) (Table 10a).

Intra–operative hypotension requiring treatment was also observed more in Group-D patients (12.5%) compared to Group-F (2.5%), hence applying chi-square test, we got p-value of 0.01 which was statistically significant. But requirement of mean dose cannot be compared between the groups as only 1 patient required dose of 6mg of ephedrine in Group-F (Table 10b).

Side effects observed in both groups were only shivering and that too in 0.5% and 0.25% population in Group-D and Group-F respectively.

Discussion

Neuraxial blockade with spinal anaesthesia is the preferred technique in most of the urological procedures as it creates excellent operating conditions, causes least hemodynamic changes as the amount of drug required is less and absence of manipulation of airway and last but the most important, it provides excellent intra and postoperative analgesia to the patient. Though it has above advantages various studies have been done to improve the quality of analgesia in procedures that cause visceral pain for which higher dose may require increasing the level of sensory blockade which may lead to hemodynamic changes that may have unfavorable effects on patients with hypertension and diabetes.[5-8]

Various studies have been done on addition various adjuncts to spinal local anesthetics to increase the duration of spinal anesthesia and analgesia, so that the total dose of local anesthetics could be decreased. Many of them have successfully concluded that adjuncts do decrease the dose of spinal local anesthetics, improve the quality of analgesia and duration as well and lastly also increase duration motor block.[8,9] So with adjuncts procedures more than 2-3 hours, even complex one could be done easily with additional requirment of different modality of anesthesia.

In our study we have compared the relative efficacy of 2 different adjuncts(dexmedetomidine and fentanyl), at different doses (i.e 10µg and 25µg respectively) with regard to duration and quality of sensory block, duration of motor block, hemodynamic changes and also we observed the side effects/adverse effects to see if they are easily treatable or not. Though we have also observed and recorded the time of onset of sensory and motor block as well, but we are more concerned with the parameters mentioned in start of this paragraph.

The type of our study design is randomized, prospective and double blind case controlled. Study includes total of 80 patients of ASA grade I and II, with 40 patients in either group.

The demographic parameters with respect to age, sex, weight, height and ASA grade are comparable in either group. Type and duration of surgeries included were also comparable in either group. In a study by, Subhi m. Al-ghanem et al.[10] observed in their study comparing 5µg dexmedetomidine versus 25µg fentanyl in gynaecological procedures that time to reach sensory level T10 was 7.5 ± 7.4 min and 7.4 ± 3.3 min respectively (p = 0.95) and in our study it was 8.77 ± 0.29 min and 8.85 ± 0.29 min respectively (p = 0.85). So above study supports our conclusion that there was significant difference in mean time to reach sensory level T10. In another study by Al-mustafa et al.[8], comparing different doses of dexmedetomidine (5 and 10 µg) with 10 mg isobaric bupivacaine, it was 6.3 ± 2.7 min and 4.7 ± 2.0 min respectively comparing with their third group which received normal saline which was 9.5 ± 3.0 min. In another study Deepika Shukla et al.[11], observed the onset time of block, both sensory up to T10 dermatome, was rapid in the

dexmedetomidine group (2.27 ± 1.09) and delayed in the magnesium group (6.46 ± 1.33) in comparison with the normal saline group was (4.14 ± 1.06).

In our study the peak sensory level was comparable in both groups, which was T7. Subhi m. Al-ghanem et al.[10] didn't observed any difference in peak level achieved in their study comparing 5µg dexmedetomidine versus 25µg fentanyl (with 10mg isobaric bupivacaine) in gynaecological procedures which was T6 in either group. While in a recent study by Rajnigupta et al.[12] in which they compared the effects of dexmedetomidine (5µg) versus fentanyl (25µg) with 12.5 mg 0.5% hyperbaric bupivacaine intrathecally in lower abdominal surgeries, they observed that there was no difference between peak sensory level achieved in both groups which were T5 and T6 respectively. Eid et al.[13] observed that the peak sensory level were T5 and T7 in groups receiving 10µg and 15µg of dexmedetomidine respectively.

In our study time to reach peak sensory level was 15.02 ± 2.2min and 14.62 ± 2.1min (p=0.426) respectively in dexmedetomidine and fentanyl group. Al-ghanem et al.[10] observed that it was 19.34 ± 2.8min and 18.39 ± 2.4min respectively (p=0.126).

In our study, the time to 2 segment regression was 126 ± 19min and 117 ± 12min (p=0.0149) in groups receiving 10µg of dexmedetomidine and 25µg fentanyl respectively. In another study by Eid et al.[11], time to 2 segment regression in group receiving dexmedetomidinne 10µg and 15µg were 103 ± 28min and 200 ± 30min respectively (statistically significant).

In our study, the time to sensory regression to S1 level observed was 366 ± 44min and 327 ± 37 min in dexmedetomidine and fentanyl group respectively ($p < 0.001$). While in study by Rajnigupta et al[12] it was 476 ± 23 min and 187 ± 12 min, hence it was also statistically significant as in our study, which supported our results. Al- ghanem et al.[10] observed in their study, that it was 274 ± 73 min and 179 ± 47min respectively. Study by Eid et al.[13] comparing different doses of dexmedetomidine observed that the time to sensory regression to S1 was 320 ± 65min and 408 ± 68 min in the respective groups while in their 3rd group which received normal saline it was 238 ± 57 min. Another similar study comparing different doses of dexmedetomidine by Al-mustafa et al.[8] observed that it was 277 ± 23 min and 338 ± 44 min compared to their third group receiving normal saline in which it was 165 ± 32 min.

In our study time to reach motor bromage 3 score were 9.1 ± 2.6 min and 9.6 ± 1.4 min in dexmedetomidine and fentanyl group respectively. Rajnigupta et al.[12] observed that it was 11.6 ± 1.8 min and 11.2 ± 1.3 respectively. Hence above 2 studies didn't showed significant difference between the either groups in their studies, though there are differences between the 2 studies. Al-ghanem et al.[10] observed that it was 14.4 ± 6.7 min and 14.3 ± 5.7 min ($p = 0.93$) respectively, not significant in this study as well. Al-mustafa et al.[8] observed that it was 13.0 ± 3.4min and 10.4 ± 3.4 min in dexmedetomidine groups receiving 5 µg and 10 µg respectively in comparison with their 3rd group receiving normal saline which was 18.0 ± 3.3 min. . In another study deepikashukla et al.[13], the onset time to motor Bromage 3 scale, was rapid in the dexmedetomidine group and delayed in the magnesium group in comparison with the normal saline group was (4.81 ± 1.03).

In our study time to reach motor bromage 0, was 289 ± 35 min and 250 ± 23 min ($p < 0.001$) respectively in dexmedetomidine and fentanyl group. Rajnigupta et al.[12] observed that 421 ± 21min and 149 ± 18 min ($p < 0.001$) respectively. Al- ghanem et al.[10] observed that it was 240 ± 64 min and 155 ± 46 min ($p < 0.001$) respectively. Eid et al.[13] observed that it was 280 ± 46 min and 336 ± 58 min respectively in groups receiving 10 and 15µg of dexmedetomidine in comparison with their 3rd group receiving normal saline 202 ± 41.8 min. Al-mustafa et al.[8] observed that it was 246.4 ± 25.7 min 302.9 ± 36.7 min in dexmedetomidine groups receiving 5µg and 10µg respectively compared with their third group receiving normal saline was 140.1 ± 32.3 min.

In relation to duration of analgesia, Eid et al has observed that dexmedetomidine reduces rest pain and dynamic pain VAS score significantly in 1st 24 hours and also reduce the rescue analgesic consumption by 45% in orthopaedic surgeries of lower limbs. In another study Rajni Gupta et al[12] observed that in lower abdominal surgeries also dexmedetomidine reduces VAS pain score in 1st24 hours by 35% and also reduce analgesic consumption by 64%, but we observed that only 14 patients in group-D and 16 patients in group-F required rescue analgesia, comparing means of these patients we observed that time of rescue analgesia from spinal block was 573min and 456min respectively ($p = 0.006$). But this difference might me because of the type of surgeries included in our study as nearly 50% of patients in either group didn't required analgesia at all in 1st 24 hours and mean analgesic requirement in these patients was 125 mg and 132 mg (p=0.50) in group D and group

F respectively was not statistically significant.

In our study the changes in mean heart rate observed were statistically significant after 60 minutes of spinal block and fall in mean heart rate of Group-D and Group-F was 22 and 14 respectively at the end of 180 min ($p < 0.001$). Hence fall in heart rate was seen more with Group D patients, which was >20% and in Group-F was <15% of baseline heart rate. But meta-analysis of various studies done by F.w. abdallah et al[14] has not shown that incidences of bradycardia are more with dexmedetomidine and statistically not significant as well ($p = 0.98$).

Meta-analysis by F.W. abdallah[15] has observed no significant incidences of hypotension with dexmedetomidine as compared with other adjutants intrathecally with $p = 0.64$, but in our study we observed that fall in mean arterial pressure was found to be statistically significant after 75 min of spinal block, which was consistently falling till 180min of spinal block and the mean fall in MAP was >20% in dexmedetomidine and ≤ 10% in fentanyl group ($p < 0.001$).

In the meta-analysis by Abdallah et al[14] in April 2013, they concluded that dexmedetomidine produces reversible bradycardia in 7% of brachial plexus block patients, similarly in our study bradycardia though observed in 7 patients of dexmedetomidine and only 2 patients in fentanyl group, it was easily reversible with a mean dose of 0.3mg of atropine in both groups ($p = 0.4569$).

In study by Rajnigupta et al., observed that intra-operative ephedrine requirement was more in dexmedetomidine group compare with fentanyl group which was (10 ± 4 mg) and (6 ± 3 mg) respectively, but in our study 5 patients in dexmedetomidine group and only 1 patient in fentanyl group required ephedrine, on applying chi-square test p-value obtained was 0.001 hence dexmedetomidine caused hypotension in significant number of patients as compared to fentanyl. The mean dose of ephedrine required to treat in dexmedetomidine group was 10 in our study but it cannot be calculated in fentanyl group as only 1 patient required ephedrine, hence p- value also cannot be calculated. In our study, none of the patients had respiratory depression and this was comparable with the results of meta-analysis by FW abdallah.

None of the studies observed any side effects which were statistically significant in our study also we observed only shivering as a side effect in 2 patients in Group D and 1 patient in Group F.

Conclusion

Dexmedetomidine is a good option to fentanyl in spinal anesthesia as it significantly prolongs duration of sensory and motor block and increase the duration of analgesia, it causes hypotension and bradycardia which are easily reversible and without any untoward adverse events.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 679–687
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.4

Study Comparing the Effects of Fentanyl and Dexmedetomidine for Attenuation of the Haemodynamic Response During Endotrcheal Extubation in Patients Undergoing Elective Surgeries

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Abstract

Introduction: Tracheal extubation is almost always associated with hemodynamic changes due to reflex sympathetic discharge caused by epipharyngeal and laryngo-pharyngeal stimulation. This increase in sympatho–adrenal activity may result in hypertension, tachycardia and arrhythmias *Aims*: The purpose of the study is to compare the effect of intravenous Fentanyl 1µg/kg with dexmedetomidine 0.7µg/kg on the hemodynamic and recovery responses during extubation. *Materials and methods*: Prospective, randomized, double blind, controlled study was conducted in 60 patients of either sex between 20 and 50 yrs of age belonging to ASA-I and II, undergoing general procedures and urological procedures were selected for the study *Results:* The heart rate increased in both the groups during extubation but the increase was more in Group-F patients. The MAP increased for the initial 1min after drug administration in Group-D. However, dexmedetomidine attenuated the increase in blood pressure to a greater degree than lignocaine. The airway response (coughing) was better attenuated in Group-D than Group-F. The patients in Group-D were drowsy but responding to verbal commands when compared to Group-F.The incidence of bradycardia and hypotension though minimally present in Group-D, which was easily managed. *Conclusion:* Compared to Fentanyl 1µg/kg, dexmedetomidine 0.7µg/kg administered I.V. before extubation attenuates airway and hemodynamic reflexes to a greater extent allowing smooth and easy tracheal extubation, thereby providing comfortable recovery

Keywords: Not Provided

How to cite this article:
Rontala Saraiah, Pasham Abbaiah. Study Comparing the Effects of Fentanyl and Dexmedetomidine for Attenuation of the Haemodynamic Response During Endotrcheal Extubation in Patients Undergoing Elective Surgeries. Indian J Anesth Analg. 2020;7(3):679-687.

Introduction

Tracheal extubation is the discontinuation of an artificial airway when indications for its placement like airway obstruction, protection of airway, suctioning, ventilatory failure and hypoxemia no longer exist. Tracheal extubation is almost always associated with hemodynamic changes due to reflex sympathetic discharge caused by epipharyngeal and laryngo-pharyngeal stimulation. This increase

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Received on 18.02.2020, **Accepted on** 16.03.2020

in sympatho–adrenal activity may result in hypertension, tachycardia and arrhythmias. This increase in B.P and HR are usually transitory, variable and unpredictable. It is more hazardous to the patient with HTN, myocardial insufficiency or cerebrovascular diseases.[1] Significant decreases in ejection fractions (from 55% + 7% to 45% + 7%) after extubation without electrocardiographic signs of myocardial ischemia is demonstrated with coronary artery disease patients. In the clinical practice respiratory complications[4] like coughing, laryngospasm, bronchospasm are three times more common during extubation than during tracheal intubation and induction of anaesthesia (12.6% vs. 4.6%).coughing cause abrupt increases in intracavitary pressures (intraocular, intrathoracic, intraabdominal, intracranial) which could put patient at high risk. Smooth tracheal extubation requires the absence of straining, movement, coughing, breath holding or laryngospasm. Various techinques and anti-hypertensive drugs are available to attenuate airway and circulatory reflexes during extubation but none have been successful.[2] Attempts have been made to attenuate the pressor response by the use of drugs such as narcotic analgesics, deep anaesthesia induced by inhalational anaesthetics, local anaesthetics, adrenoceptor blockers and vasodilator drugs.[3] Studies have been carried out with use of diltiazam, lignocaine, esmololand labetalol, as sole agent or in comparison with each other. To attenuate airway and pressor response during tracheal extubation, Fentanyl, a synthetic opioid, has been reported to reduce the prevalence of coughing during and after extubation and to suppress the sneezing reflex after abdominal hysterectomy and periocular injections. Fentanyl has also been reported to attenuate the cardiovascular responses to tracheal extubation in elective gynecological surgeries. Dexmedetomidine a highly selective alpha2 adrenoceptor agonist has been studied as single dose at the time of extubation. It has a sympatholytic effect through decrease in concentration of norepinephrine[22]. This in turn decreases the blood pressure and heart rate. Dexmedetomidine therefore is theoretically appropriate for reducing airway and circulatory reflexes during extubation.

Materials and Methods

This prospective, randomized, double blind, controlled study was conducted in the Department of Anesthesiology and Critical care at Gandhi Medical Collage, Secundrabad during 2017-2018. After Institutional ethical committee approval, 60 patients of either sex between 20 and 50 yrs of age belonging to ASA-I and II, undergoing general procedures and urological procedures were selected for the study .

Excluding criteria: Patients with ischemic heart disease, with 2nd and 3rd degree heart block, uncontrolled hypertension, uncontrolled diabetes, any medication that affect heart rate or blood pressure, Pregnant and breast feeding women, expected difficult intubation and history of allergy to study drugs.

During the pre-operative visit, all patients were clinically evaluated, assessed and investigated as per the proforma (Proforma-II). The study protocol was explained to the patients and a written informed consent was taken. No patient was given any premedication. 60 cases are randomly divided into two groups 30 in each group. They were named as-

Group-F was Fentanyl group. In this group, 1mcg/kg of Fentanyl was administered 10min before extubation.

Group-D was Dexmedetomidine group. In this group, 0.7mcg/kg of Dexmedetomidine with infusion was administered for 10 min before extubation.

All basic investigations are done and Standard monitoring with electrocardiography (ECG), pulse oximetry (SpO_2), $ETCO_2$ and non- invasive blood pressure was done in the operation theatre. Intravenous line was established using 18 guage intravenous canula. In order to attain double blinding, the person who was not involved in recording the date prepared Fentanyl 1µg/kg. or Dexmedetomidine 0.7 µg/kg Patients were randomly allocated to two equal groups of 30 each by means of a computer generated table of random number to receive either Fentanyl 1µg/ kg (Group F) or Dexmedetomidine 0.7 µg/kg (Group D) over a period of 10 minutes, 10 min prior to extubation.For all the patients anesthesia was induced by using propofol 2mg/kg and fentanyl 2 µg/kg. Atracurium 0.5mg/kg was used to relax muscles for insertion of endotracheal tube. Anesthesia was maintained on O_2 (33%) + N_2O (66%)+ Sevoflurane (1-2%), with muscle relaxant as and when required. Intraoperatively analgesia was maintained with Paracetamol 15mg/kg infuse over 30 minutes. Intraoperatively patients were ventilated to maintain partial pressure of $ETCO_2$ between 30-35 mmHg. About 10 minutes prior to extubation, inhalational agent was stopped and the infusion was started over a period of 10 minutes by the anaesthesia resident (who was unaware of the

contents of the infusion). Residual neuromuscular blockade was reversed with neostigmine 0.05mg/ kg and glycopyrolate 10 µg/kg. Trachea was extubated after the patient resumed spontaneous respiration and obeyed verbal commands.Heart rate, systolic blood pressure, diastolic blood pressure, SpO_2 was recorded at base line / at the start of drug injection, at 1 and 5 minutes after the start of drug infusion, and thereafter at the time of extubation at the 1, 5, 10, 15, 20 minutes after extubation.

Hypotension was defined as a decrease in systolic blood pressure >20% from baseline or a mean arterial pressure of <60 mmHg and was corrected with intravenous fluids and if required, with small dose of mephenteramine 3mg IV. Bradycardia was defined as a heart rate of <60 beats/min and was corrected, if associated with hemodynamic instability, with atropine 0.5 mg IV.

Quality of extubation was evaluated based on cough immediately after extubation using 5 pt rating scale (extubation quality score).[4]

1. = No coughing
2. = Smooth extubation, minimal coughing (1 or 2 times)
3. = Moderate coughing (3-4 times)
4. = Severe coughing and straining (5-10 times)
5. = Poor extubation, very uncomfortable (laryngospasm and cough 10 times).

Post-operative sedation was evaluated on a Ramsay sedation scale (6 point scale)[5] at extubation and thereafter at every 15 minutes for 1 hr.

1. =Anxious or agitated and restless or both.
2. =Cooperative, oriented and tranquil.
3. =Drowsy but responds to commands.
4. =Asleep, brisk response to light glabellar tap or loud auditory stimulus.
5. =Asleep, sluggish response to light glabeller tap or loud auditory stimulus.
6. =Asleep and un arousabe.

Occurrence of any event like laryngospasm, bronchospasm, desaturation, respiratory depression, vomiting was noted.

Statistical Methods

Data was entered in Microsoft excel and analysis was done using SPSS version 20.Descriptive statistical analysis was done. Results on continuous measurements are presented as Mean & Standard Deviation. Results oncategorical measurements are presented as Percentages. Significance is assessed at 5 % level of significance. Student t test (independent, two tailed) has been used to find out the. Significance of study parameters on a continuous scale between two groups .

Chi square test is used to find out the significance of study parameterson a categorical scale between two groups

Results

The minimum age in Group D & F were 18 & 20yrs respectively. The maximum age in both groups was 55yrs. The mean age in Group F & D were 39.6333 + 7.131 & 42.56 + 10.377 respectively. There was no significant difference in the age of patient's between the Group F & D [p = 0.208]

Table 1: Demographic data in present study

Age in intervals	Fentanyl	Dexmed	Total
18-28	3 (10%)	4 (13.3%)	7 (11.7%)
29-38	10 (33%)	7 (23.3%)	17 (28.3%)
39-48	15 (50%)	11 (36.7%)	26 (43.3%)
49-55	2 (6.7%)	8 (26.7%)	10 (16.7%)
Mean Age	39.6 ± 7.13	42.5 ± 10.37	0.208
Gender distribution			
Male	15 (50%)	14 (46.7%)	29 (48.3%)
Female	15 (50%)	16 (51.7%)	31 (51.7%)
Weight distribution in kgs			
50-59	10 (33%)	14 (46.7%)	24 (40%)
60-64	8 (26.7%)	7 (23.3%)	15 (25%)
65-69	9 (30%)	7 (23.3%)	16 (26.7%)
70 and above	3 (10%)	2 (6.7%)	5 (8.3%)
Mean Body weight	61.9 ± 6.104	60.63 ± 5.78	0.413

50% of Group F and 46.7% of Group D were males. Females are 50% in Group F and 53.3% in Group D. The sex distribution did not have any statistically significant difference [p = 0.796]

Body weight distribution of the patients. The mean body weight in Group F & D were 61.9 + 6.104 and 60.633 + 5.78. There was no statistically difference in the body weights between the two groups [p = 0.413] (Table 1).

The basal HR were comparable in both groups and the difference was not statistically significant (p = 0.736). The mean HR was compared at different time intervals and it was observed that, after administration of drug in Group-F, the mean HR at 1min and 5min were 89.466 ± 7.247 and 92.533 ± 11.64 respectively showing continuous raise of HR before extubation, While in Group-D mean HR at 1min and 5min was 83.433 ± 12.57 and 75.166 ± 1.81

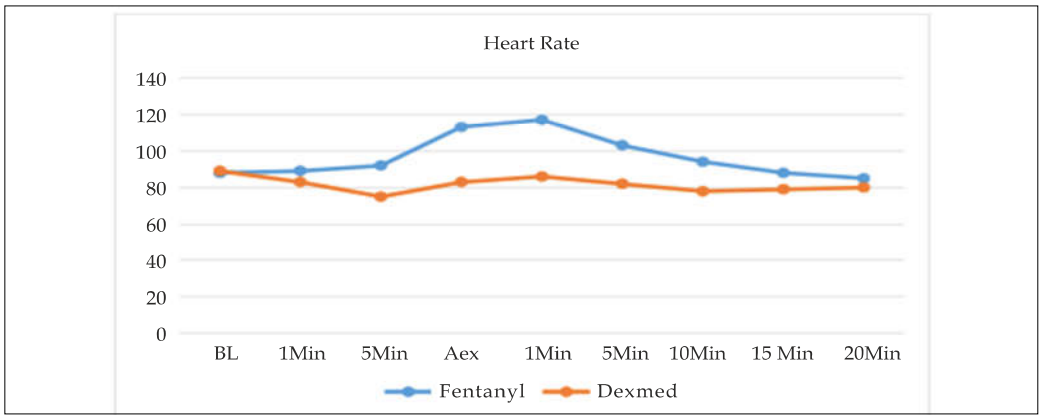

Fig. 1. Comparison of heart rate in two groups of drugs

respectively showing continuous fall in HR. The difference in the HR is statistically significant (p = 0.0001).The mean HR at extubation in Group-F was 113.233 ± 7.71 is significantly more than mean HR in group-D, 83.733 ± 12.23 (p = 0.0001). The peak raise in mean HR was at 1min after extubation in both Group- F and Group-D 117.5 ± 8.029 and 86.7 ± 11.79 respectively and the difference is statistically significant. At 3, 5, 10, 15. min after drug administration the HR in Group-F remained significantly high compared to Group-D (Fig. 1).

In Group-F, the basal mean SBP was 122.266 ± 7.80 and 125.1 ± 9.67 in Group-D, The difference was statistically not significant (p = 0.217). Mean SBP at 1min in Group-F increased minimally, 123.66 ± 7.14 and in Group-D increased minimally 129.33 ± 12.60 and the difference is statistically not significant (p = 0.036). Mean SBP at 5 min in Group-F was 127.46 ± 7.08 which is significantly more than mean SBP 108.83 ± 10.79 in Group-D, the difference is statistically significant (p = 0.001). At extubation mean SBP in Group-F was 147.96 ± 7.83 which was

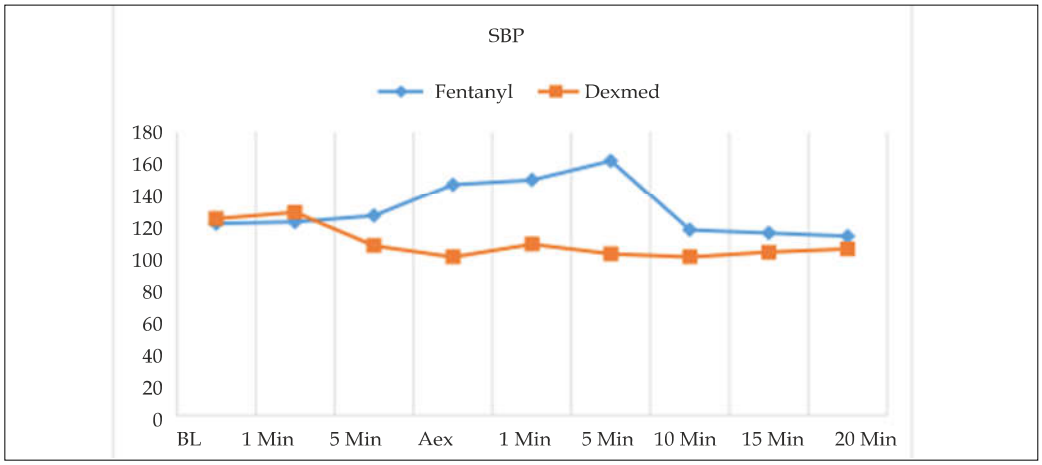

Fig. 2. Shows comparison of SBP between Group-F and Group-D

significantly more than mean SBP 101.7 ± 12.17 in Group-D. Peak raise in SBP occurred at 1min after extubation in both Group-F and Group-D (150.26 ± 7.77) and 109.76 ± 10.87 respectively, but the peak raise was more in Group-F compared to Group-D and the difference is statistically significant (p = 0.001). Mean SBP at 1, 5, 10, 15, 20 min after extubation in Group-F was comparatively more than Group-D and it is statistically significant (p = 0.001) (Fig. 2).

The basal mean DBP are comparable in both the groups and are statistically not significant (p = 0.348). 1min after drug administration the mean DBP in Group-F and Group-D are 79.2 ± 7.097 and 80.33 ± 5.90 respectively and the difference is not statistically significant (p = 0.504). The mean DBP at 5min and at extubation in Group F were significantly high compared to mean DBP in Group-D (p = 0.001). Peak raise in DBP occurred at 1min after extubation in both Group-F (98.9 ± 5.23) and Group D (78.23 ± 8.73) but the raise was more in Group-F compared to Group-D and

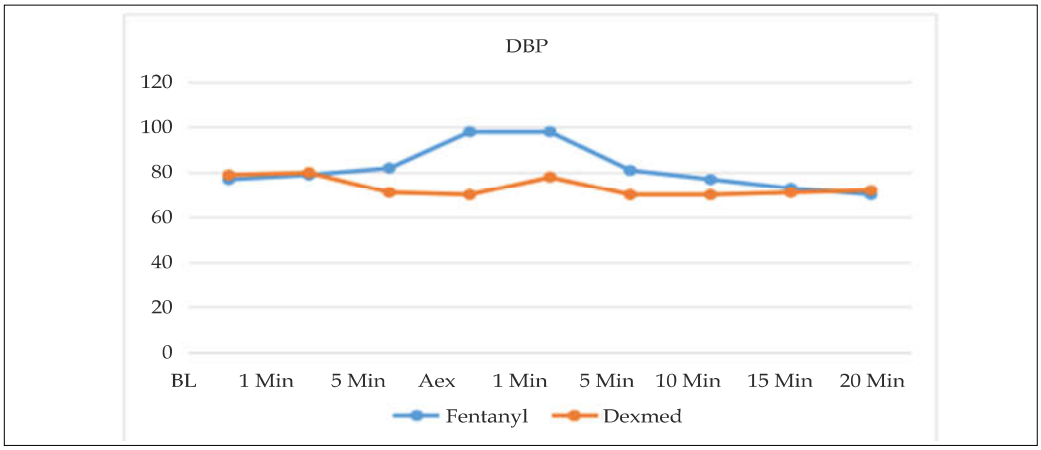

Fig. 3. Shows the comparison of DBP between Both Group-F and Group-D.

the difference is statistically significant. The mean DBP at, 5, 10 min in Group-F were significantly more compared to mean DBP in Group-D and the difference is statistically significant (p = 0.001).A t 15min,The mean DBP in Group-F and Group-D are 73.56 ± 5.43 and 71.6 ± 7.71 respectively and the difference is not statistically significant (p = 0.258). At 20min,The mean DBP in Group-F and Group-D are 70.46 ± 6.12 and 72 ± 6.44 respectively and the difference is not statisticallysignificant (p = 0.349) (Fig. 3).

The basal mean MAP are 91.96 ± 5.76 and 94.36 ± 6.44 respectively and are comparable in both groups (p = 0.134). AT 1min after the drug administration the change in mean MAP was statistically not significant (p = 0.766). At 5min after administration of drug and at extubation the MAP continued to increase in Group-F, while there is a decrease in MAP in Group-D and the difference is statistically significant (p = 0.001). The peak raise in mean MAP occurred at 1min after extubation in both Group-F (115.73 ± 5.11) and Group-D (88.23

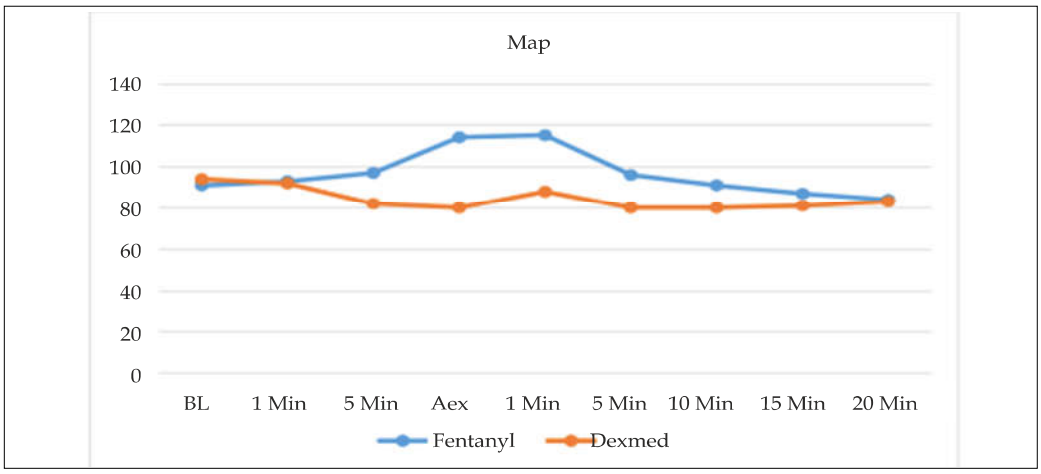

Fig. 4. Comparison of mean arterial pressure in twogroups of drugs

± 7.89) and the difference is statistically significant. The peak raise in MAP was more in Group-F compared to Group-D. The mean MAP at 5, 10, 15, min in Group-F is significantly more compared to Group-D. The mean MAP in Group-F and Group-D are 84.733 ± 4.37 and 83.3 ± 6.31 respectively and the difference is not statistically significant (p = 0.311). shows the mean SpO_2 distribution among two groups. The mean SpO_2 in Group-F was 99.6000 with standard deviation of 0.85 and in Group-D was 99.5000 with standard deviation of 0.90 and the difference is statistically not significant (p = 0.661) (Fig. 4).

There was a significant difference in the quality of extubation between the two groups (p = 0.125). 86.7% of the patients in Group-D could be extubated smoothly, where as 13.3% patients showed minimal coughing at the time of extubation. 66.7% of patients in Group-F could be extubated smoothly, 33.3% patients showed minimal coughing (Table 2).

There was a significant difference in the sedation score between the two groups (p = 0.001). In

Table 2: Distribution of extubation response

		Fentanyl	Dexmed	Total
Extubation response	1	20(66.7%)	26(86.7%)	46(76.7%)
	2	10(33.3%)	4(13.3%)	14(23.3%)
	3	0	0	0
	4	0	0	0
	5	0	0	0
Total		30	30	60

Group-F, 24 patients that is 80% have a score of 1, 6 patients (20%) have a score of 2. In Group- D, 0 patients have a score of 0, 20 patients that is 66.7% have a score of 2and 10 patients (33.3%) have score of 3 (Table 3).

In Group-F, 4 patients had vomiting and 2 had shivering. In Group-D 2 patients developed bradycardia and 3 patients developed hypotension. None had shivering or hypotension (Table 4).

Table 3: Distribution of ramsay sedation score

	Score	Fentanyl	Dexmed	Total
Ramsay sedation score	1	24(80%)	0	24(40%)
	2	6(20%)	20(66.7%)	26(43.3%)
	3	0	10(33.3%)	10(16.7%)
	4	0	0	0
	5	0	0	0
	6	0	0	0
Total		30	30	60

Table 4 : Distribution of side-effects among drug groups

Side Effects	Fentanyl		Dexmed	
	Number of Patients	%	Number of Patients	%
No	24	80	25	83.33
Bradycardia	0	0	2	6.66
Hypotension	0	0	3	10
Vomiting	4	13.33	0	0
Shivering	2	6.66	0	0
Total	30	100	30	100

Discussion

Most of the general anaesthetic procedures in the modern anaesthetic practice are carried out with endotracheal intubation. Laryngoscopy, tracheal intubation and extubation are considered as the most critical events during administration of general anaesthesia as they provoke transient but marked sympatho-adrenal response manifesting as hypertension and tachycardia. The increase in the pulse rate and blood pressure are usually transient, variable and unpredictable. Transient hypertension and tachycardia are probably of no consequence in healthy individuals but either or both may be hazardous to those with hypertension, myocardial insufficiency or cerebrovascular diseases. Pressor response is exaggerated in hypertensive patients even though rendered normotensive preoperatively by antihypertensive medication. Pressor response may result in post-operative myocardial infarction, acute left ventricular failure, intracranial bleed and dysrrythmias in individuals with end organ decompensation. Many methods like use of inhalational anaesthetic agents, lidocaine, opioids,direct acting vasodilators, calcium channel blockers and β-blockers have beentried by various authors for blunting haemodynamic responses to extubation. But all such manoeuvres had their own limitations. For example, use of halothane was associated with dysrrythmias, calcium channel blockers produced reflex tachycardia, direct acting vasodilators needed invasive hemodynamic monitoring and lidocaine did not give consistent results in blunting the hemodynamic responses to extubationFentanyl, a synthetic opioid, has been reported to reduce the prevalence of coughing during and after extubation and to suppress the sneezing reflex after abdominal hysterectomy and periocular injections. Fentanyl has also been reported to attenuate the cardiovascular responses to tracheal extubation in elective gynecologic surgery.Alpha2- agonists like dexmedetomidine decrease the sympathetic outflow and noradrenergic activity, thereby counteracting hemodynamic fluctuations occurring at the time of extubation due to increased sympathetic stimulation.This study was undertaken to compare the effect of intravenous Fentanyl 1μg/kg with dexmedetomidine 0.7μg/kg on the hemodynamic and recovery responses during extubation.

The present study was done in 60 patients, planned for various elective surgical procedures under general anaesthesia. Patients were selected after thorough preoperative evaluation. Patients with cardiac, renal, cerebrovascular diseases, 1st, 2nd, 3rd degree heart block, difficult airway and obese patients (BMI > 30) are excluded from the study. Patients were divided into two groups, Group-F and Group-D, 30 in each group. In both the groups there was no statistical difference with respect to their age, weight, sex, ASA grading, preoperative heart rate and blood pressure.The premedication, induction agent, muscle relaxant were standardized for both groups. At the last skin suture inhalational anaesthetic was discontinued,

on the return of spontaneous efforts Group-F patients received 1µg/kg fentanyl diluted to 10ml over 60 sec IV while Group-D received 0.7µg/ kgdexmedetomidine diluted to 10ml over 60 sec IV. HR, SBP, DBP, MAP are measured at 1min and 5min after the study drugs were administered. Neuromuscular block was reversed.Trachea was extubated 5min after study drug was administered and when the patents respirations are sufficient and obeying simple commands. HR, SBP, DBP, MAP, SpO_2, are measured at extubation,1min, 5min, 10min, 15min, 20min after extubation.The HR in Group-D did not show a significant raise compared to basal value from 1min of drug administration, at extubation and any time period post extubation. Though there is a raise in HR at extubation and 1min after extubation, the raise in HR was significantly below the base line HR. This observation is in concurrence with the study done by Rani P et al.[6], where the HR in the dexmedetomidine group remained below the baseline value at all the time intervals following extubation. The raise in the HR that occurred during extubation and 1min after extubation in Group-D is less compared to the raise in HR in Group-F. In Group-F there was a significant raise in HR compared to basal value. The raise HR in Group-F was more persistent than the Group-D. This is accordance with the study done by Rani P et al.[6]Bradycardia was observed in 2 patients at 1min and 2min after giving IV dexmedetomidine in Group-D, but none of the patients required treatment. No patients in Group-F developed bradycardia. These results correlate with the study done by Bindu et al.[7] The study done by Aksu R et al.[8] also found that the incidence of bradycardia was higher in Group-D compared to Group-F which correlates with our study.In our study the SBP increased in the 1st 1min after the dexmedetomidine was given and returned to normal after 5min. This is because the effect of α-2 agonists on the hemodynamics is biphasic, an immediate increase in systemic arterial pressure which is mediated by stimulation of peripheral α-2B receptor followed by a longer lasting reduction in pressure caused by stimulation of α-2 adrenoceptor in central nervous system. SBP decreased minimally after 1min in fentanyl group. Aksu R et al[8] and Rani p et al[6] observed similar increase in SBP after the initial administration of dexmedetomidine.We observed that at extubation SBP was significantly low in Group-D and is 24mmHg less than the basal SBP, While in Group-F SBP at extubation was significantly high and is 25mmHg greater than the basal SBP. Maximum increase in SBP occurred at 1min after extubation in both the groups. In Group-D though there is an increase in SBP at 1min after extubation it was 4mmHg less than the basal value. In Group-F the increase in SBP was 9mmHg greater than the basal value. Dexmedetomidine attenuated the ncrease in SBP to greater degree than fentanyl. The DBP increased at 1min after drug administration in both Group –D and Group-F and the difference is statistically not significant. In Group-D, DBP at extubation was significantly low and is 9mmHg less than the basal value. In Group-F at extubation the DBP was significantly high compared to Group-D. Maximum increase in DBP occurred at 1min after extubation in both groups but it was significantly high in Group-F compared to Group-D. These observations correlates with the observations made by Nishina et al.[9]In our study the MAP increased in the 1st 1min after the dexmedetomidine was given and returned to normal after 2min. This is because the effect of α-2 agonists on the hemodynamics is biphasic. MAP also increased after 1min in fentanyl group but the difference is statistically not significant.Similar observation was made by Rani P et al.[6] wherein they found initial transient raise in MAP in 20% of cases after IV dexmedetomidine. In another study Aksu R et al.[7] also observed similar increase in MAP after the initial administration dexmedetomidine. We observed that at extubation MAP was significantly low (80.13 ± 8.69) in Group-D and is 14mmHg less than the basal MAP, While in Group-F MAP at extubation was significantly high (114.53 ± 5.44) and is 23mmHg greater than the basal MAP. Maximum increase in MAP occurred at 1min after extubation in both the groups. In Group-D compared to the basal MAP the increase in MAP was 6mmHg and in Group-F It was 25mmHg. Dexmedetomidine attenuated the increase in MAP to greater degree than Fentanyl. MAP remained below the basal value till 20min after extubation in Group-D, while in Group-F it reached basal value 10min after extubation. These results correlate with the studies conducted by Turan et al[10] they found that dexmedetomidine 0.5µg/ kg administered 5min before the end of surgery stabilized hemodynamics. Jain et al.[11] carried out a study on the effect of dexmedetomidine on the stress response to extubation and inferred that bolus of drug administered before reversal provided hemodynamic stability that may prove beneficial for cardiac patients. In our study Hypotension was seen in 3 patients in dexmedetomidine group. Hypotension was managed with IV fluids. None of the patients required vasopressors for the correction of hypotension. In Fentanyl group no patients had hypotension. These results correlate

with Guler et al.[12], study. They suggested that single dose of dexmedetomidine 0.5µg/kg given IV over 60 sec before tracheal extubation attenuated airway-circulatory reflexes during extubation .In the same study 1 patient had bradycardia and 3 had hypotension.Mean SpO_2 value in Group-D (99.5) and Group-F (99.6) are comparable. There is no incidence of desaturation in both the groups. This observation is in concurrence with study conducted by Aksu et al[8]. Sedation in our study was assessed using Ramsay sedation scale. Following extubation significant number (67%) of patients in Group-D are co-operative , oriented and tranquil (score of 2), 33% Patients were drowsy but responding to oral commands (score of 3) as against 80% of patients in Group-F are anxious or restless or both (score of 1). This observation is in agreement with the comparative study done between dexmedetomidine and lignocaine by Rani P et al.[6]. Quality of extubation was evaluated based on cough immediately after extubation, using 5 point score. Dexmedetomidine by virtue of its analgesic and sedative properties is known to blunt airway reflexes. In our study 86.7% of patients in the Group-D had smooth extubation (score 1) as against to only 67% patients in Group-F. Incidence of coughing was significantly higher inGroup-F than Group-D (33% VS 13%).This observation is in concurrence with the study done by Aksu R et al[8] where most Patients in dexmedetomidine group could be extubated smoothly with less coughing compared to fentanyl group. The results of Shrirang et al[13] study also correlates with our study. Guler et al[12]. noted the effect of dexmedetomidine on children undergoing adeno-tonsillectomy where in dexmedetomidine group had significantly decreased incidence and severity of agitation and smooth extubation without any increase in incidence of side effects.

In our study , insignificant number of patients in Group-F had vomiting's and shivering with none in Group-D. The absence of shivering among Group-D patients may be due to dexmedetomidine suppressing shivering, possibly by its activity at alpha2 B receptors in the hypothalamic thermoregulatory center of the brain. None of the patients in either groups developed undue sedation or desaturation and respiratory depression. Similar findings are have been made by Bindu et al.[7], Guler et al.[12] and Gosai ND et al.[14] studies also correlate with these findings.

Conclusion

From the data and statistical analysis we conclude that, compared to Fentanyl 1µg/kg, dexmedetomidine 0.7µg/kg administered I.V. before extubation attenuates airway and hemodynamic reflexes to a greater extent allowing smooth and easy tracheal extubation , thereby providing comfortable recovery.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 688–696
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.5

Intravenous Dexmedetomidine 0.6µg/kg and 1µg/kg for Attenuation of the Haemodynamic Response to Laryngoscopy and Intubation: A Clinical Study

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Abstract

Introduction: Laryngoscopy and intubation are noxious stimuli and are associated with haemodynamic responses in the form of laryngo-sympathetic stimulation which is manifested as hypertension, tachycardia. The magnitude of haemodynamic changes observed may be dependent on various factors such as the depth of anaesthesia, whether any measures are taken prior to airway manipulation, the anaesthetic agent used, the duration of laryngoscopy and intubation. *Aims*: The present study is aimed to comparing the effectiveness of two different doses of intravenous Dexmedetomidine, 0.6 µg/kg body weight and 1µg/kg body weight for attenuating haemodynamic response to laryngoscopy and endotracheal intubation and also to find out any adverse effects. *Materials and methods :* A Randomized, controlled study between 2 doses of intravenous dexmedetomidine–0.6 µg/kg body weight and 1 µg/kg body weight for attenuation of haemodynamic response to laryngoscopy and endotracheal intubation. was undertaken in 60 patients of either sex between 18 to and 55 yrs of age belonging to ASA-I undergoing elective general endotracheal anesthesia were selected for the study. *Results:* There was marked decrease in HR after dexmedetomidine administration. In group D-0.6 and group D-1 HR, SBP, DBP and MAP markedly increased at 1 minute following laryngoscopy and intubation in the control group where as in dexmedetomidine group there was a fall in HR, SBP, DBP and MAP at various intervals following intubation which was statistically significant. There was no statistical difference between the group D-0.6 and group D-1 with regard to haemodynamic parameters after laryngoscopy and endotracheal intubation. There was increased incidence of sedation in patients belonging to group D-1 when compared to group D-0.6 which was statistically significant. Incidence of bradycardia and hypotension was higher in group D-1 when compared to group D-0.6 which were managed easily. *Conclusion:* It is concluded that Dexmedetomidine obtunds the haemodynamic responses to laryngoscopy and endotracheal intubation and 0.6 µg/kg body weight is the ideal dose for the same.

Keywords: Not Provided

How to cite this article:
Syed Abid Ali, M Gouthami, B Swathi. A Intravenous Dexmedetomidine 0.6µg/kg and 1µg/kg for Attenuation of the Haemodynamic Response to Laryngoscopy and Intubation: A Clinical Study. Indian J Anesth Analg. 2020;7(3):688–696.

Introduction

Laryngoscopy and endotracheal intubation are the most important and essential skills for an anaesthesiologist in maintaining the airway. However, both laryngoscopy and intubation are noxious stimuli and are associated with haemodynamic responses in the form of laryngo-

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Received on 24.01.2020, **Accepted on** 07.03.2020

sympathetic stimulation which is manifested as hypertension, tachycardia. The magnitude of haemodynamic changes observed may be dependent on various factors such as the depth of anaesthesia, whether any measures are taken prior to airway manipulation, the anaesthetic agent used, the duration of laryngoscopy and intubation.

To date, the exact mechanism of haemodynamic responses to laryngoscopy and intubation has not been clarified. The principle mechanism in hypertension and tachycardia is the sympathetic response which may be the result of increase in catecholamine activity.

The increase in the heart rate and blood pressure are usually transitory, variable and unpredictable. Transitory hypertension and tachycardia are probably of no consequence in healthy individuals but either or both may be hazardous to those with hypertension, coronary artery disease or cerebrovascular diseases. This laryngoscopic reaction in such individuals may predispose to development of pulmonary edema, myocardial insufficiency, dysrrhythmias[9] and cerebrovascular accident.[1]

Intravenous anaesthetic induction agents do not adequately or predictably suppress the haemodynamic responses produced by endotracheal intubation.[10] So prior to initiating laryngoscopy, additional pharmacological measures like use ofvolatile anaesthetics, topical and intravenous lidocaine, opioids, vasodilators – sodium nitroprusside, Nitroglycerine, Calcium channel blockers and β-blockers have been tried by various authors. None of these drugs mentioned have been found to be effective to attenuate the sympathetic response to intubation.

Besides minimizing the cardiovascular response, anaesthesia induction for patients at risk must also satisfy the following requirements: it must be applicable regardless of the patient group, prevent impairment of cerebral blood flow and avoid awareness of the patient; it should neither be time consuming nor effect the duration or modality of the anaesthetic technique and also should not have any effect on the recovery characteristics of the patient.

Hence there is a need to find drugs which can suppress the cardiovascular response to intubation and also help in potentiating the effects of induction agents to meet the above requirement.

Various studies have found that Dexmedetomidine decreases the haemodynamic response to laryngoscopy and intubation. It has been introduced recently in India (2009).[2]

Various studies have used Dexmedetomidine in the dose of 0.6 µg/kg body weight and 1µg/kg body weight as intravenous bolus for attenuating the haemodynamic response. There is conflicting reports as to which dose of the drug is ideal to suppress the intubation response and also have minimal adverse effects.

Hence there is a need to know whether 0.6 µg/kg body weight to 1 µg/kg body weight is the ideal dose for attenuation of haemodynamic response to larynogoscopy and endotracheal intubation. Hence, the present study is aimed to comparing the effectiveness of two different doses of intravenous Dexmedetomidine, 0.6 µg/kg body weight and 1µg/kg body weight for attenuating haemodynamic response to laryngoscopy and endotracheal intubation and also to find out any adverse effects.

Materials and Methods

A study is Randomized, controlled study between 2 doses of intravenous dexmedetomidine– 0.6 µg/kg body weight and 1 µg/kg body weight for attenuation of haemodynamic response to laryngoscopy and endotracheal intubation. was undertaken in Department of Anesthesiology and Critical care at Gandhi Medical College and Hospital, 2017 to 2018.

After Institutional ethical committee approval, 60 patients of either sex between 18 and 55 yrs of age belonging to ASA-I undergoing elective general endotracheal anesthesia were selected for the study .

Inclusion Criteria: Adult patients aged between 18 and 55 years of both sex, ASA class 1 and Elective surgeries under general end tracheal anesthesia

Exclusion Criteria: Patients with cardiac, coronary, renal, hepatic, cerebral diseases and peripheral vascular diseases, hypertension, with difficult airway and obese patients (BMI > 30), with endocrinal diseases like hyperthyroidism, hypothyroidism and diabetes mellitus etc.Pregnant females, time for laryngoscope and intubation exceeding 15 seconds.

During the pre-operative visit, all patients were clinically evaluated, assessed and investigated as per study protocol a written informed consent was taken .

The study population (60 patients) was randomly divided into two groups with 30 patients in each

group using sealed envelopes containing the name of the group and patient asked to pick up the envelope. The envelope was opened by senior anesthesiologist who was assigned to prepare the solutions and was not involved with the study.

Group D-0.6: (n=30) received injection Dexmedetomidine 0.6 µg/kg body weight- diluted to 10 ml of normal saline, administered intravenously over 10 min.

Group D-1: (n=30) received injection Dexmedetomidine 1 µg/kg body weight- diluted to 10 ml of normal saline, administered intravenously over 10 min.

Pre-anesthetic evaluation was done an evening before surgery. A routine preanesthetic examination was conducted assessing General condition of the patient, Airway assessment by Mallampatti grading and rule of 1-2-3, Nutritional status and body weight of the patient

A detailed systemic examination and basic investigation were done in all patients. All patients included in the study were premedicated with tablet alprazolam 0.5 mg and tablet ranitidine 150 mg orally at bed time the previous night before surgery. They were kept nil orally 10 pm onwards on the previous night.

On arrival of the patient in the operating room, an 18-gauge intravenous cannula was inserted under local anaesthetic infiltration and an infusion of 500 ml Ringer Lactate was started. The patients were connected to multiparameter monitor which records heart rate, non-invasive measurements of SBP, DBP, MAP, $EtCO_2$ and continuous ECG monitoring and oxygen saturation. The baseline systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate were recorded (basal parameters). The cardiac rate and rhythm were also monitored from a continuous visual display of electrocardiogram from lead II.

After recording the baseline readings, patients in group D-0.6, received Dexmedetomidine 0.6µg/ kg body weight diluted in 10 ml normal saline intravenously over 10 min using syringe pump, 10 min before induction.

Patients in group D-1, received Dexmedetomidine 1µg/kg body weight, diluted in 10 ml normal saline intravenously over 10 min using syringe pump, 10 min before induction.

The study drug was prepared by the senior anaesthesiologist who was not involved in the study and as such, the observer as well as patient were blinded for the study.

All patients were premedicated with injection midazolam-0.02mg/kg body weight and injection fentanyl 1µg/kg body weight IV after drug administration, 3 min before induction. Then patients were preoxygenated for 3 minutes via a face mask with closed circuit. Anaesthesia was induced with injection. propofol 1-1.5 mg/kg which continued till the patient's verbal response was abolished and dose of propofol required was noted Endotracheal intubation was facilitated with 1.5 mg/kg IV succinylcholine one minute prior to laryngoscopy and intubation. Laryngoscopy and intubation were performed using Macintosh no. 3 blade lasting for not more than 15 seconds and after confirmation of bilateral equal air entry and $EtCO_2$, the endotracheal tube was fixed.

Anaesthesia was maintained using 66% nitrous oxide and 33% of oxygen with 1% sevoflurane. After the patients recovered from succinylcholine, further neuromuscular blockade was maintained with vecuronium 0.05 mg/kg body weight initially and 0.5 mg increments as and when required. At the end of the procedure, total dose of vecuronium required for the surgery was recorded and patients were reversed with inj. Neostigmine- 0.05 mg/kg body weight and inj. Glycopyrolate- 0.01 mg/kg body weight. Sedation was assessed at the end of the surgery using Ramsay sedation score. The time for recovery was also noted, (the time from giving the reversal agent to extubation).

The cardiovascular parameters were recorded as Heart rate [HR] in beats per minute, Systolic blood pressure [SBP] in mm of Hg, Diastolic blood pressure [DBP] in mm of Hg and Mean arterial pressure [MAP] in mm Hg

The above cardiovascular parameters were monitored at time interval Basal-before giving study drug, 2, 5, 8, before, after, One, five and ten minutes after laryngoscopy and intubation

Incidences of side effects were recorded in all the three groups. The side effects of the study drug like hypotension, bradycardia and sedation were noted. Hypotension was treated using 3mg increments of IV mephenteramine and fluids. Bradycardia was treated using 0.6mg of IV atropine. Sedation scoring was done as per Ramsay sedation scale.

SPSS for windows (version 17.0) was employed for data analysis. $p < 0.005$ was considered as significant and $p < 0.01$ was considered as highly significant

Results

Age distribution of the patients in all two groups. The minimum age in group D-0.6, group D-1 were 18 years, 20 years, respectively. Maximum age in group D-0.6, group D-1 were 50 years, 46 years respectively. All two groups were similar with respect to age distribution and there is no statistical significance between the groups (p = 0.2972) (Table 1).

Table 1: Showing the demogrphic distribution

	Group D-0.6	Group D-1
	No of patients	No of patients
Age in years		
18 -20	3 (10)	1(3.33)
21-30	11(36.7)	11(36.7)
31-40	10(33.3)	14(46.66)
41-55	6(20)	4(13.33)
Total	30(100)	30(100)
Mean age in years ± SD	35.5667 ± 8.15	33.466 ± 6.79
p- value	0.2972(NS)	
Gender		
Male	16 (53.3)	15 (50)
Female	14 (46.7)	15 (50)
p-value	1.0000 (INS)	
Body Weight		
40-44	0 (0)	1 (3.3)
45-49	8 (26.7)	7 (23.3)
50-54	5(16.7)	7 (23.3)
55-59	9 (30.0)	7 (23.3)
60-64	3 (10.0)	5(16.7)
65-69	2 (6.7)	3 (10.0)
70 +	3 (10.0)	0 (0)
Main Body weight in kg ± SD	53.83 ± 8.54	53.83 ± 7.40
Minimum Body weight in kg	45	40
Maximum Body weight in kg	81	68
p-value	0.3269(NS)	

NS- Not significant

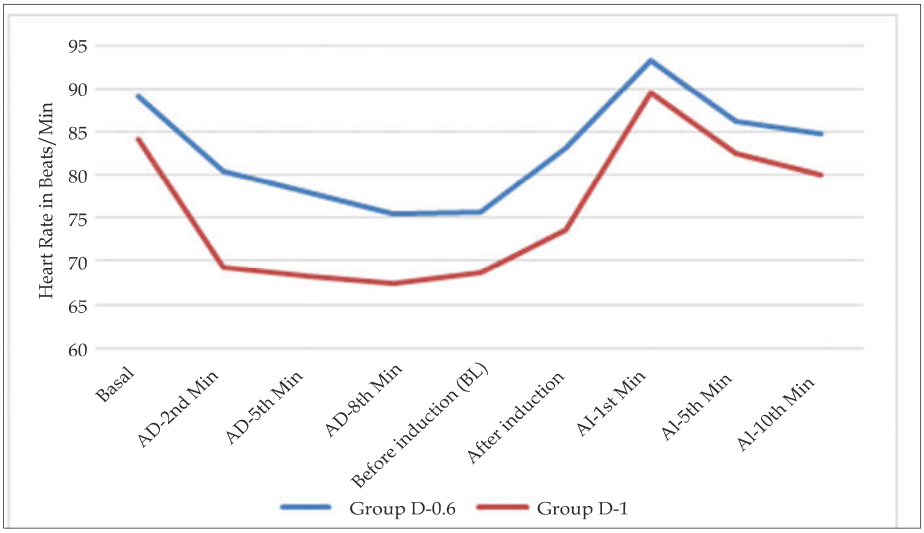

Fig. 1: Intergroup comparision of mean heart rate (bpm) changes in response to laryngoscopy and intubation between two groups

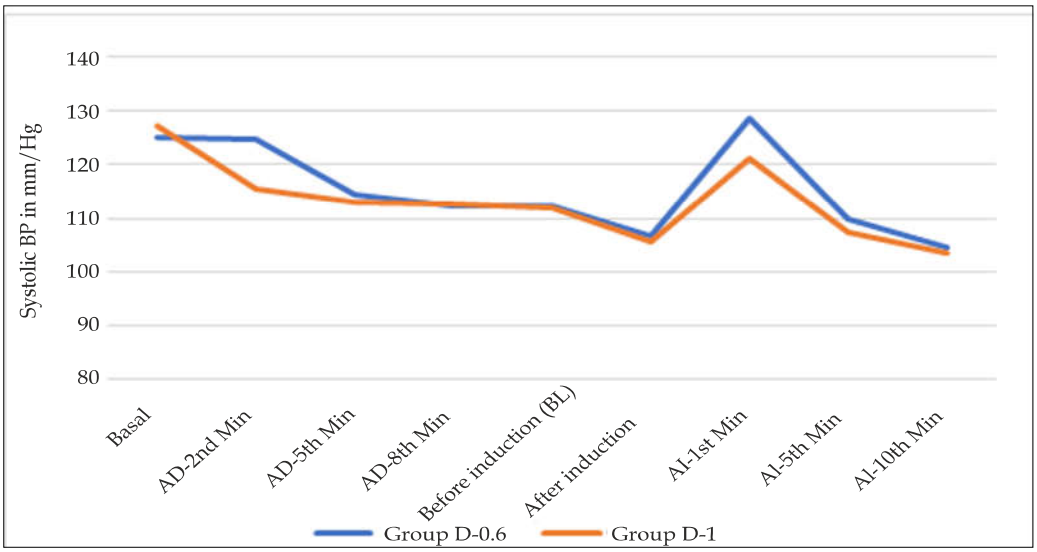

Fig. 2: Comparison of systolic blood pressure changes (mmHg) changes in response to laryngoscopy and intubation between two Groups

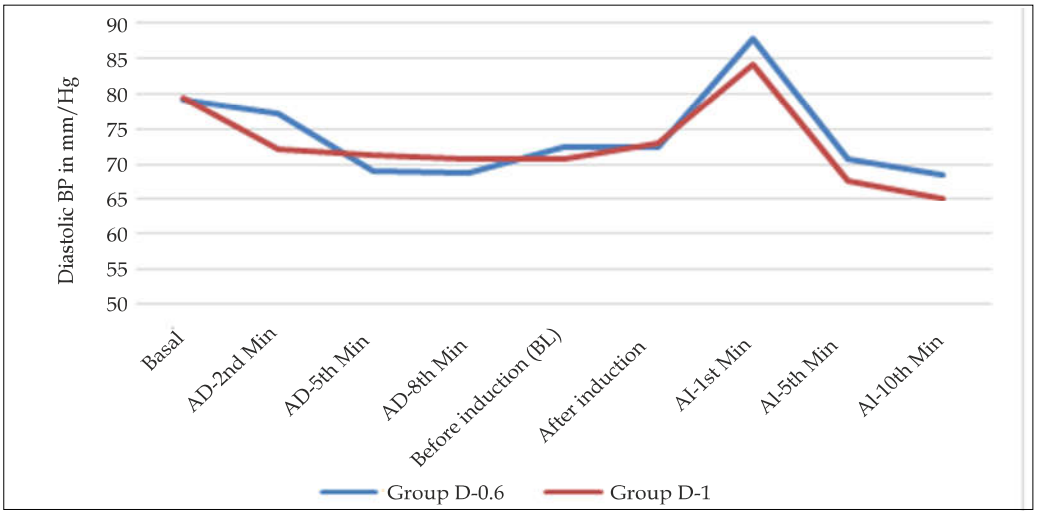

Fig. 3: Comparison of diastolic blood pressure changes (mmHg) changes in response to laryngoscopy and intubation between two Groups

The basal mean HR were comparable in both the groups. statistical evaluation between the groups shows statistical significance in the mean HR between group D-0.6 and groups D-1, after study drug administration at 2nd min, 5th min & 8th min and before induction and after induction. The changes in mean HR were comparable in both the groups and statistically not significant, after intubation at 1st min 5th min and 10th min (Fig. 1).

The basal mean SBP were comparable in both the groups. In group D-1, there is statistically significant decrease in mean SBP after drug administration at 2nd min only, when compared to groupD-0.6. statistical evaluation shows no significance in the mean SBP values at 5th min and 8th min after drug administration and before and after induction and also at various intervals after intubation between the two groups (Fig. 2).

The basal mean DBP were comparable in both the groups. In group D-1, there is statistically significant decrease in mean DBP after drug administration at 2nd min only, when compared to group D-0.6. statistical evaluation shows no significance in the mean DBP values at 5th min and 8th min after drug administration and before and after induction and also at various intervals after intubation between the two groups (Fig. 3).

The basal mean MAP was comparable in both the groups. In group D-1, there is statistically significant decrease in mean MAP after drug administration at 2nd min only, when compared to groupD-0.6.

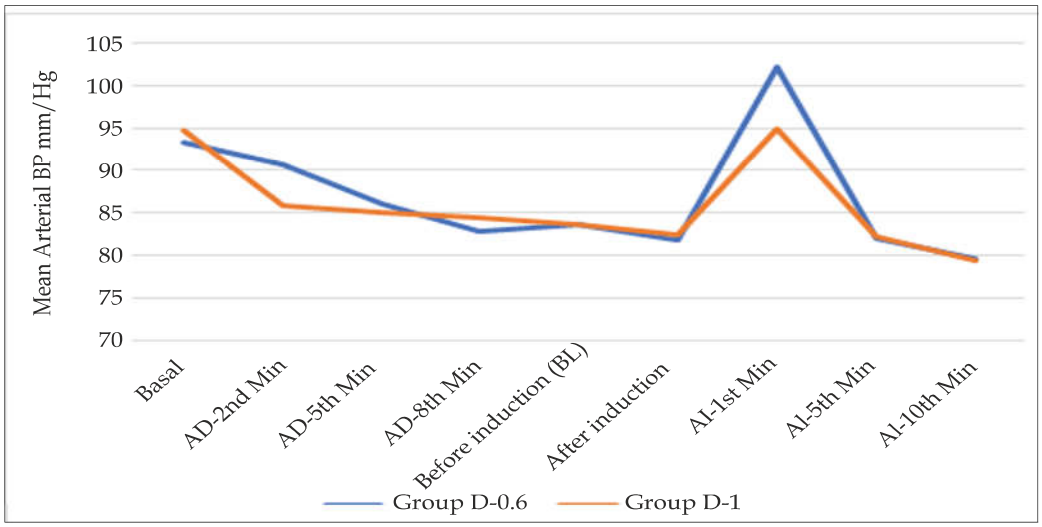

Fig. 4 Comparison of Mean Arterial pressure changes (mmHg) changes in response to laryngoscopy and intubation between two Groups

Statistical evaluation shows no significance in the mean MAP values at 5th min and 8th min after drug administration and before and after induction and also at various intervals after intubation between the two groups (Fig. 4).

Statistical evaluation between the groups showed increased incidence of sedation in groupD-1 than in droupD-0.6 which statistically highly significant .Recovery time is similar in two groups. There is no statistical significance between the two groups with respect to recovery time (Table 2).

Table 2: Showing the statistical singnificant in GroupD-1 compare to GroupD-0.6 in different variables

Variables	GroupD-0.6	GroupD-1	*p*-Value
SBP 2nd min	124.66 ± 13.7	115.7 ± 10.06	0.0006 (HS)
DBP 2nd min	77.10 ± 8.19	72.03 ± 10.41	0.041 (S)
MAP 2nd min	90.70 ± 6.48	85.9 ± 9.55	0.027(S)
MHR AD-2nd min	80.46 ± 12.1	69.26 ± 9.41	0.000 (HS)
MHR AD-5th min	78.30 ± 11.8	68.36 ± 11.08	0.0001 (HS)
MHR AD-8th min	75.50 ± 11.5	67.33 ± 10.54	0.006 (HS)
Before Induction	75.60 ± 10.4	68.76 ± 10.29	0.0014 (S)
After Induction	83.16 ± 13.1	73.66 ± 12.5	0.006 (HS)
Sedation score	2.13 ± 0.43	2.63 ± 0.18	0.0001
Recovery time	2.82 ± 0.3	3.01 ± .02	0.30 (NS)

In group D-0.6, one patient had bradycardia which was treated. In group D-1 bradycardias who were treated (Table 3).

Table 3: Showing the side effects between two groups

	Nil	Bradycardia	Hypotension	Treatment required
GroupD-0.6	49	0	0	1
GroupD-1	45	3	2	5
p value	0.10 (NS)			

Discussion

Dexmedetomidine has been found by various authorsto blunt the haemodynamic response for laryngoscopy and intubation. Dexmedetomidine has been recently introduced in India (only in 2009). Not many studies have been done to know the effectiveness of Dexmedetomidine in attenuating the haemodynamic response to laryngoscopy and intubation in India. Hence it has been selected as our study drug.

Various authors have employed IV Dexmedetomidine for blunting haemodynamic responses to laryngoscopy and intubation in different doses. Different doses of Dexmedetomidine have been used to find the effectiveness for blunting haemodynamic responses to laryngoscopy and intubation, with conflicting results. It has been used in the doses of 0.3 µg/kg, 0.4 µg/kg, 05 µg/kg, 0.6 µg/kg and 1 µg/kg body weight, 0.3 µg/kg to 0.5 µg/kg body weight does was not very effective in blunting the response.Both 0.6 µg/kg and 1 µg/kghave been found to be effective.[3] It is not yet found which one of this dose is effective with minimal side effects. Hence, in our study these two

doses of Dexmedetomidine have been compared to know the minimum effective does of the drug for this purpose with least side effects.

In the present study dexmedetomidine was diluted in 10 ml of normal saline and given intravenously over 10 minutes using syringe pump. Rapid administration of bolus dose of dexmedetomidine, initially results in transient increase in blood pressure and reflex decrease in HR. The initial reaction is due to peripheral α-2B adrenoceoptors stimulation of vascular smooth muscle and can be attenuated by a slow infusion over 10 minutes. Hence in our study we administered the bolus dose over 10 minutes.The administration of the test drugs over 10 minutes in our study, is similar to the studies conducted by Mowafi et al.[2], Basar et al.[4] and Kunisawa et al.[5] and Jarineshin H.[6]

From the pharmacokinetic profile, it is seen that the distribution half life of intravenous dexmedetomidine is approximately 6 minutes. Various authors Aho et al.[7], Scheinin et al.[8], Jakola et al.[9], Mowafi et al.[2] and Keniya et al.[10] have administered dexmedetomidine 10 minutes before induction. Hence, in the present study dexmedetomidine was administered 10 minutes before induction to blunt the haemodynamic response to laryngoscopy and intubation.

In our study, it was observed that there was a statistically highly significant decrease in the mean HR after the administration of 0.6 µg/ kg body weight and 1 µg/kg body weight of Dexmedetomidine before induction which is similar to the findings of Scheinin et al.[8], Jaakola et al.[9], Basar et al.[4], Keniya et al.[10] and Chirag Patel et al.[4]

Compared to, group D-0.6, it was observed that there is a statistically highly significant decrease in mean HR in group D-1. The same thing has also been observed in the studies conducted by Martina Aho et al.[7] and Sagiroglu et al.[11] who have found that higher doses of Dexmedetomidine produces more decrease in the HR.

After induction of anaesthesia, compared to pre induction values, it was found that HR increased by nearly 12 bpm in the control group. In group D-0.6 there is a increase in HR Of 8 bump and in group D-1 there is a increase in HR of 5 bpm which is statistically highly significant. In all the 3 groups there is an increase in the HR after the administration on thiopentone. This is in accordance to the property of Dexmedetomidine; the baroreceptor activity is being well preserved.

In the present study, following laryngoscopy and intubation at 1 minute, the mean HR increased by 36 bpm in the control group whereas in group D-0.6 the mean HR increased by only 4 bpm and in group D-1 the mean HR increased by only 5 bpm which is statistically highly significant (p = 0.000) when compared to control group. But the mean change in HR after intubation at various intervals in between group D-0.6 and group D-1 was not statistically significant. Various authors have found similar response to IV dexmedetomidine at 1 min after intubation.

Aho et al.[7] noted that following laryngoscopy and intubation HR at 1 minute increased by 35 bpm in control group and by 15 bpm in 0.6 µg/kg dexmedetomidine group which was statistically significant and compares with our study. The 15 bpm increase in their study is higher than the group D-0.6 in our study (4 bpm). This is probably because in their study all the patients were pre-treated with glycopyrolate.

The increase in mean heart rise in control group sustained even at 5th minute and was 23 bpm whereas in group D-0.6 and group D-1 there is a decrease in HR by 3 and 4 bpm respectively which is statistically highly significant (p = 0.000). Similar observations were made by Scheinin et al.[8] and Jakola et al.[9] with both control and with Dexmedetomidine – 0.6 µg/kg. In the study done by Sagiroglu AE et al.[11], the decrease in HR at 5th min with 1 µg/kg Dexmedetomidine was 18 bpm which his higher than our study. This is probably because all the patients in our study were preloaded with 500 ml of Ringer Lactate which was not done in the study mentioned above.

At 10th minute in our study even at 10th minute, there was increase in HR by 13 bpm in control group compared to decrease in the HR by 4 bpm in both group D-0.6 and group – 1 which was statistically highly significant (p = 0.000). Our study compares with the studies done by Basar et.al. 4 and Chirag Patel et al.[3], who also observed a decrease of 5 bpm and 12 bpm at the end of 10th min. In our study, compared to 0.6 µg/kg body weight there was no significant difference in the mean HR at 1st min, 5th min and 10th min after intubation with 1 µg/ kg body weight. Both were equally effective in obtunding the HR response. Same thing has also been observed by sagiroglu AE et al.[11]

Changes in Systolic Blood Pressure (SBP) after Dexmedetomidine Administration

After administration of Dexmedetomidine, there is a gradual reduction in blood pressure till induction in both group D-0.6 and group D-1, which was statistically highly significant. Aho et al.[7] and Keniya et al.[10] found a continuous gradual reduction of SBP as in our study. There was no reduction in SBP in control group till induction which was statistically not significant.

After induction there was a reduction of 10 mmHg of SBP in group D-0.6 and reduction of 22 mmHg in group D-1 and 10 mmHg in control group compared to basal value which is statistically highly significant. Similar observations were made by Kunisawa et al[12] where in there was a decrease in SBP by 12 mmHg in Dexmedetomidine group.

In our study, it is seen that there is highly significant fall in the SBP in group D-0.6 and group D-1 at 1st min 5th min and 10th min following laryngoscopy and intubation compared to control group (p = 0.000) wherein there was an increase of SBP of 29 mmHg, 11 mmHg and 1 mmHg at 1st min, 5th Min and 10 min following laryngoscopy and intubation respectively. Studies done by Scheinin et al.[11], Jaakola et al.[9] and Keniya et al.[10]found similar results that compares with our study. Comparing the SBP at various time intervals between group D-0.6 and group D-1, there was no statistical significant difference. This is consistent with the studies conducted by Sagiroglu et al.[11]

Changes in Diastolic Blood Pressure (DBP) after dexmedetomidine administration there is a gradual decrease of DBP after drug administration at 2nd min, 5th min and 8th min, till induction in both group D-0.6 and group D-1, which is statistically significant. In control group there is not much of variation in DBP till induction. Similar observations were also found by Aho et al.[7], Kunisawa et al.[5] and Keniya et al.[10] where there was a decrease in DBP in dexmedetomidine group and no change in control group.

After Induction in the present study, there was a reduction of 3 mmHg in the control group and 7 mmHg in group D-0.6 and 6 mmHg in group D-1 compared to basal value. Jakola et al.[9] found a decrease in DBP by 3 mmHg in control group and 15 mmHg in Dexmedetomidine group which compares with the present study.

After Laryngoscopy and Intubation in our study there is an increase of DBP by 21 mmHg in control group which gradually decreased to near basal values by 10th minute. In group D-0.6 and group D-1, there is an increase in DBP at 1st min by 8 mmHg and 5 mmHg respectively. However there is a decrease in DBP by 9mmHg and 11 mmHg at 5th min and 10th min in group D-0.6 and decrease in DBP by 8mmHg and 14 mmHg at 5th min and 10th min in group D-1 compared to basal values which is statistically highly significant. Jakola et al.[9] Kunisawa et al.[12] noted similar observations as in our study. In our study, comparing the DBP at various time intervals after laryngoscopy and intubation between group D-0.6 and group D-1, there was no statistical significant difference. This is consistent with the studies conducted by Sagiroglu et al.[11]

After administration of Dexmedetomidine, there is a continuous fall in MAP in both group D-0.6 and group D-1, till induction which is statistically significant. In control group not much of variation was observed in MAP till induction compared to basal values and to Dexmedetomidine group. Basar et al.[4] and Mowafi et al.[2] found which compares with our study.

After induction, there was a reduction in MAP by 12 mmHg in group D-0.6 and 12 mmHg in group D-1 which is statistically significant when compared to group C. Similarly Mowafi et al.[2] observed a decrease in MAP by 13 mmHg in Dexmedetomidine group which concurs with our study.

After Laryngoscopy and Intubation at 1st minute, in group D-0.6, there is an increase of MAP by 9 mmHg. whereas in group D-1, there is an increase in MAP by 1 mmHg compared to the basal values. However at 5th and 10th min the MAP in group D-0.6 was lower by 11 mmHg and 14 mmHg respectively, whereas in group D-1 it was lowered by 12 mmHg and 15 mmHg compared to the basal values which is statistically highly significant, similar to studies done by Basar et al.[4]

In our study, comparing the MAP at various time intervals after laryngoscopy and intubation between group D-0.6 and group D-1, there was no statistical significant difference. This is consistent with the studies conducted by Sagiroglu et al.[11], Talke et al.[13] studied the effect of dexmedetomidine on neuromuscular blockade and noted that dexmedetomidine increased the plasma concentration of rocuronium significantly ($p < 0.05$). The authors could not find a definitive reason for this effect. They hypothesized tht dexmedetomidine might have influcned the pharmacokinetics of rocuronium by decreasing both renal an hepatic blood flow. Similar observation was made by Ghada Ahmad et al.[14]

In group C, mean sedation score was 2.03. In group D-0.6 and group D-1, mean sedation score was 2.13 and 2.63 respectively which was statistically highly significant (p = 0.000) when compared to group C. Group D-1 patients were more sedated, when compared to group D-0.6 which was statistically highly significant. This is similar to observations done by Aho et al.[7], Yildiz et al.[15]and Chirag et al.[3]

Recovery time is similar in all three groups and statistically not significant. This is similar to observations made by Scheinin et al.[11] and Basar H et al.[4]. In group D-0.6, one patient had bradycardia which was treated with inj.atropnine. In group D-1 three patients had bradycardia and two patients had hypotension who were treated with inj. atropine and inj.mephenteramine. In group C none of the patients had bradycardia or hypotension.

Conclusion

Two different doses of Dexmedetomidine – 0.6 µg/kg body weight and 1 µg/kg body weight diluted in 10 ml saline, given 10 minutes before induction are equally efficacious in obtunding the haemodynamic responses to laryngoscopy and endotracheal intubation.However the incidence of sedation and side effects like hypotension and bradycardia is more with 1 µg/kg body weight of Dexmedetomidine.

We conclude that Dexmedetomidine obtunds the haemodynamic responses to laryngoscopy and endotracheal intubation and 0.6 µg/kg body weight is the ideal dose for the same.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 697–702
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.6

Haemodynamic Response To Fiberoptic Nasotracheal Intubation Under General Anaesthesia

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Abstract

Introduction: The cardiovascular response to tracheal intubation, although transient, may be harmful to some patients, mainly those with myocardial or cerebrovascular disease. So we have conducted a study to find out hemodynamic effect of intubation using FOB. *Aim and Objectives:* To observe haemodynamic response to nasotracheal intubation under general anaesthesia using fiberoptic bronchoscopy with respect to :Haemodynamic changes during intubation,at the time of & after intubation; Time required for intubation; Saturation; Post extubation epistaxis. *Methodology:* 50 ASA grade I and II patients of both sexes in the age group of 18 - 60 years scheduled for an elective surgery under general anesthesia were sleeted for nasotracheal intubation with FOB. A uniform protocol of anesthesia was used. Measurements: Heart Rate [HR], Systolic Blood Pressure [SBP], Diastolic Blood Pressure [DBP] & Mean Arterial Pressure [MAP] were noted at their baseline, post-induction values, at the time of insertion of the scope, immediately after intubation & at 3, 5 and 10 minutes after intubation. *Result:* Haemodynamic response in the form tachycardia, increase in SBP, DBP & MAP occurred in nasotracheal intubations with the fiberoptic bronchoscope. SpO_2 was continuously monitored and patients maintained 100% saturation during induction, at the time of insertion of FOB, at 3min, 5min and 10 min. 8 patients had lower reading immediately after intubation with mean Spo2 of 98.72%. Mean time for intubation using FOB was 69.52 sec. *Conclusion:* Fiberoptic bronchoscope under general anesthesia causes significant increases in blood pressure and heart rate

Keywords: Nasotracheal intubation, General Anaesthesia, Hemodynamic Responses, Fibreoptic Bronchoscope, Difficult Intubation.

How to cite this article:
Tushar D Bhavar, Himanshu Khanapurkar, Suhit Natekar. Haemodynamic Response To Fiberoptic Nasotracheal Intubation Under General Anaesthesia. Indian J Anesth Analg. 2020;7(3):697–702.

Introduction

Fiberoptic assisted tracheal intubation was introduced into anaesthetic practice by Murphy in 1967 and Taylor & Towey in 1972.[1,2] Improved techniques have evolved as experience and expertise with fibrescopes have increased, and fiberoptic endoscopy has come to occupy an important place in the management of the difficult intubation. Flexible fiberoptic intubation of the trachea is now

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Received on 13.02.2020, **Accepted on** 16.03.2020

the method of choice when direct laryngoscopy is expected to be difficult.

Nasotracheal intubation can evoke the nasocardiac reflex, which depresses the tachycardic response.[3] The fiberoptic bronchoscope and tracheal tube passing through the nasal cavity tend to be more aligned with the laryngeal and tracheal axes than when introduced through the mouth because there is no sharp turn between choanae and the laryngeal aperture. Therefore, it is possible that FNI results in less friction and stimuli to the epiglottis, glottis and trachea than FOI.

Fiberoptic intubation under general anesthesia does have some advantages. The patient is not conscious of discomfort and the passage of time, so that neither patient nor operator is embarrassed by incompetence. The incidence of coughing is reduced. Nevertheless there are major disadvantages to using general anesthesia. The patient is no longer able to maintain his own airway, and therefore desaturation can occur. The soft palate, tongue and epiglottis tend to fall against the posterior pharyngeal wall and can be difficult to dislodge so that even if the airway is clear enough for spontaneous or controlled ventilation to occur it may be difficult for the operator to obtain a view of the laryngeal inlet.

The cardiovascular response to tracheal intubation, although transient, may be harmful to some patients, mainly those with myocardial or cerebrovascular disease. So we have conducted a study to find out hemodynamic effect of intubation using FOB.

Aims and objective

To observe haemodynamic response to nasotracheal intubation under general anaesthesia using fiberoptic bronchoscopy in 50 ASA grade I and II patients for elective surgery under general anesthesia requiring endotracheal intubation with respect to

- Haemodynamic changes during intubation.
- Haemodynamic changes at the time of & after intubation.
- Time required for intubation.
- Saturation.
- Post extubation epistaxis.

Materials and Methods

The study was conducted at Rajindra hospital Patiala in 50 patients, aged 18 to 60 yrs of ASA grade I and II scheduled to undergo elective surgery under general anaesthesia requiring intubation.

Inclusion criteria

- ASA I and II
- Age 18 to 60 yrs
- BMI of 30 or less

No diagnosed chronic medical disease

Exclusion criteria

- Patient's refusal
- Patients with an anticipated difficult airway
- Obesity
- Cardiovascular and Endocrine disease
- On drugs known to produce changes in heart rate and blood pressure like beta blockers, digitalis, calcium channel blockers, oral contraceptives.
- Bleeding disorders
- History of nasal surgery or trauma
- Nasal polyp

A written informed consent was obtained from each patient after explaining the technique prior to inclusion in this study in their own vernacular language.

Thorough preanaesthetic checkup was done in every patient and minimum 6 hrs NBM was advised

All patients received inj glycopyrolate (0.2mg) I.V, inj midazolam (2mg) IV + promethazine (25mg) IM 30 min before the elective surgery. Fifteen minutes before shifting the patient to the OT table, in both the nasal passages 0.1% oxymetazoline nasal drops where instilled. All patients received tab. alprazolam 0.25 mg 1 HS and 6 am on the day of surgery.

Method

The study was conducted in 50 patients of either gender aged 18 to 60 years belonging to ASA I and II scheduled for elective surgery.

After the patient is brought to operation table baseline measurements of heart rate, blood pressure and SpO_2 were taken. Fentanyl in a dose of 1.5 µg/kg were administered intravenously 5 minutes before induction. Patients were preoxygenated with 100% O_2 for 3 minutes. General anesthesia was induced with an intravenous injection of propofol, 2mg/kg and intubation was facilitated with the use of rocuronium 0.9 mg/kg intravenously. Then patient were ventilated with 100 % oxygen. Intubation was

commenced exactly after 90 seconds of giving inj. rocuronium. If any difficulty was encountered in performing facemask ventilation after anaesthesia induction, the patient was withdrawn from the study. During the intubation, the patient's head was placed in the sniffing position and a clear airway manouvre was maintained by trained assistants who extended the atlanto-occipital joint and displaced the mandible anteriorly by application of firm pressure behind the ascending rami. Nasotracheal intubation was carried out with the aid of fiberoptic bronchoscope. A 7.00 mm internal diameter, cuffed endotracheal tube (ETT) was used for female patients and 7.5 mm internal diameter cuffed ETT for male patients. The ETT lubricated with lignocaine jelly was threaded over the fiberoptic bronchoscope. The fiberoptic bronchoscope was then introduced in the more patent nasal passage and once in nasopharynx, glottis identified and scope then advanced 5 to 7 cm beyond the laryngeal inlet till carina is visible. The ETT was then advanced into the trachea over the scope and fiberoptic bronchoscope removed gently through the endotracheal tube looking for position of ETT. After introduction of ETT, anesthesia was maintained with O_2:N_2O:40:60 along with 0.8 - 1.5% isoflurane. The following parameters were observed: heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial blood pressure (MAP). These parameters were recorded at following time intervals: baseline value, after induction, at the time of insertion of fiberoptic bronchoscope, immediately after intubation and thereafter at 3, 5 and 10 minutes. ECG and SpO_2 were monitored continuously as per the intervals mentioned above. The study was terminated at the end of 10 minutes after intubation. However vitals were monitored throughout the surgery.

Time of intubation from cessation of mask ventilation to connection of breathing circuit to ETT was noted. And postextubation epistaxis if any noted. Data was collected, tabulated and analyzed using SPSS software.

Results

The mean age was 36.84 yrs and male to female ratio was 18:32 with mean weight being 60.8 Kg.

SpO_2 was continuously monitored during intubation and it was found that patients maintained 100% saturation during induction, at the time of insertion of FOB, at 3min, 5min and 10 min. 8 patients had lower reading immediately after intubation with mean SpO_2 of 98.72%.

Mean time for intubation using FOB was 69.52 sec.

Epistaxis was seen in 5 of 50 patients i.e.10%

Haemodynamic parameters are tabulated in Table 1 and depicted in Graph 1.

Discussion

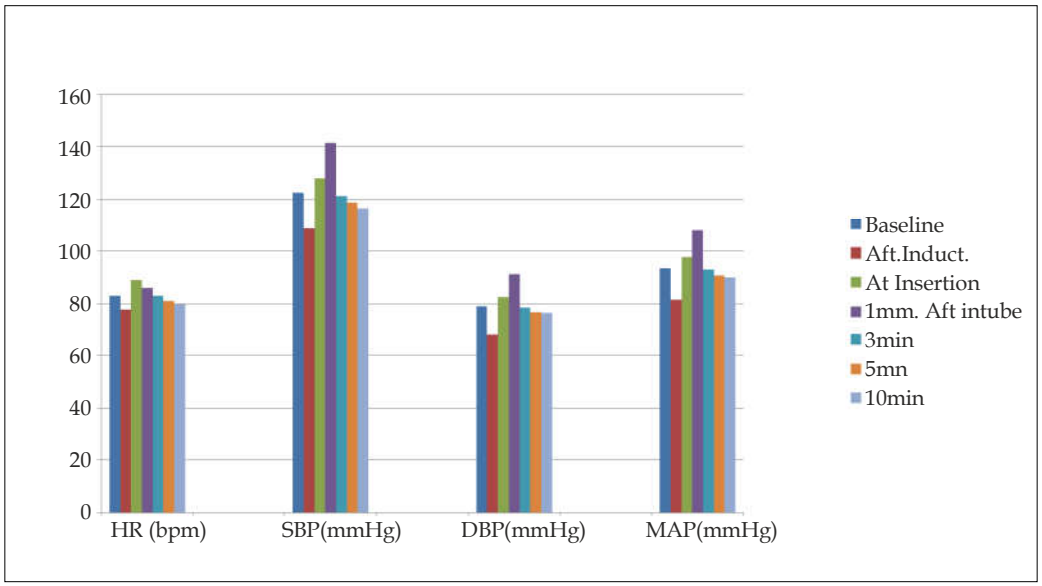
This study has clearly showed that under general anesthesia FNI causes significant increases in blood pressure and heart rate.

FOB is more technical, requires hand eye coordination and one has to reach till carina using FOB and then guide ETT over it and then withdraw FOB looking for tube. Time require for FNI was comparable with most of the studies mentioned in Table 2.

There was significant fall of all parameters after induction comparing with baseline ($p < 0.0001$). This is due to the effect of anaesthetic agents used for induction. This finding is consistent with

Table 1. Haemodynamic changes during FOB intubation

Parameter	Baseline	Aft. Induct.	At Insertion	Imm. Aft intub.	3min	5min	10min
HR (bpm)	83.16 ± 14.7	77.76 ± 13.7	88.96 ± 15.85	86.08 ± 15	83.04 ± 14.58	81 ± 14.44	79.84 ± 14
p value		< 0.0001	< 0.0001	< 0.0001	0.3765	< 0.0001	< 0.0001
SBP(mmHg)	122.48 ± 14.24	108.6 ± 12.87	127.96 ± 15.05	141.4 ± 16.4	121.36 ± 14.54	118.8 ± 13.61	116.52 ± 13.81
p value		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
DBP(mmHg)	79 ± 13.65	67.96 ± 11.41	82.56 ± 14.46	91.24 ± 16	78.64 ± 14	76.72 ± 13	76.6 ± 13.53
P value		< 0.0001	< 0.0001	< 0.0001	0.0012	< 0.0001	< 0.0001
MAP(mmHg)	93.5 ± 13.5	81.5 ± 11.5	97.7 ± 14.28	107.96 ± 15.72	92.88 ± 13.81	90.75 ± 12.85	89.91 ± 13.3
p value		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001



Graph 1: Haemodynamic changes during FOB intubation

most of the studies conducted.[4-7,11-23] The addition of fentanyl usually decreases the postintubation hypertension but can increase the propofol-induced preintubation hypotension.[12]

At the time of insertion of FOB there was significant rise of HR, SBP, DBP & MAP. This increase is due to stress response to bronchoscopy.[7]

The fiberoptic nasotracheal intubation can avoid the mechanical stimulus to oropharyngolaryngeal structures thereby it is likely to attenuate

Table 2: Time to intubation in various studies

Study conducted by	Time required in sec FNI
J.E. Smith[4]	26.9
J.E. Smith, et al.[5]	37
H.G. Schaefer, et al.[6]	77.2
Michal Barak, et al.[7]	55
Finfer SR, et al.[8]	59.8
Aghdaii N, et al.[9]	39.4
Yushi U. Adachi, et al.[10]	102

haemodynamic response.[18] During orotracheal intubation, the fiberoptic intubation time is approximately three times greater than that required using conventional laryngoscopy; thus, any benefit from reduced pharyngeal stimulation was outweighed by the effects of prolonged intubation. During nasotracheal intubation, the fiberoptic intubation time is only 25% greater than that required using the conventional technique. Study conducted by J.E. Smith, et al.[5] showed that arterial pressure was lower in patients intubated using the fiberoptic laryngoscope as compared to direct laryngoscope, these differences may arise because of the combined effects of differences in airway stimulation and differences in the duration of laryngoscopy between the two techniques. The fibrescope may produce less mechanical pressure on the tissues of the anterior pharynx, which may therefore induce less reflex sympathetic activity.[5] Similar findings were note in other studies like Ali, Liaquat, et al.[24]

HR remained high even after intubation and returned to baseline value at 3min. SBP, DBP & MAP further increased after intubation and returned to baseline value at 3min. Similarly maximum mean HR was noted at the time of insertion of FOB while maximum mean SBP, DBP & MAP were seen immediately after intubation. This finding is because nasotracheal intubation can evoke the nasocardiac reflex, which depresses the tachycardic response to nasotracheal intubation.[3]

These findings are consistent with study conducted by J.E. Smith which shows that the increase in systolic pressure was sustained for a longer period and concluded that the cardiovascular responses associated with fiberoptic intubation under general anaesthesia appear to be severe.[4]

This findings are also consistent with study conducted by J.E. Smith, et al. which shows that highest mean systolic pressure was delayed until the second minute.[5] These findings are also consistent with most other studies.[17,22]

This may be due to following reasons:

1. It has been shown that the longer the intubation time the more likely is it to develop hypercapnia, which can result in hypertension and tachycardia.[18] Longer time may tend to produce more sympathetic activity.[5]
2. FOB necessitates the lifting of the jaw upward to make a clear passage for the FOB and for the tracheal tube to enter the glottis. Lifting of the jaw upwards itself is sufficient to cause a cardiovascular response similar to those observed in the laryngoscopic intubation.[18,22]
3. The advancement of the tracheal tube over the FOB is often impeded when the Murphy's tip catches on the downward sagging epiglottis, arytenoid cartilage, vocal cords and anterior tracheal wall. On such occasions, the successful intubation often requires some specific maneuvers e.g. rotating the tracheal tube, further lifting jaw upward and adjusting the patient's head-neck position.[18,22]
4. During the fiberoptic intubation, the insertion cord of the FOB must be placed into the trachea for guidance followed by advancing the tracheal tube over the insertion cord into the trachea and then the FOB is removed. This can cause repeated friction and irritation to the trachea.[18]
5. The traction on the tongue which is necessary to clear the airway which itself is a potent stimulus as the Macintosh blade.[4]
6. Tracheal tube insertion itself is most invasive stimuli.[25]
7. Longer intubation time may also cause weaning of anaesthetic effect of inhaled anaesthetic agent, hypoxia & hypercarbia in patients intubated using FOB. This drawback was eliminated by using a mask adapter by Makoto Imai, et al. and found that FOB resulted in milder hemodynamic changes compared to conventional laryngoscopy, as they were able to maintain anaesthesia during intubation.[13]

HR, SBP, DBP and MAP were below baseline at 5min and 10min. This is due to effect of anaesthetic agents used for maintainance of anaesthesia. This finding is consistent with most other studies.[6,11,17, 18,22] Epistaxis was seen in 10% of patients and was comparable with other stuies.[26]

Conclusion

Fiberoptic bronchoscope under general anesthesia causes significant increases in blood pressure and heart rate.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 703–709
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.7

Sonoclot Analyzer Guided Transfusion Therapy in Patients Undergoing On-Pump Cardiac Surgeries

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Abstract:

Context: The study was conducted to establish a co-relation between Sonoclot parameters and blood and blood product during on-pump cardiac surgeries. *Aims:* To estimate the amount of blood and blood product transfusion and post-operative drain are affected by Sonoclot-guided transfusion therapy. *Settings and Design:* Randomised controlled Study *Methods and Material:* Total of 120 patients were randomly assigned by computer generation to either Sonoclot guided therapy or routine hospital therapy. Patients of either sex undergoing on-pump complex cardiac surgical procedures. Patients having pre-existing hepatic disorders, a renal disease requiring dialysis, and those who received anticoagulant or antiplatelet drugs within one week of surgery were excluded. *Statistical analysis used:* Data were analyzed using descriptive statistics to get the frequency distribution & the Independent Sample T-test was used for inter-group Comparison. *p*-value of <0.05 is considered as statistically significant. SPSS (Statistical Software for Social Sciences) version 20 was used. *Results:* The whole blood transfusion in the two groups was non-significant both intra-operative and post-operative period. While a comparison of FFP transfusion during an intra-operative period in Sonoclot group was significant. Platelets were administered in the post-operative period and comparison in the two groups was not significant. A comparison of 24 hr drain output in two groups of patients was non-significant. *Conclusions:* It allows the diagnosis of an exact cause of hemostatic abnormality i.e. deficiency of coagulation factors or fibrinogen or platelet function.

Keywords: Point of care test, Sonoclot, Transfusion, On-pump cardiac surgeries.

How to cite this article:
Khan Afroz Shahana M, Vaishali A Mohod, Quazi Mohammed Azhar. Sonoclot Analyzer Guided Transfusion Therapy in Patients Undergoing On-Pump Cardiac Surgeries. Indian J Anesth Analg. 2020;7(3):703–709.

Introduction:

The incidence of blood loss is higher in cardiac surgical procedures, leading to transfusion of allogeneic blood products in as much as 10%–20% of cases[1,2]. The main cause of this is, coagulopathy caused by multiple factors like changes in the hemostatic system associated with increased age, preoperative medication with platelet and/ or coagulation inhibitors and transient platelet dysfunction associated with cardiopulmonary bypass (CPB)[3-9]. The Systemic inflammatory response caused by exposure to CPB with activation of coagulation and fibrinolytic systems leads to coagulopathy caused by factor consumption and transiently reduced platelet count and function[10,11]. Strategies to decrease an amount of blood loss have been incorporated such as the collection and reinfusion of autologous blood products[12],

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Received on 31.01.2020, **Accepted on** 29.02.2020

alterations in heparin and protamine dosing[13], and the prophylactic use of anti-fibrinolytic therapy[14] however, microvascular bleeding and transfusions still occur[15].

Laboratory-based coagulation tests take a long time and reflect only initial thrombin formation and do not give information about clot stability and fibrinolysis which leads to the practice of inappropriate and empirical blood transfusions resulting in increased morbidity and mortality and hospital costs[16-18].

Perioperative coagulation monitoring with point-of-care (POC) devices is routinely done and has been recommended in cardiac patients as it helps in the identification of an exact cause of bleeding and to guide the clinician in appropriate specific therapy[19,20]. Viscoelastic point of care coagulation instruments like Thromboelastographic (TEG), the thromboelstometer (ROTEM) and the Sonoclot have been used in clinical practice for perioperative monitoring of excessive bleeding in cardiac surgery[21-23]. They measure clot formation and clot dissolution that assess coagulation, platelet function[24], platelet-fibrinogen interactions and fibrinolysis. They indicate any alterations in hemostasis in a timely fashion and correlate well with conventional coagulation tests and may be used to predict transfusion of red cells, plasma and, platelets. Patients undergoing cardiac surgical procedures are at risk for major perioperative blood loss and life-threatening postoperative bleeding require multiple transfusions[25]. Blood and blood product transfusions are associated with increased risk of patient morbidity and mortality[26-28]. Thus, effective blood loss management must focus on the real rather than an assumed cause of bleeding with targeted hemostatic therapy administered with minimal delay. Sonoclot analyzer provides information on the hemostasis process including coagulation, fibrin gel formation, fibrinolysis, and able to assess platelet function[29]. It takes 20-30 minutes for the complete assessment of whole blood including platelet function[30-31]. So useful for evaluating intraoperative hemostatic changes[32].

This study was conducted to establish a co-relation between Sonoclot signature parameters and blood and blood product transfusion decisions taken by the anesthesiologist during on-pump cardiac surgeries. Sonoclot signature parameters studied included sonoclot activated clotting time (Son ACT), clot rate (CR), platelet function (PF). We compared transfusion requirements after cardiopulmonary bypass (CPB) using Sonoclot analyzer and routine transfusion therapy which is based on clinical judgment and without strict adherence to any algorithm. The main objective of the study was to determine, whether an amount of blood and blood product transfusion and post-operative drain were affected by Sonoclot-guided transfusion therapy.

Materials and Methods

After Institutional Ethics Committee approval, a total of 120 patients were randomly assigned by computer generation to either Sonoclot guided transfusion therapy (case) or routine hospital transfusion therapy (control) group of 60 each. Patients of either sex undergoing on-pump cardiac surgical procedures like single or multiple valve repair or replacement, coronary artery bypass grafting (CABG), combined CABG with valve repair or replacement, isolated aortic root or arch repair, or combination of aortic root or arch with valve repair or replacement or CABG were included. Patients having pre-existing hepatic disorders, a renal disease requiring dialysis, and those who received anticoagulant or antiplatelet drugs within one week of surgery were excluded. Sonoclot® Coagulation & Platelet Function Analyzer, Sienco, Inc. CO, USA was used to perform point of care coagulation monitoring in all patients undergoing on-pump cardiac surgeries.

At the onset of surgery, prophylactic antifibrinolytic (tranexamic acid) was administered. Cardiopulmonary bypass was conducted in the standard manner using moderate hypothermia, membrane oxygenator, arterial line filtration and, heparin-coated circuits. Baseline K-ACT (kaolin activated clotting time) was used in all patients. Anticoagulation for CPB was achieved with bovine heparin 300IU/kg administered via an internal jugular catheter with confirmation by the backflow of blood. ACT >480 seconds was accepted as adequate anticoagulation for CPB. Additional heparin in doses of 100 IU/kg was administered to maintain the ACT at least >400 seconds. ACT was monitored every 30 minutes. Protamine was administered slowly over a 20 minutes period in a ratio of 1mg/100 U of the first dose of heparin. In both, the groups' baseline coagulation tests included hemoglobin, hematocrit, platelet count, prothrombin time (PT), INR. In the control group, K-ACT was monitored. In Sonoclot group baseline glass beads-activated ACT was done and after protamine administration again glass beads

activated ACT was done. All intraoperative results of the Sonoclot parameter such as an ACT, clot rate and Platelet function were interpreted by the anesthesiologist directly involved in the study. During CPB hematocrit of 21% was accepted. In control group routine transfusion therapy, which was based on the clinical judgment was followed i.e. in case of absence of clot in the surgical field and presence of obvious clinical bleeding, patients were transfused with FFP (15ml/kg) and platelet concentrate (10 mL/kg). In Sonoclot group transfusion of non-red blood cell (RBCs) component therapy was according to abnormal Sonoclot parameters. In both, the groups packed RBCs were transfused when hematocrit was less than 27% in the post-bypass period.

All the patients were shifted to the ICU for elective mechanical ventilation.

Post-operative blood loss as measured by chest tube drain at 24 hr was recorded. The data were analyzed for differences between Sonoclot and control groups with regard to transfusions and post-op bleeding. Data were analyzed using descriptive statistics to get the frequency distribution & the Independent Sample t-test was used for inter-group Comparison. *p*-value of < 0.05 is considered as statistically significant. SPSS (Statistical Software for Social Sciences) version 20 was used.

Results

One hundred twenty patients were taken for the study (60 in each patient). Baseline patient characteristics age, sex, BMI, preoperative hematocrit was comparable. Intra-operative variables like CPB duration, minimal temperature, total heparin and, protamine dose did not vary by study group (Table 1).

Various hematological and coagulation parameters (Table 2) derived from Sonoclot analyzer parameters were comparable in two groups except for the clot rate (Table 3) which was significantly deteriorated after heparin neutralization (p <0.05).

A Comparison of an average number of units of whole blood and FFP transfused in the Sonoclot and control group (Tables 5,6) showed that there was no significant difference in whole blood transfusion in the two groups both intra-operative and post-operative period. While a comparison of FFP transfusion in two groups during an intra-operative period was significant and during the post-operative period transfusion of FFP was comparable. Platelets were administered in the post-operative period and comparison in the two groups was not significant (Table 6) (Fig. 1 and 2). A comparison of 24 hr drain output in two groups of patients is shown in table 7 which was non-significant.

Table 1: Baseline Information

Parameters	Groups	N	Mean	Std. Deviation	Std. Error Mean	*p* Value
Age	cases	60	47.50	15.83	2.04	> 0.05
	controls	59	44.80	17.02	2.21	
BMI	cases	60	27.15	6.706	0.86	> 0.05
	controls	60	27.00	6.494	0.83	
PB HCT	cases	60	38.02167	5.37	0.69	> 0.05
	controls	60	38.71000	6.20	0.80	
CPB time	cases	60	171.83	66.21	8.54	> 0.05
	controls	60	182.00	84.44	10.90	
Min temp	cases	60	28.65	1.999	0.26	> 0.05
	controls	60	28.60	.924	0.11	
Total heparin	cases	60	27100	8605.532	1110.96	> 0.05
	controls	60	28500	10023.103	1293.9	
Protamine	cases	60	185.00	52.513	6.779	< 0.05
	controls	60	170.67	38.746	5.002	

BMI- Body mass index, PB HCT- Pre-bypass haematocrit, CPB- Cardiopulmonary bypass

Table 2: Haematological and Sonoclot Profile

Parameters	Groups	N	Mean	Std. Deviation	Std. Error Mean	*p* Value
HB	cases	60	12.65	1.790	0.23	> 0.05
	controls	60	12.85	2.07	0.26	
PB HCT	cases	60	38.02	5.37	0.69	> 0.05
	controls	60	38.71	6.20	0.8	
PB ACT	cases	60	130.98	38.49	4.969	> 0.05
	controls	60	125.72	27.37	3.534	
OB HCT	cases	60	24.66	3.72	0.48	> 0.05
	controls	60	24.44	4.41	0.56	
OB ACT	cases	60	614.25	185.932	24.0	> 0.05
	controls	60	608.77	183.056	23.63	
OBCR	cases	60	2.62	1.68	0.21	NA
	controls	0a	.	.	.	
Off Hct	Cases	60	27.0	3.5	0.45	>0.05
	Control	60	26.88	4.52	0.58	
Off ACT	Cases	60	140.93	31.70	4.09	>0.05
	Control	60	134.45	30.84	3.98	

HB- haemoglobin, PB HCT- Pre-bypass haematocrit, PB ACT- Pre-bypass Activated clotting time, OB- On bypass, CR- Clot rate

Table 3: Prebypass and off bypass CR (clot rate)

Sonoclot N=60	Mean CR	N	Std Dev	T- value	*p* Value
Prebypass	36.05	60	6.133	3.08	<0.05 (0.003)
Offbypass	37.03	60	7.73		

Table 4: Prebypass and off bypass PF (platelet function) Sonoclot

N=60	Mean PF	N	Std Dev	T-value	*p* Value
Prebypass	3.53	60	0.75	- 0.19	>0.05
Offbypass	3.35	60	1.17		

Table 5: Intraoperative Blood and Blood Products transfusion

	Groups	N	Mean	Std. Deviation	Std. Error Mean	*p* Value
IO Blood	cases	60	1.18	0.948	0.12	> 0.05
	controls	60	1.23	1.015	0.13	
IO FFP	cases	60	2.33	1.989	0.26	< 0.05 (0.001) **
	controls	60	3.20	1.614	0.20	
IO Platelets	cases	0a	.	.	.	NA
	controls	0a				

IO- Intraoperative, FFP- Fresh frozen plasma

Table 6: Postoperative Blood and Blood Products transfusion

	Group	N	Mean	Std. Deviation	Std. Error Mean	*p* Value
PO blood	Cases	60	.38	0.66	0.08	> 0.05
	Control	60	.28	0.61	0.07	
PO FFP	Cases	60	.43	1.17	0.15	> 0.05
	Control	60	.47	1.29	0.16	
PO Platelets	Cases	60	.23	0.74	0.09	> 0.05
	Control	60	.15	0.63	0.08	

PO- Postoperative

Table 7: 24 Hrs Drain Output

	Group	N	Mean	Std. Deviation	Std. Error Mean	*p* Value
24 h drain	Cases	59	228.81	92.942	12.100	> 0.05
	Control	60	234.17	80.513	10.394	

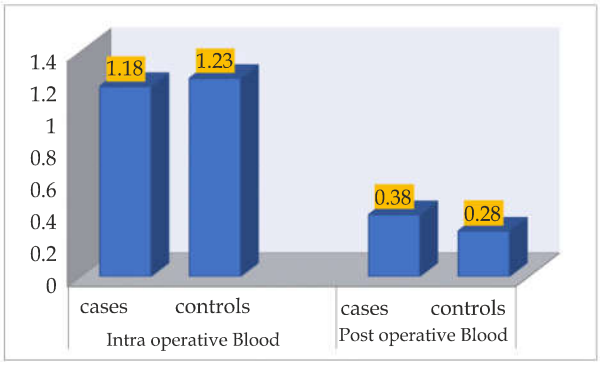

Fig. 1: Intraoperative and Postoperative Blood transfusion

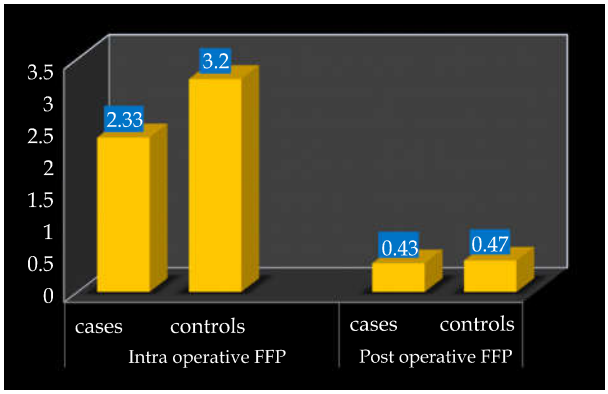

Fig. 2: Intraoperative and postoperative FFP

Discussion

In our, study we have determined the utility of Sonoclot analyzer in directing appropriate blood component therapy thereby any reduction in blood and blood product transfusion during on-pump cardiac surgical procedures. We found that transfusion of intra-operative FFP was significantly less in the Sonoclot analyzer group compared to the routine transfusion group. But both intra-operative and post-operative transfusion of packed red blood cells and post-operative FFP transfusion in both the groups were similar in our study. Similarly, platelets were administered postoperatively in all patients and overall exposure was the same in both the groups. Furthermore, a comparison of post-operative 24 hr chest drain in two groups was non-significant.

Our results suggest that using Sonoclot to determine the need for blood products reduced the proportion of patients exposed to intra-operative FFP. Although the overall transfusion of packed red blood cells in two groups was similar which could be explained by the fact that the decision of red blood cell transfusion was based on hematocrit in our study. We also found out that there is no transfusion disparity in both FFP and platelets administered in the two groups in the postoperative period which could be suggested by the fact that Sonoclot guided algorithm was no longer enforced in the post-operative period.

The study conducted by Linda Shore-Lesserson et al on TEG-guided (point of care coagulation test) transfusion in cardiac patients found intraoperative transfusion rates did not differ but there was significantly fewer postoperative and total

transfusion rate in the TEG group hence, concluded that reduction in transfusions may have been due to improved hemostasis in these patients who had earlier and specific identification of the hemostasis abnormality and thus received more appropriate intraoperative transfusion.[33] Dominique B. Bischof et al. determined if Sonoclot with its sensitive glass bead–activated, the viscoelastic test could predict postoperative bleeding in cardiac surgical patients at predefined time points and concluded that only glass bead measurements by Sonoclot after heparin reversal before chest closure but not preoperatively were predictive for increased postoperative bleeding.[34]

The viscoelastic tests and the response to a platelet agonist are some of the dynamic tests which are more reflective of platelet function over time. The specific agonist like thrombin or collagen can be used for assessment of platelet response to endothelial injury and its ability for normal hemostasis in vivo and are utilized in transfusion algorithms for bleeding patients. Platelet transfusion is often empirical in the management of bleeding patients. Although there are many platelet functions tests available[35], many of them are not suitable or bedside monitoring as they are time-consuming. The time to peak in Sonoclot correlates with the general platelet function.[36] Rajkumar V et al. have studied the utility of Sonoclot in pediatric patients undergoing cardiac surgery with CPB for congenital heart disease for the prediction of postoperative bleeding. Both laboratory parameters (prothrombin time, INR, activated partial thromboplastin time fibrinogen, D-dimer) as well as POC Sonoclot glass bead activation time, clot rate and platelet function (gbPF) were done before induction of anesthesia and following heparin reversal after the termination of CPB in all patients. Their conclusion was clot rate and platelet function (gbPF) have maximum predictive value.[37]

Espinosa et al compared laboratory tests of coagulation, TEG, and Sonoclot for prediction of post-CPB bleeders in adult patients undergoing elective cardiac surgery, and concluded that although laboratory tests had maximal sensitivity and specificity for prediction of postoperative bleeding, Sonoclot variables that reflect platelet function (R1 & R2)

had a statistically significant correlation with blood loss.[38] Like previous studies correlation between various POC variables and fibrinogen concentrations was consistent.[39,40] The role of fibrinogen has been underscored in coagulation and hemostasis and as a contributor to the clot strength. Reduced levels of fibrinogen during CPB could predict the risk of postoperative bleeding and transfusion requirements. They found that Son ACT and Clot rate correlated significantly with aPTT. An aPTT is prolonged in hypocoagulable states so as low clot Rate. The POC devices assess platelet function rather than platelet counts so, clinically more useful than standard platelet counts. The routine coagulation tests will have to remain the gold standard for assessment of many aspects of hemostasis.

There are many limitations to our study. Postoperative outcome i.e. any improvement in morbidity and mortality or decrease in ICU stay and any cost reduction because of appropriate administration of blood and blood products in the postoperative period were not investigated.

Conclusion

Sonoclot is a point of care method of monitoring of coagulation status during on-pump cardiac surgeries which is easily performed and reproducible. It allows the diagnosis of an exact cause of hemostatic abnormality i.e. deficiency of coagulation factors or fibrinogen or platelet function. With Sonoclot guided transfusion algorithm we were able to demonstrate intraoperative reduction of blood products i.e. fresh frozen plasma administration. But, the use of point of care test should be extended in the postoperative period till 24 hrs as well to demonstrate an overall advantage of this device for the reduction of blood and blood product transfusion and improvement of patient's outcome.

Key Messages: Sonoclot analyzer directs appropriate blood component therapy. With Sonoclot guided algorithm we were able to demonstrate intraoperative reduction of blood product administration. But its use should be extended in the postoperative period till 24 hrs to demonstrate an overall advantage of this device and improvement of patient's outcome.

*Conflict of Interest: **Nil***

*Acknowledgement: **Nil***

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 710–715
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.8

Revascularisation Surgeries in Pediatric Patients With Moyamoya Disease: An Anesthesia Point of View (Implications)

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Abstract

Background: Moyamoya disease is a progressive occlusive cereberovascular disorder that usually presents as recurrent strokes in pediatric population. There is paucity of literature on anesthetic management of pediatric patients in the Indian subcontinent. The main objective of our study was to evaluate the perioperative course and outcome of children undergoing revascularization surgery of Moyamoya disease. *Methodology*: A series of 11 patients aged between 5 months-10 years age group were analyzed overa period of one year. *Conclusion* – Anaesthetic management involves maintainence of cerebral blood flow and cerebral perfusion pressure and normothermia to avoid perioperative ischemic complications.

Keywords: Moyamoya disease (MMD), Revascularization, Anaesthetic management, Scalp block, Magnetic Resonance Imaging (MRI).

How to cite this article:
Amarnath Reddy Basavanapalli, Neha Kanojia, Muralidhar Joshi. Revascularisation Surgeries in Pediatric Patients With Moyamoya Disease: An Anesthesia Point of View (Implications). Indian J Anesth Analg. 2020;7(3):710–715.

Introduction

Moyamoya disease (MMD) is a chronic cerebrovasculopathy of unknown etiology first described in 1957 by Takeuchi and Shimizu, as characterized by progressive stenosis and occlusion at the terminal portion of the internal carotid artery and an abnormal vascular network at the base of the brain in the circle of Willis. To compensate for the blood flow around the occlusive region, a fine vascular network develops that resembles "puffs of smoke", thus, the Japanese term "moyamoya" (Japanese for misty).[1-3] The unique appearance of moyamoya vessels elucidated by Suzuki and Takaku in 1969 triggered international recognition of MMD.[3] Kudo named it officially as the Spontaneous occlusion of the circle of Willis.[4]

The risk factors for peri-operative complications, predominantly the cerebral ischemic events in patients with MMD are: history of transient ischemic attacks, severity of disease, type of revascularization procedure, significant reduction in hematocrit, intraoperative hypotension, intra-operative hypercapnia and reduction in circulating blood volume.[5-7] The prime objective of treatment for MMD is to improve cerebral blood flow; however, medical treatments appear to be

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Received on 24.01.2020, **Accepted on** 07.03.2020

ineffective in preventing ischemic and hemorrhagic events.[8,9] Surgical revascularization represents an optimal therapeutic option.[10]

Peripheral nerve blockade minimizes the perioperative complications thereby providing an admirable monitoring of neurological status and also maintains haemodynamic stability. In our present study we performed scalp block as an anesthesia management strategy in pediatric moyamoya patients of age above 3 years. We observed improved pain management with decreased postoperative pain, headaches and crying in children using scalp block as an anesthesia implication.

Epidemology

MMD was originally noticed exclusively in East Asia, Nishio (1964) and Nishimoto et al. (1965, 1966) regarded it as a vascular malformation. They considered it an entity peculiar to Japan.[15,16] It is now progressively diagnosed around the world and represents an important source of childhood stroke.[17,18] The diagnosis of MMD is mainly based on angiographic findings and a majority of these cases are reported in Asia.[19] Even in Japan, the overall incidence of MMD remains below 1 per 100,000. Its incidence ranges between 0.086 in USA to 0.54 per 100,000 patients globally.[20,21] 2.2 for blacks and 0.5 for Hispanics as compared with whites.[21] The incidence peaks in two age groups: children who are approximately 5 years of age and adults in their mid-40s.[22] Females are affected nearly twice as often as males.[23] Familial occurrence accounts for about 15% of patients.[24] It accounts for one-fifth of the identifiable cerebral arteriopathies in childhood stroke up to most common cerebrovascular disease in children in East Asia.[25,26] In children, unilateral involvement occurs about 18%[24] and progress to bilateral involvement within 2 years.[27]

Materials and Methods

A retrospective study was undertaken on revascularization surgeries for MMD over a period of one year. Institutional ethical committee approval was obtained for the study. Data collection included clinical presentation, the demographic profile of the patient, diagnosis, surgical procedure, intra-operative course, postoperative outcome at discharge.

Diagnosis

Cerebral angiography remains the gold standard to confirm the diagnosis of MMD Clinical picture includes transient ischemic attacks, slow cognitive decline, headaches, dizziness, seizures, visual impairment, involuntary movements, hemiparesis, monoparesis, sensory impairment or cerebral infarction.[28,29]

Surgical treatment of moyamoya typically uses the external carotid artery (ECA) as a source of new blood flow to the ischemic hemisphere. Two general methods of revascularization are used:

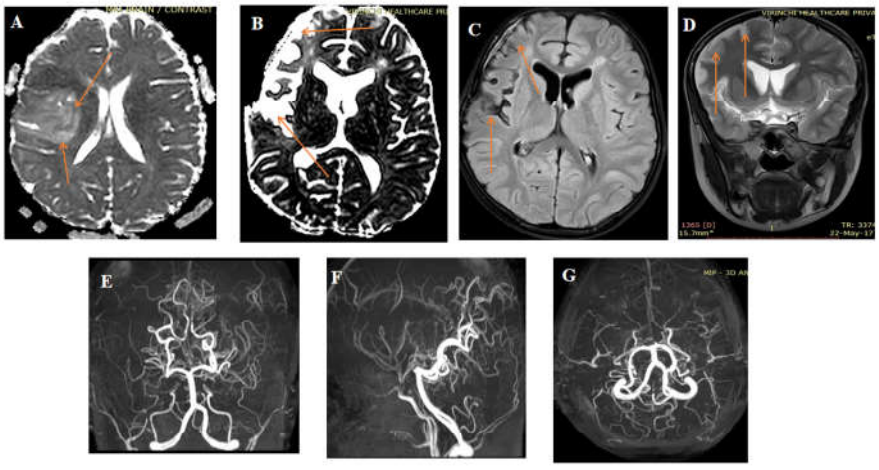

Fig. 1: Radiological assessment for MMD in pediatric patients

(**A)-** Subcaute infarct in right temporal region; (**B) –** Diffusion weighted sequence- showing acute infarcts in left frontal region; **(C)** – FLAIR- LT SIDE- acute infarct in temporal lobe, Right side – subacute infarct in right temporal region; **(D)** – coronal T2W1- infarcts in temporal lobe; **(E)** – MRA-stenosis of Internal carotid artery, Middle cerebral artery and anterior communicating artery. (ICA, MCA, ACA); **(F)** – MRA- puff of smoke appearance; **(G)** – MRA stenosis of MCA, ICA and ACA

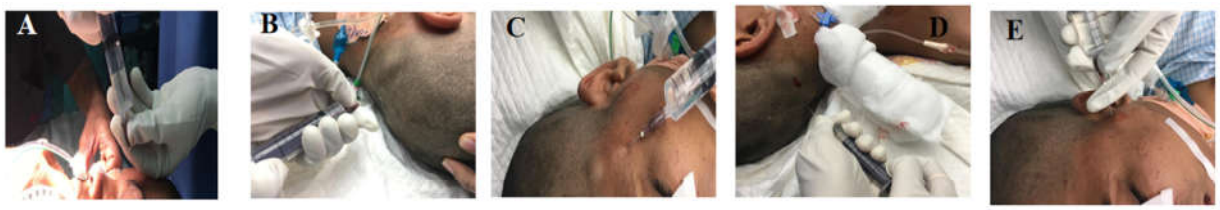

Fig. 2: Scalp block procedures done in pediatric patients for pain management

(A) Supraorbital and supratrochlear nerve block; (**B)** Greater occipital nerve block; (**C)** Zygomaticotemporal nerve block; (**D)** Lesser occipital nerve block; E) Auriculotemporal nerve block.

direct and indirect. In direct revascularization, a branch of the ECA (usually the superficial temporal artery) is directly anastomosed to a cortical artery. Indirect techniques involve the placement of vascularized tissue supplied by the ECA such as dura, temporalis muscle, or the superficial temporal artery (STA) itself in direct contact with the brain, leading to the growth of new blood vessels to the underlying cortex. The direct bypass techniques that have been proposed include STA to the middle cerebral artery (MCA), occipital artery (OA) to MCA, and middle meningeal artery to MCA anastomoses.[30] The indirect techniques include encephalomyosynangiosis(EMS),encephalo duro arteriosynangiosis (EDAS),[31-33] encephalo duro arterio myo synangiosis (EDAMS), encephalo myo arterio synangiosis, multiple cranial bur holes,[33] and omental transposition (Fig. 1).

Use of scalp block in children decreases the adverse effects of opioids (nausea, vomiting, respiratory depression, itching) and postoperative analgesia along with hemodynamic stability, Mean arterial pressure (MAP), and HR responses to skull pin placement and scalp incision in patients undergoing craniotomy. We performed scalp block in patients more than 3 years old with 0.2% ropivacaine after induction with general anesthesia. Patients were more comfortable with stable hemodynamics both intra operative and postoperative. The safe dose of ropivacaine is 2.5-3.0 mg/kg body weight (Fig. 2).

Results

Statistical analysis was done using SPSS version 17. Data are presented as number (%) or mean ± SD or median. We analyzed the records of 11 patients with MMD who underwent re-vascularisation procedures at our center. Out of 11 patients two children underwent indirect revascularization procedures and nine children had direct revascularization procedures (two patients EDAMS, one STA+MCA, eight STA+MCA + EDAMS) during the study period. Four patients had postoperative neurological complications. The demographic details are presented in Table 1 which includes the mean age (4.8 ± 2.88 years), weight (16.8 ± 8.86 kg) and gender (Male: 05, Female: 06) of children who underwent revascularization procedure for MMD respectively. Clinical features include Fever, LOC, headache, seizures, neurologic deficit, ischemic stroke and haemmorhage these are presented in Table 2. Surgical treatment details of patients are presented in Table 3. Post surgical data presented in Table 4 comprises of baseline parameters like haemoglobin, hematocrit , mean intra operative and postoperative factors associated with post-procedure hospital stay, blood transfusions and post-operative hemoglobin and post-operative complications. In our study we have given blood transfusion to 2 children out of 11 children. One of the child was re-operated.

Table 1: Demographic profile

Variables	N = 11 (No. of patients)	MEAN ± S.D, %
Age (years)	Min – 5 months Max – 10 years	4.86 ± 2.88
Weight (kg)	Min -5.8 Max – 34	16.8 ± 8.86
Gender (M/F)	05:06	M- 45.5% F- 54.6%
UL/BL	03:08	UL- 27.3% BL- 72.7%

Table 2: Clinical Features

Surgical Treatment	N= No. of pateints	Percentage (%)
Direct Revascularisation		
STA-MCA	1	9.1
STA-MCA+EDAMS	8	72.7
STA-MCA+EDAS	0	0
Indirect Revascularisation		
EDAMS	2	18.2

Table 3: Surgical Treatments

Surgical Treatment	N= No. of pateints	Percentage (%)
Direct Revascularisation		
STA-MCA	1	9.1
STA-MCA+EDAMS	8	72.7
STA-MCA+EDAS	0	0
Indirect Revascularisation		
EDAMS	2	18.2

Table 4: Post Surgical Data

Baseline parameters, intra operative data, ICU stay, hospital stay	Mean ± SD & %
Hemoglobin (g%)	11.42 ± 0.82
Haematocrit	34.3 ± 2.86
Duration of surgery (hrs)	2.5 ± 0.7
Duration of anaesthesia (hrs)	4.08 ± 0.76
Intraoperative fluids (ml)	576.36 ± 279.25
Urine output (ml)	204.55 ± 156.29
Blood loss (ml)	153.18 ± 127.36
ICU stay (days)	1.09 ± 0.53
Hospital stay (days)	5.36 ± 1.50
Blood transfusion	(n= 4) 36.4%
Post op Hemoglobin (g%)	9.35 ± 1.27
Post op complication	(N= 2)18.2%

Discussion

The prime goal of anesthetic management during revascularization is to maintain a balance between O_2 supply and demand.[35,36] Identification of risk factors for peri-operative complications and outcomes related to the use of anesthesia agents, adequate pain control, increased use of regional anesthesia and better monitoring techniques in providing high quality and safe patient care to patients with MMD is also of significance. CBF is maintained by avoiding hypotension & maintaining normocarbia, appropriate depth of anesthesia and analgesia for minimizing and prevention of increase in $CMRO_2$ associated with pin application, laryngoscopy, intubation and surgical stimulus.

Although no specific anesthesia technique has been precisely shown to decrease perioperative complications in moyamoya patients, several methods for optimizing intraoperative cerebral hemodynamics are commonly used to help minimize this risk. Like, use of Intravenous anesthetics as opposed to inhalation agents are associated with reduced regional CBF in moyamoya patients,[37] which could cause an increased risk for cerebral steal syndrome and perioperative ischemic complications. Maintainence of mean arterial blood pressure about 10% above preoperative baseline throughout the surgical procedure has shown to decrease perioperative complications. In most of the cranial procedures hypocarbia is used to achieve brain relaxation through global cerebral vasoconstriction, this technique is largely opposed as meticulous maintenance of normocarbia throughout the procedure is essential to minimise the risk for ischemic complications. Contrary to most cranial procedures, mannitol is avoided to maintain adequate intravascular volume throughout the procedure.

Most of the children presented with ischemic stroke whereas hemorrhage was rare in our study. Standard monitoring in the form of HR, ECG, NIBP, SpO_2, $ETCO_2$ & temperature was carried out for all patients. Intra-arterial catheters were placed in either a radial artery or dorsalis pedis artery for continuous BP recording. It is extremely important to prevent peri-operative crying. This requires proper pre medication, smooth inhalational or IV induction and good post op pain management.

All children had received IV Fentanyl (2µg/ kg), Paracetamol for postoperative analgesia on a fixed schedule. Older children had received scalp block after induction. In our study, we have used the scalp block as the anesthesia consideration to reduce the perioperative complications post revascularization. Induction was achieved in our study with Sevoflurane in small children. In older children, who had an IV cannula, IV induction with graded doses of Propofol was carried out. Atracurium 0.5mg/kg was given to facilitate tracheal intubation. Anaesthesia was maintained with Sevoflurane and opioids with air and oxygen mixture (50:50). We avoided N_2O as it can cause cerebral vasodilation leading to intra-cerebral steal. Maintenance of normotension is recommended in MMD to prevent ischemic insults. In our centre, balanced anaesthesia technique was used and the main goals was the maintenance of normovolemia by adequate fluid therapy and urinary output. It is imperative to maintain normothermia during re-vascularisation surgery. We used heating blankets to maintain body temperature.

A decreased hematocrit due to anaemia or perioperative blood loss places the MMD patients at risk of cerebral ischemia. Hematocrit 30-42% has been proposed as adequate. In our study, 4 patients had low postoperative Hemoglobin and 2 patients developed new stroke and TIA leading to prolonged duration of hospital stay. Postoperative

ischemic complications were fewer in patients who have combined STA-MCA bypass with EDAMS procedure as compared with indirect bypass. In our study, none of the children developed headaches except one case who showed headache with transient weakness of the eyelids. Some of the children displayed seizures preoperatively. We also observed that the risk of neurological deterioration (weakness of upper and lower limbs, left and right hemeperesis) was higher in patients who underwent indirect vascularisation compared to those of direct anastomatic procedures.

There have been a few studies in which researchers have used a scalp block for a craniotomy. The authors Nguyen A etal., Pinosky ML etal of 2 studies also used the same NB technique as ours but in adults, and they also reported that the block yielded effective analgesia.[38,39]

Conclusion

Moyamoya disease with unknown etiology results in a challenge in determining medical treatment. Re-vascularization surgery remains the only viable option to decrease further ischaemic episodes and neurologic deterioration. Proper pre-operative evaluation is the most effective method to achieve good results. Anaesthetic management of MMD should focus on the maintenance of adequate cerebral blood flow and cerebral perfusion pressure ensuring adequate cerebral oxygenation and to avoid ischemic complications. Scalp block was found to be very effective in reducing postoperative pain and crying in children and it also reduces the risk of ischemic neurological complications there by decrease the hospital stay of the patient.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 716–719
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.9

The Relationship Between Body Mass Index and Incidence of Postdural Puncture Headache in Female Patients Undergoing Infraumbilical Surgeries

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Abstract

Introduction: Postdural puncture headache is a common complication following dural puncture for spinal anesthesia. The objective was to study the relationship between body mass index and incidence of postdural puncture headache in female patients undergoing infraumbilical surgeries under spinal anesthesia. *Methodology:* After institutional ethical committee cleareance and written informed consent, a prospective observational study was conducted in 70 female patients undergoing infraumbilical surgeries under spinal anesthesia. Body mass index was calculated and they were grouped into 2groups, one with BMI < 25kg/m2 and another with BMI ≥ 25kg/m2. Incidence of PDPH was assessed in both the groups. *Results:* Postdural puncture headache was reported in 5 patients in the group with BMI < 25kg/m2 and in one patient in the higher BMI group. The overall incidence of PDPH was 8.57% following spinal anesthesia. But the incidence of PDPH was higher in the low BMI group compared to the high BMI group and the results showed a statistical significance with a *p* value <0.04. Gauge of the needle and number of attempts showed no correlation with the incidence of PDPH and results had a p value >0.05. *Conclusion:* The findings of our study was consistent with the previous studies that showed a inverse relationship between body mass index and incidence of postdural puncture headache.

Keywords: Postdural puncture headache, body mass index, spinal anesthesia, infraumbilical surgeries

How to cite this article:
Amulya N, Narendra Babu MC, Lavanya Chetan et al. The Relationship Between Body Mass Index and Incidence of Postdural Puncture Headache in Female Patients Undergoing Infraumbilical Surgeries. Indian J Anesth Analg. 2020;7(3):716–719.

Introduction

Postdural puncture headache is caused either due to intentional or unintentional dural puncture during therapeutic or diagnostic lumbar puncture.[1] International headache society defined PDPH as any headache that developed within 5days of dural puncture and is not better accounted for any other cause.[2]

The advantages of regional anesthesia is that it allows minimal manipulation of the airway, avoidance of cardiodepressant drugs and decreased incidence of postoperative nausea and vomiting.[3]

Identification of the midline and bony landmarks is difficult in obese patients . The fat pockets present in them give a false positive loss of resistance which results in more number of needle placement attempts.[3]

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Received on 16.02.2020, **Accepted on** 16.03.2020

The retrospective study by Miu et al found no correlation between higher body mass index and development of PDPH after accidental dural puncture following epidural and combined spinal epidural insertions in women. Another retrospective study by Peralta et al showed that incidence of PDPH decreased with increasing BMI after unintentional dural puncture in parturients .

The purpose of this prospective study is to evaluate the relationship between body mass index and PDPH in female patients undergoing infraumbilical surgeries under spinal anesthesia.

Materials and Methods

The prospective study was conducted after obtaining institutional ethical clearance in our tertiary care hospital. The study comprised of 70 female patients posted for elective infraumbilical surgeries of ASA grade 1 and 2. The preoperative evaluation was done and the procedure was explained. A written informed consent was taken. The BMI was calculated and patients were grouped into two groups. Group A with BMI <25kg/m^2 and group B with BMI ≥25kg/m^2 according to WHO definition of normal weight and overweight.[6]

Inclusion criteria

1 Female aged between 18-60 years
2 ASA grade I and II
3 Elective infraumbilical surgeries

Exclusion criteria

1 Patient refusal
2 Previous history of migraine, neurological disease, history of fever, common cold, sinusitis and features of raised intracranial pressure.

Baseline heart rate, blood pressure and saturation were recorded. 18 gauge intravenous access was secured.

Under all aseptic precautions subarachnoid block was preformed using Quincke Babcock needle of either 23G, 25G or 26G.

Postoperatively the patients were followed up for 7days. The patients were asked to report if they experienced frontal or occipital headache, radiating to the neck and shoulders, which occurs or worsens less than 15minutes after assuming upright position and improves with recumbent position.[7,8]

Patients complaining of headache were reassured, psychological counseling was given, were advised bed rest, to maintain adequate hydration by drinking plenty of oral liquids as most of them reported headache after the second postoperative day when they tolerating oral intake. Caffeine in the form of coffee and acetaminophen was also prescribed. The headache was relieved by these conservative methods.

Statistical Analysis

The comparison of proportions between two groups was tested by applying z-test and the result is considered statistically significant whenever P value is less than or equal to 0.05.

Results

Seventy female patients in the age group between 18-60 years undergoing infraumbilical surgeries under spinal anesthesia were included in the study.

Five patients out of the 35 in group A experienced PDPH i.e, 14.28% and one patient in group B with BMI ≥ 25kg/m^2 i.e, 2.86% patients experienced PDPH. The statistically analysis of the data had a *p* value <0.04 (Table 1) which was significant and showed that the BMI was inversely related to the incidence of PDPH following spinal anesthesia.

Table 1: Comparison of incidence of PDPH in group A and B

Postdural puncture headache	BMI		Total	*p* - value	
	<25	≥ 25			
Yes	5	1	6	$p < 0.04$	Significant
No	30	34	64		
Total	35	35	70		

23G, 25G and 26G Quincke Babcock needle were used in the study. 3 patients with 23G needle and 3 patients with 26G needle experienced PDPH. But none of the patients with 25G needle group experienced PDPH. The relation between the gauge of the needle and incidence of PDPH was statistically insignificant with a *p* value >0.05 (Table 2)

A maximum of 3 attempts was take to do lumbar puncture. The number of attempts did not show any correlation with the incidence of PDPH and the *p* value was >0.05 (Table 3).

Table 2: Comparison between gauge of the needle and PDPH

Postdural puncture headache	Gauge of needle			Total	*p*-value	
	23.0	25.0	26.0			
Yes	3	0	3	6	$p > 0.05$	Not significant
No	4	10	50	64		
Total	7	10	53	70		

Table 3: Comparison between the number of attempts and PDPH

Postdural puncture headache	No. of attempts			Total	*p* - value	
	1	2	3			
Yes	3	1	2	6	P > 0.05	Not significant
No	53	9	2	64		
Total	56	10	4	70		

Discussion

The decreased CSF volume causing, sagging of the intracranial structures, due to the leakage of cerebrospinal fluid out of the intrathecal space is the cause for postdural puncture headache. The traction on the pain sensitive areas of the brain and meninges causes headache. The CSF loss causes increased cerebral blood flow and vascular dilation which also results in headache similar to that of vascular origin.[9]

In our study comprising of 70 female patients undergoing infraumbilical surgeries under spinal anesthesia showed an inverse relationship between BMI and incidence of PDPH. 5 patients in group A with BMI < 25kg/m^2 and one patient with BMI ≥ 25kg/m^2 in group B experienced PDPH and p value was <0.04 was statistically significant.

The results of our study correlated with the study conducted by Peralta et al, the incidence of PDPH after unintentional dural puncture in parturients with BMI > 31.5kg/m^2 was lower than with BMI < 31.5kg/m^2.

The increased abdominal pressure results in increased epidural pressure in obese compared to thin patients which lessens the pressure gradient from the intrathecal space to the epidural space, decreasing CSF loss.[10,11]

But another retrospective study conducted by M.Miu et al, found no evidence that women of higher BMI are less likely to develop PDPH. The bigger epidural needle caused a rent in the dura, epidural fat did not tamponade it nor did the inflammatory response heal the meningeal tear was the explanation given in the study. In our study the smaller gauge spinal needle used may the reason for the correlation observed.

The gauge of the needle used in our study showed no significant correlation with the incidence of PDPH. Similar results were observed in a review of 70 studies conducted by Arevalo-Rodriguez I et al. the varies sizes of the large and small guage needles showed no significant difference in the effects in terms of risk of PDPH.

Sumitra G Bakshi, in patients of age 20-40years showed a positive correlation between the needle size and the incidence of PDPH. Many studies have confirmed that a bigger needle increased the incidence of PDPH and with Quinckes needle the severity was directly related to the size of the needle.[1,7,10]

The number of attempts did not have a positive correlation in our study on the incidence of PDPH. Khraise N Wail et al, the repeated puncture attempt increased the risk of PDPH by 2.55-fold. Though 50% of patients with 3 attempts developed PDPH in our study , 10% with 2 attempts and 5.36% with single attempt , the results had a p value >0.05 and was not significant. The small number of patients enrolled may be the reason.

Conclusion

Our study was consistent with the previous studies and the incidence of PDPH was inversely related to the body mass index in female patients undergoing infraumbilical surgeries under spinal anesthesia. The size of the needle had no correlation to the incidence of postdural puncture headache. The number of attempts showed a positive correlation to the incidence of PDPH but was not statistically significant.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 720–725
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.10

Axillary Approach Versus Infraclavicular Approach In Ultrasound-Guided Brachial Plexus Block: A Comparative Study

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Abstract

Background: Brachial plexus block (BPB) is a well accepted technique to provide anaesthesia and analgesia for upper limb surgeries. Usage of ultrasound (USG) guided BPB technique has overcome the disadvantages caused by traditional landmark technique. *Objective:* To determine the block performance time, onset time, success rate, and any complications with the USG guided technique in both Axillary and Infraclavicular BPB *Methods:* For an ultrasound guided brachial plexus block 80 patients undergoing elective upper limb surgeries were randomly allocated into 2 groups group AX (axillary), Group IC (infraclavicular) to receive Ropivacaine 0.75% 25 ml. Block performance time, onset and duration of sensory and motor block and success rate were assessed. *Results:* The mean block performance time of Group IC (6.43 ± 0.38) was significantly shorter compared to Group AX (8.46 ± 0.43). The mean onset time of sensory block (5.33 ± 1.67 vs 7.03 ± 2.01) and motor block (9.23 ± 3.01 vs 17.53 ± 4.10) were significantly faster in Group IC compared to Group AX. Duration of sensory block (290.38 ± 78.65 vs 295.25 ± 35.86) and motor block (356 ± 97.99 vs 357.8 ± 108.13). Success rate was (95%) in group IC and (85%) in group AX. *Conclusion:* Ultrasound guided BPB through infraclavicular approach has shorter performance time, higher success rate and faster onset of sensory and motor block when compared to axillary approach. There was no statistically significant difference in duration of sensory and motor block in both approaches.

Keywords: Brachial plexus Block, Ropivacaine, Ultrasound.

How to cite this article:
TC Balaraju, Patil Vishalakshi, Kondikar Lohit, et al. Axillary Approach Versus Infraclavicular Approach In Ultrasound-Guided Brachial Plexus Block: A Comparative Study. Indian J Anesth Analg. 2020;7(3):720–725.

Introduction

Brachial plexus block (BPB) is a well accepted technique to provide anaesthesia and analgesia for upper limb orthopaedic surgeries[1]. Brachial plexus block through traditional nerve localization techniques relay on surface anatomical landmarks, patients' perception of paresthesia or by elicitation of motor twitch by electrical stimulation has got some disadvantages like inconsistent block success, inadvertent arterial puncture, pneumothorax, nerve injury.

These disadvantages can be overcome by using ultrasound (USG) guided brachial plexus block where there will be real time visualization of nerves and surrounding anatomy, continual observation of the needle tip and spread of local anaesthetic[2,3,4].

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Received on 24.01.2020, **Accepted on** 29.02.2020

Many researchers have compared the ultrasound-guided technique to the nerve stimulator guided technique, but there are not many comparative studies between the various methods for ultrasound-guided nerve blocks so we wanted to compare ultrasound guided infraclavicular block with ultrasound guided axillary block to asses success rate , performance time, onset and duration of sensory and motor blockade and complications if any.

Materials and Methods

After Institutional ethical committee approval and written informed consent, 80 patients between the age group 18-60 years, ASA physical status I and II who were scheduled to undergo elective forearm and hand surgeries in Navodaya Medical College, Hospital And Research Centre were included in the study.

Patients with chest deformity, clavicle fracture, patients with parasthesia and paresis in operating upper limb, patients with coagulopathy, local infection in the area of the block and patients allergic to local anaesthetics, pregnant women or morbid obese patients were excluded from the study.

All patients were randomized by computer generated random number table into two groups: group AX (ultrasound guided Axillary brachial plexus block) and group IC (ultrasound guided Infraclavicular brachial plexus block). All the patients were premedicated with oral tab Alprazolam 0.5mg 30 mins before shifting to the operation theatre. After shifting the patients to the operation theatre, vital signs were monitored by non invasive blood pressure monitoring, pulse oximeter, and electrocardiogram. All the blocks were performed by an anaesthesiologist with minimum experience of 10 ultrasound guided brachial plexus blocks under the supervision of an experienced anaesthesiologist. A standardized local anaesthetic solution of Ropivacaine 0.75 % 25 ml was injected to all the study patients, the anaesthesiologist who performed block was not involved in further monitoring of the patient.

Patients in group AX were made to lie down in the supine position with the arm to be blocked externally rotated more than 90 degrees and the elbow flexed to expose the axillary area. Skin over the axillary area was painted with betadine and all further procedures were done under aseptic technique. Under the guidance of ultrasound (LOGIQ C5 Premium/ GE) a 7.5 to 10 MHz linear probe was positioned in the axillary crease perpendicular to the axillary artery to visualize axillary artery and surrounding structures. Axillary artery was confirmed by pulsatile motion and with color Doppler image. Once the axillary artery is identified, radial nerve (5-6'o clock position to the artery), median nerve (9-11'o clock position to the artery), and ulnar nerve (2'o clock position to the artery) were located and after local infiltration of the skin, injection Ropivacaine 0.75% 7ml each was given perineurally by using in-plane technique with 22 G 50mm insulated needle (stimuplex ^{R} B/ BRAUN / JAPAN). Then musculocutaneous nerve was identified as a triangular bright echogenic structure between biceps and coracobrachialis muscles and using in-plane technique remaining 4ml injection Ropivacaine 0.75% was given perineurally.

Patients in gourp IC were placed in supine position with arms at the sides and head slightly rotated to contralateral side of the blocking arm. Skin over the infraclavicular area was painted with betadine and all further procedures were done under aseptic technique. Under the guidance of ultrasound (LOGIQ C5 Premium/ GE) a 7.5 to 10 MHz linear probe was positioned in infraclavicular fossa, axillary artery was located and confirmed by using color Doppler after local infiltration of the skin, by using in plane technique a 21 G 100mm insulated needle (stimuplex ^{R} B/BRAUN / JAPAN) was inserted above the ultrasound probe and the needle was advanced until the tip was located just posterior to axillary artery. 2ml of injection Ropivacaine 0.75% was injected to visualize hypoechoic bubbles i.e. double bubble sign after that remaining 23 ml was injected.

After completion of the block, the onset of sensory and motor blockade was assessed every 2 min for the first ten minutes, followed by every 5 minutes for the next 20 minutes using pin prick method and Bromage scale respectively. Successful block was defined as complete surgical anaesthesia. Complete surgical anaesthesia is defined as the ability to proceed with surgery without the need for intravenous narcotics or general anaesthesia or even local infiltration by the surgeon5. If one or more nerve was spared it was considered as incomplete block and then a rescue block of the concerned nerves at appropriate level was given. If there is no onset of nerve block even after 30minutes post block performance it was considered as failed block. Sensory score was assessed by testing the dermatomes supplied by following nerves by pin prick method using 25g needle

1. Radial nerve – dorsum of hand over 2nd

metacarpophalyngeal joint
2. Median nerve – thenar eminence
3. Ulnar nerve – little finger
4. Musculocutanious nerve – lateral side of forearm
5. Medial cutaneous nerve of forearm – medial side of forearm

Scoring system was taken from KoscielniakNielsen et al for checking sensory block.

(0 – sharp pain, 1 – touch sensation only and 2 – no sensation).

Motor block was evaluated by testing following responses

1. Radial nerve -thumb abduction
2. Median nerve – third finger flexion
3. Ulnar nerve – little finger flexion
4. Musculocutaneous nerve – elbow flexion

Bromage scale used to assess motor block.

- Normal motor function (no effect- 0)
- Decrease motor strength compared to contralateral limb -1
- Complete motor block-2

Intraoperatively patients were monitored for pulse rate, blood pressure, electrocardiogram, spo2 and for complications if any. Block performance time, onset and duration of sensory and motor block, quality of block, success rate and complications such as haematoma, haemorrhage, pneumothorax, and accidental intravascular injections were observed.

Block performance time was defined as the time interval from placement of ultrasound probe to the removal of needle after injection of local anaesthetic. Successful block was defined as complete surgical anaesthesia. Incomplete block was defined as sparing of one or more nerves.

Onset of sensory block was described as the time period between injection of drug and complete loss of pinprick sensation.

Onset of motor block was defined as the time elapsed from injection of drug to complete motor block. Failed block was determined when there is no onset of nerve block 30 minutes after the procedure. Rescue analgesia time When VAS Score is 4 or more. Duration of sensory block was defined as the time interval between the brachial plexus block and the first dose of rescue analgesia. Duration of motor block was defined as the time interval between brachial plexus block and the recovery of one of these movements: thumb abduction, 3rd finger flexion, little finger flexion, elbow flexion.

Statistical Characteristics

We hypothesized that infraclavicular block would have faster block performance time compared to axillary block. For study to have 91% power and alpha error at 0.05 a minimum of 40 patients would be required in each group to detect a 9% difference in block time, assuming a standard deviation 1.5. Hence we enrolled 40 patients in each group to compensate for possible dropouts.

Data were entered in MS-Excel programme (2007) and were analyzed with IBM Stastistical Package For Social Sciences (SPSS) version twenty two.

Descriptive statistics including proportions, measures of central tendency and measures of dispersion were used to describe the data. Further, student's t –test was used to compare proportions. A *p*- value of <0.05 was considered to be statistically significant.

Results

The demographic profile was analyzed and distribution of the age, sex, and weight of the patients in both the groups was compared, results were comparable. In our study mean performance time was shorter in group IC (06.43 ± 0.38) compared to group AX (08.46 ± 0.43). The onset of sensory block was faster in group IC (05.33 ± 1.67) compared to group AX (07.03 ± 2.01). The onset of motor block was faster in group IC (09.23 ± 3.01) compared to group AX (17.53 ± 4.10) 2 (5%) patients had incomplete block in group IC and 6 (15%) patients had incomplete block in group AX. So the success rate was (95%) in group IC and (85%) in group AX. There were no failed blocks. The duration of sensory block in group IC (290.38 ± 78.65) and group AX (295.25 ± 35.86) was comparable. The duration of motor block in group IC was (356 ± 97.99) comparable to group AX (357.8 ± 108.13) and 2 (5%) patients in each group had inadvertent vascular puncture (Table 1, 2 and Figs. 1-3).

Table 1: Demographic data

Demographic data	Group IC	Group AX	*p* - Value
Age (years)	33.7 + 8.10	36.95 + 8.00	0.0748
Weight (kg)	58.83 + 5.91	57.48 + 3.90	0.231
Height (cms)	157.2 + 5.42	157.1 + 4.73	0.895
Sex (Male/Female)	23/17	21/19	0.822
ASA PS (I/II)	28/12	29/11	0.999

Table 2: Anaesthetic data

Anaesthetic data	GROUP IC	GROUP AX	*p* – value
Block Performance Time (Min)	6.43 + 0.38	8.46 + 0.43	< 0.001
Onset of Sensory Block (Min)	5.33 + 1.67	7.03 + 2.01	< 0.001
Onset of Motor Block (Min)	9.23 + 3.01	17.53 + 4.1	< 0.001
Duration of Sensory Block (Min)	290.38 + 78.65	295.25 + 35.86	0.722
Duration of Motor Block (Min)	356 + 97.99	357.8 + 108.13	0.913
Success Rate (%)	95%	85%	
Incomplete Block	2/40	6/40	0.263

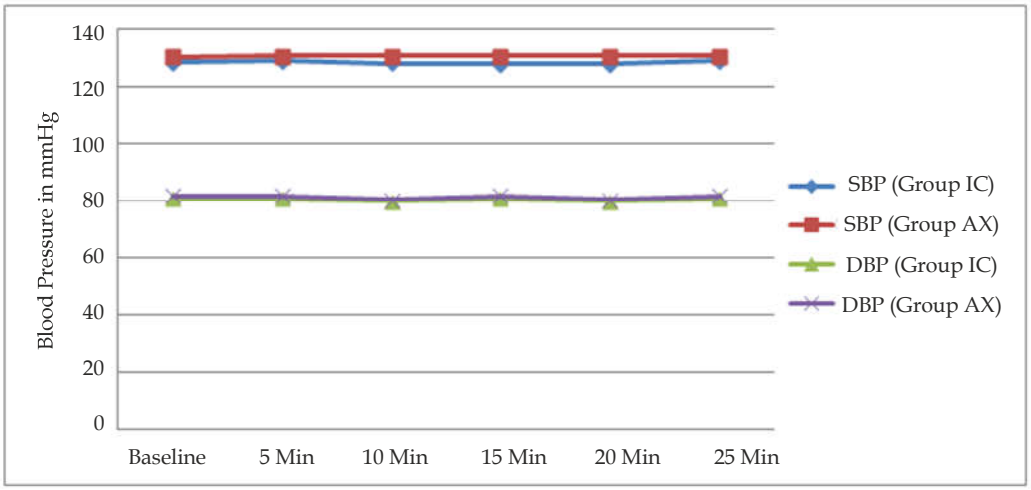

Fig.1: Blood pressure changes during surgery

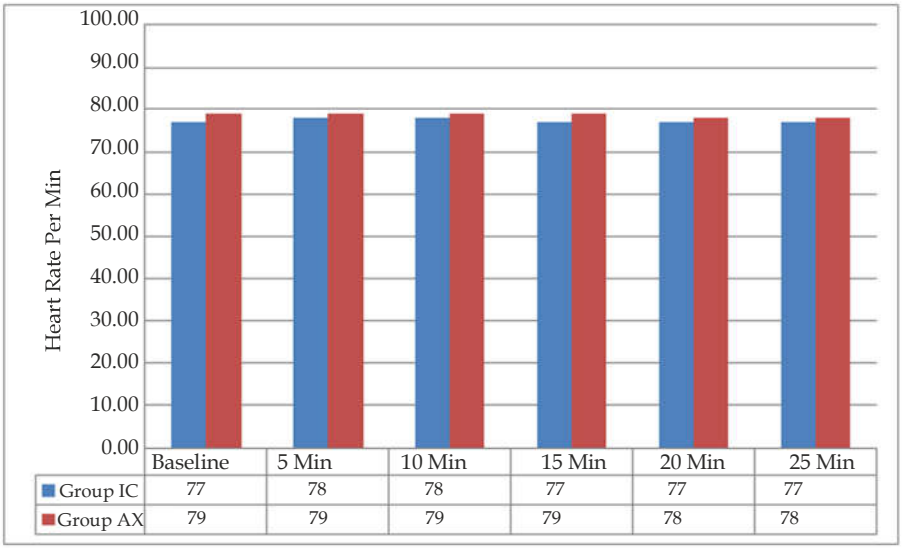

Fig. 2: Heart rate changes during surgery

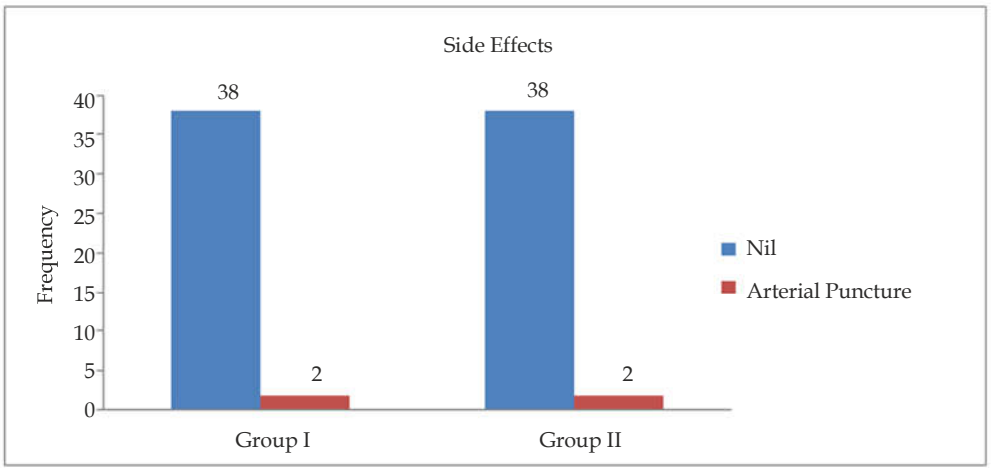

Fig. 3: Side effects

Discussion

Forearm surgeries can be performed under brachial plexus block through supraclavicular approach, infraclavicular approach and axillary approach[6]. Usually anaesthesiologists have an inclination towards supraclavicular or axillary approach over infraclavicular approach because of technical difficulty and chances of increased complication rate in blind infraclavicular approach. With increased use of ultrasonography the complications associated with infraclavicular approach have been reduced because of direct visualization of nerve structures, needle tip and spread of the drug, [7] so we wanted to compare ultrasound guided infraclavicular approach versus axillary approach. In our study block performance time was shorter in group IC when compared to group AX, this difference was because the additional minutes required for axillary block, may be because the needle was targeted at 3 nerves around the axillary artery and one for the musculocutaneous nerve where as drug was deposited at only one point in infraclavicular block. This was consistent with the results of previous study by In Ae song et al.[8]

We have defined block performance time as the time interval from placement of ultrasound probe to the removal of needle after injection of local anaesthetic.[9] Whereas In Ae song et al., have defined performance time as from the time betadine was applied onto the skin to the removal of the block needle. Other studies have measured it differently from needle to needle[10,11,12] as ultrasonographic identifying of nerve plexus and surrounding structures will take some time before performing block, this is more practical way of inducing block.

Onset of sensory block in Infraclavicular Group is (5.33 ± 1.67) and in Axillary Group is (7.03 ± 2.01)

Onset of motor block in group IC (9.23 ± 3.01) and in group AX (17.53 ± 4.1) this earlier onset of sensory and motor block in group IC might be because of infiltration of local anaesthetic solution more proximal to nerves and relative late onset in group AX might be because of infiltration of local anaesthetic solution periphery to nerves.

Duration of sensory and motor block in each study groups was comparable and statistically not different. Duration of sensory block in group IC (290.38 ± 78.65) and in group AX (295.25 ± 35.86). Duration of motor block in group IC (356 ± 97.99) and in group AX (357.8 ± 108.13)

The success rate in our study was ninety five percent with infraclavicular group and eighty five percent in axillary group. Five percent in infraclavicular and fifteen percent in axillary group had incomplete block.

This high success rate for infraclavicular block in our study mirrors findings of previous studies[13]. A success rate of 90-95% for ultrasound guided infraclavicular block was quoted in few studies.[14,7] A success rate of 97.5% for ultrasound guided axillary block was quoted in study conducted by Rania Maher Hussien et al5 and a success rate of 95-100% for ultrasound guided axillary block was quoted by Vincent et al.[15] which was in contrast to the findings of our study (85%). This high success rate in infraclavicular block may be because of use of ultrasound in brachial plexus block not only identifies the anatomical structures but also allows complete identification of the needle passage till local anaesthetic was injected.

The comparatively lower success rate in axillary block is also attributable to relative lack of experience of the anaesthesiology residents and potential variable anatomical position in relevance the axillary artery.[13]

Complications

In each group there were 2 cases of vascular puncture which could be attributed to relative inexperience of the anesthesiology residents performing the block.

Limitations

Even though the block performer did not participate in further monitoring of the patients, evaluation of study parameters begun immediately after the block and it was not possible to completely remove traces like betadine or the puncture site on the skin for the particular block which could indicate the group to which patient belongs. This could result in bias in recording results and hence we could not conduct a completely blinded study.

We failed to follow up the patients for one week to identify for neurological defecits.

Conclusion

Ultrasound guided brachial plexus block through infraclavicular approach has shorter performance time, higher success rate and faster onset of sensory and motor block when compared to ultrasound guided brachial plexus block through axillary approach. There was no statistically significant difference in duration of sensory and motor block in both approaches.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 726–733
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.11

Comparision of Effects of Fentanyl and Intravenous Paracetamol on Consumption of Sevoflurane

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Abstract

Aims: The study was designed to compare the effect of IVFentanyl vs. IV Paracetamol on consumption of Sevoflurane and the recovery characteristics. *Plan of study:* Patients scheduled for elective surgeries under general Anaesthesia are randomly allocated with 50 patients in each group. Group- F received Fentanyl 1mcg/kg per min as bolus 5min before infusion immediately after intubation. Group- P received Paracetamol 1gm in 100ml for a period of 15min and twenty five minutes before intubation. Intra-operatively Sevoflurane concentration was titrated to maintain entropy value of 40-60. Total volume of Sevoflurane consumed is obtained from GE/Datex-Omeda S/5 advance monitor and average Sevoflurane consumed in ml/hr is calculated.*Results:* Consumption of Sevoflurane in Group- F was 16.01 ± 0.95ml/hr as compared to 16.9 ± 2.2 ml/hr in Group- P which was statistically significant. Post extubation at the end of fifth minute all patients in Group- P attained score of 12 as compared to only 56% patients of Group- F and it was is statistically significant (p <0.001). *Conclusion:* Consumption of Sevoflurane & post-operative pain was less in Fentanyl group when compared to paracetamol group. However recovery characteristics are better in paracetamol group.

Keywords: IV Paracetamol, IV Fentanyl, Consumption of Sevoflurane, Entropy.

How to cite this article:
Chiranthkumar G Nelogal, Ramachandraiah R, Mahesh KM, et al. Comparision of Effects of Fentanyl and Intravenous Paracetamol on Consumption of Sevoflurane. Indian J Anesth Analg. 2020;7(3):726–733.

Introduction

A patient hypnotic state can be evaluated in real time using several devices that quantify the EEG. Entropy module based upon spectral entropy describes the irregularity, complexity or unpredictability of a signal. Monitoring anaesthetic depth makes it possible to administer appropriate dose of anaesthetics and prevent anaesthetic awareness, side effects of over dose, economic and environmental waste. Anaesthetic management using proper volatile anaesthetic administration is equally important as maintaining patient's vital signs[2]. Demonstrations have shown that intravenous paracetamol is associated with rapid, predictable analgesia in perioperative period.

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Received on 23.01.2020, **Accepted on** 15.02.2020

Entropy is considered to be more accurate and reliable indicator of the hypnotic effect of anaesthetics and sedative drugs.[3] The entropy module generates state entropy (SE) and response entropy (RE).The SE frequency is in the range of 0.8-32 Hz of the raw EEG signal and RE frequency is in the range of 0.8-47 Hz.[4]

Intraoperative analgesia is an integral component of balanced anaesthesia technique. Opioids remain the agent of choice for severe pain; however this class of analgesics is associated with dose dependent adverse effects and untoward post-operative outcomes.[5]

It was demonstrated that there is profound synergism for both analgesia and sedation between Opioids and volatile anesthetics.[6] Fentanyl and its congeners are being used for managing the analgesic component and were shown to reduce the MAC of Sevoflurane.[7]

When multiple intravenous doses of Fentanyl are administered or when there is continuous infusion of the drug, the plasma concentration of Fentanyl does not decrease rapidly & the duration of analgesia as well as depression of ventilation may be prolonged.[8]

Paracetamol, a non-opioid agent by virtue of its central cyclooxgenase inhibition and its indirect influence on serotonergic system is found to be an effective analgesic.[9] It has a good safety profile & easily crosses the blood brain barrier & thus produces analgesia.[10] Various authors have studied the effect of Paracetamol on intraoperative and postoperative analgesic consumption and found to have an opioid sparing effect.[11] Studies are scarce as to the effect of intravenous Paracetamol on consumption of Sevoflurane and recovery characteristics. This clinical study is designed and aimed to compare the effect of intravenous Paracetamol and Fentanyl on consumption of sevoflurane and recovery characteristics using Entropy monitored general anaesthesia.

Materials and Methods

After institutional ethical committee approval, written informed consent was taken from patients belonging to physical status ASA I & II.The study included 100 patients. They were randomly allocated into 2 equal groups. Patients of age group 20-50yrs were selected for the study undergoing general anaesthesia.Preanaesthetic evaluation and investigations were done of all the patients participating in study. Patients with anticipated difficult intubation, who are already receiving Opioid & analgesics, patients whose body weight <70% or >130% of ideal body weight were excluded from the study.

Sample size was calculated based on previous studies. Keeping confidence limit at 15%, and power of study being 80%, minimum sample size required to detect a 15% difference in Sevoflurane concentration consumption was 72. To overcome errors and non-participation, 100 patients were selected and randomly divided into two groups with 50 patients in each group.

Group- F: Received Fentanyl 1mcg/kg body weight IV bolus 5min before the intubation, (Fentanyl bolus was given to obtain adequate analgesic concentration in perioperative period till the infusion is started) followed by 0.02mcg/ kg per min infusion of Fentanyl immediately after intubation.

Group- P: Received IV Paracetamol 1gm in 100ml over 15min, twenty five minutes before the plan of induction & intubation.

After shifting the patient to operating room, IV access was obtained on the forearm with 18G IV cannula and ringer lactate infusion started. Premedication was done with Midazolam 1mg IV, Glycopyrrolate 0.2mg, Tramadol 50mg IV and was preoxygenated with 100% O_2 for 3 min. Induction was done with IV Propofol 2mg/kg and intubation was facilitated with IV Atracurium 0.5mg/kg, controlled ventilation with 6liters of fresh gas flow N_2O:O_2 (60:40).

After intubation, Sevoflurane was set and its concentration was titrated every 5min by 0.5 volume% to maintain SE value 40-60. (The gradient between SE & RE was maintained in the range of 5-10). Once the inspired and expired concentrations of Sevoflurane are equal or ±0.2%, the fresh gas flow was reduced to 2 litres/min. Sevoflurane was switched off at the time of beginning of skin stapling. At the end of skin closure, fresh gas flow was increased to 6 litres/min with 100% oxygen.Each patient was monitored for electrocardiography, oxygen saturation, Et Sevoflurane, MAC, non-invasive blood pressure, EtCo2, train of four (TOF), State Entropy (SE) & Response Entropy (RE) .

Both the groups received sevoflurane after intubation.Neuromuscular blockade was reversed with Neostigmine 0.05mg/kg and Glycopyrolate 0.01mg/kg. When TOF count was 4, Sevoflurane starting and cutoff time were noted. Total volume of Sevoflurane consumed for each case was obtained from GE/Datex-Omeda S/5 avance monitor and Sevoflurane consumed in ml/hr was calculated. After extubation, the anaesthesia monitoring

was continued till 10min. Recovery status was ascertained by fast-track scoring system.

Statistical analysis

Data was analysed using SPSS V18 software. *p*- Value < 0.05 was considered forstatistical significance.Descriptive statistics of $ETCO_2$, FiSevo, MAC, and duration of surgery were noted. Sevoflurane consumption & haemodynamic variables were analysed and presented with mean and standard deviation. Independent t-test was used to compare the average $ETCO_2$, Fi Sevo, MAC, Duration of surgery, Sevoflurane consumption and haemodynamic variables were compared at different time. Chi-square test was used to compare the level of consciousness score, physical activity score, respiratory stability, oxygen saturation score & pain assessment score between the groups.

Results

The patients' demographics with respect to age, height, weight, gender distribution, ASA grading and duration of surgery were comparable between the groups. Mac sevoflurane required for anaesthetic depth in Group-P was significantly higher than Group-F. Sevoflurane consumption was significantly higher when compared to Group- F (*p* value- 0.053). Heart rate, SBP, DBP and MAP were significantly higher in Group- P when compared to Group- F.

Recovery characteristics as assessed by Fast Track Scoring System, level of consciousness, physical activity, oxygen saturation status, and emetic symptoms were comparable in both the groups. Haemodynamic parameters were found to be high at 3rd and 4th minute in Group- P. The immediate pain score was high in Group- P as compared to Group- F. At the end of fifth minute 100% in Group- P attained score of 12 as compared to 56% in Group- F and was statistically significant ($p < 0.001$) and at the end of 8th minute, Group- F attained score of 12 (Tables 1-12 and Fig. 1,2).

Table 1. Demographic data

Basic variables	Group- F	Group- P	*p*- value
Age in years	40 ± 7.3	39 ± 8.7	0.67
Height in cm	157.60 ± 3.84	156.80 ± 3.06	0.78
Weight in kg	57.8 ± 6.9	60 ± 5.1	0.58
Duration of Surgery	85.7 ± 16	91.2 ± 15	0.09

Table 2. Comparison of MAC and duration of Sevoflurane usage

	Group- F	Group- P	*p*- Value
MAC	1.28 ± 0.08	1.38 ± 0.07	0.000*
Duration of Sevoflurane Usage	85 ± 17min	89 ± 17.5min	0.159

Table 3. Comparison of Sevoflurane consumption

	Group- F	Group- P	*p*- value
Sevoflurane Consumption ml	22.3 ± 3.8	24.06 ± 5.04	0.053
Sevoflurane ml/ hour	16.01 ± 0.95	16.9 ± 2.2	0.012*

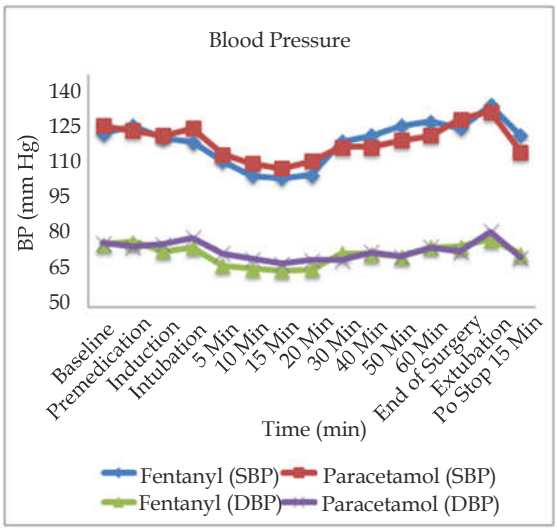

Fig. 1: Comparison of Systolic Blood pressure between the groups

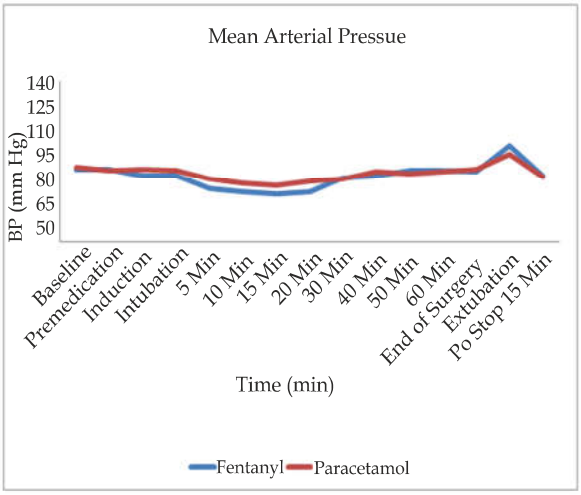

Fig. 2: Comparison of Mean Arterial Pressure between the groups

Table 4: Recovery characteristics assessed by Fast track criteria

Parameters	Description	Score
Level of consciousness	Awake and oriented	2
	Arousable with minimal stimulation	1
	Response to tactile stimulation	0
Physical activity	Able to move all extremities on command	2
	Some weakness in movement of extremities	1
	Unable to voluntarily move extremities	0
Hemodynamic stability	Blood pleasure <15% of base line MAP value	2
	Blood pleasure 15% - 30% of base line MAP value	1
	Blood pleasure >30% of base line MAP value	0
Respiratory stability	Able to breathe deeply	2
	Tachypnea with good coughs	1
	Dyspnea with weak coughs	0
Oxygen saturation status	Maintain value >90% on room air	2
	Requires supplemental oxygen (nasal prongs)	1
	Saturation <90% with supplemental oxygen	0
Post-operative pain assessment	None of Mild discomfort	2
	Moderate to severe pain controlled with IV analgesics	1
	Persistent severe pain	0
Post-operative emetic symptom	None or mild nausea with no active vomiting	2
	Transient vomiting or retching	1
	Persistent moderate to severe nausea and vomiting	0
	Total score	14

[A minimal score of 12 is taken for complete recovery. Recovery time is assessed at 1min interval and is calculated accordingly for each case]

Table 5: Comparison of level of consciousness

Level of consciousness at		0	1	2	*p* value
1 min	F	2	32	26	0.89
	P	2	24	24	
2 min	F	2	32	16	0.63
	P	0	24	26	
3 min	F	2	18	30	0.01
	P	0	4	46	
4 min	F	2	4	46	<0.001
	P	0	0	50	
5min	F	1	4	35	<0.001
	P	0	0	50	
6 min	F	0	3	47	0.242
	P	0	0	50	
7 min	F	0	2	48	0.495
	P	0	0	50	
8 min	F	0	2	48	0.495
	P	0	0	50	

[Level of consciousness and Score: Awake and oriented =2; Arousable with minimal stimulation=1 ;Response to tactile stimulation= 0]

Table 6: Comparison of Physical activity

Physical activity at		0	1	2	*p* Value
1 min	F	0	41	9	0.624
	P	0	38	12	
2 min	F	0	41	9	0.241
	P	0	35	15	
3 min	F	0	37	13	0.284
	P	0	41	19	
4 min	F	0	31	29	0.204
	P	0	21	34	
5 min	F	0	2	48	0.287
	P	0	0	50	
6 min	F	0	0	50	--
	P	0	0	50	
7 min	F	0	0	50	--
	P	0	0	50	
8 min	F	0	0	50	--
	P	0	0	50	

[Physical activity and score: Able to move all extremities on command- 2; Weaknessin movement of extremities- 1;Unable to voluntarily move extremities-0]

Table 7: Haemodynamic stability score

Haemodynamic Stability at		0	1	2	*p* value
1 min	F	0	50	0	0.117
	P	4	46	0	
2 min	F	0	49	1	0.60
	P	3	47	0	
3 min	F	0	28	22	0.001
	P	0	44	6	
4 min	F	0	27	23	0.001
	P	0	42	8	
5 min	F	0	0	50	--
	P	0	0	50	
6 min	F	0	0	50	--
	P	0	0	50	
7 min	F	0	0	50	--
	P	0	0	50	
8 min	F	0	0	50	--
	P	0	0	50	

[Blood pressure: <15% of base line MAP value -2; Blood pressure: 15% - 30% of base line MAP value - 1;Blood pressure>30% of base line MAP value 0]

Table 8: Comparison of Respiratory stability

Respiratory Stability at		0	1	2	*p* value
1 min	F	0	47	3	<0.001
	P	0	26	24	
2 min	F	0	47	3	<0.001
	P	0	26	24	
3 min	F	0	46	4	<0.001
	P	0	25	25	
4min	F	0	41	9	<0.001
	P	0	16	34	
5 min	F	0	17	33	<0.001
	P	0	0	50	
6 min	F	0	4	46	0.041
	P	0	0	50	
7min	F	0	0	50	--
	P	0	0	50	
8 min	F	0	0	50	--
	P	0	0	50	

[Respiratory stability score: Able to breathe deeply- 2; Tachypnea with good coughs- 1; Dyspneic with weak coughs- 0]

Table 9: Oxygen saturation status score

Oxygen Saturation status at		0	1	2	*p* value
1 min	F	0	2	48	0.157
	P	0	0	50	
2 min	F	0	2	48	0.157
	P	0	0	50	
3 min	F	0	2	48	0.157
	P	0	0	50	
4 min	F	0	2	48	0.157
	P	0	0	50	
5 min	F	0	0	50	--
	P	0	0	50	
6 min	F	0	0	50	--
	P	0	0	50	
7 min	F	0	0	50	--
	P	0	0	50	
8 min	F	0	0	50	--
	P	0	0	50	

[Maintain value >90% on room air - 2;Requires supplemental oxygen (nasal prongs) - 1; Saturation <90% with supplemental oxygen - 0

Table 10: Comparison of Pain assessment

Pain assessment at		0	1	2	*p* value
1 min	F	3	41	6	0.02
	P	13	37	0	
2 min	F	3	41	6	0.02
	P	13	37	0	
3 min	F	3	41	6	0.02
	P	13	37	0	
4 min	F	1	40	9	0.02
	P	10	36	4	
5 min	F	0	25	25	0.23
	P	3	27	20	
6 min	F	0	2	48	0.143
	P	3	2	45	
7 min	F	0	2	48	0.181
	P	3	0	47	
8 min	F	0	2	48	0.081
	P	3	0	47	

[Pain assessment score: None of Mild discomfort- 2, Moderate to severe pain controlled with IV analgesics- 1; Persistent severe pain- 0]

Table 11: Comparison of Post-operative emetic symptoms

Post-operative Emetic	Symptoms at	0	1	2	*p* value
1 min	F	0	6	44	0.293
	P	0	3	47	
2 min	F	0	5	45	0.23
	P	0	0	50	
3 min	F	0	5	45	0.23
	P	0	0	50	
4 min	F	0	5	45	0.23
	P	0	0	50	
5 min	F	0	1	49	0.32
	P	0	0	50	
6 min	F	0	1	49	0.32
	P	0	0	50	
7 min	F	0	0	50	--
	P	0	0	50	
8 min	F	0	0	50	--
	P	0	0	50	

Table 12: Comparison of Recovery status score

Time(minute)	Paracetamol > 12No of pts (%)	Fentanyl >12 No of pts (%)	*p* value
1	2 (4.0)	0 (0.0)	0.153
2	3 (6.0)	0 (0.0)	0.079
3	11 (22.0)	2 (4.0)	0.007
4	27 (54.0)	11 (22.0)	0.001
5	50 (100.0)	28 (56.0)	<0.001
6	50 (100.0)	39 (78.0)	<0.001
7	50 (100.0)	45 (90.0)	0.022
8	50 (100.0)	50 (100.0)	1.0

Discussion

Studies have shown that fentanyl reduces MAC of sevofluraneand its consumption[19] along with opioid related side effects[5].Clinical studies have found that 1gm paracetamol employed alone is as effective as 30 mg Ketorolac, 75mg Diclofenac or 10 mg morphine with a greater safety profile[9]. Preoperatively administered intravenous paracetamol 1gm has no negative effects on intraoperative or postoperative haemodynamic parameters and ensures effective analgesia during post operative period, increases patient's satisfaction by reducing postoperative opioid consumption there by reducing the length of hospital stay[9].

In our study we considered analgesic dose of Fentanyl 0.02µg/kg/min to compare analgesic component of Paracetamol and its effect on consumption of Sevoflurane.Dose to peak effect of IV Paracetamol 1gm was found to be 20min as quoted in the study by CD Osier[15], and dose to peak effect of Fentanyl was found to be 3.6 min as shown in study by Steven Shafer[16].

O Ibreheim et al. in their study compared recovery status and Sevoflurane consumption between BIS and conventional group, where patients were induced with Propofol 1.5-2 mg/kg Fentanyl 2µg/kg and succynil choline 1-1.5 mg/ kg with Sevoflurane for maintenance with 2 litre of FGF found the consumption of Sevoflurane per hour was 15.66 ± 4.04 ml liquid which is found concurrent with our study[12]

Airbanet al have compared the use of Paracetamol on its opioid sparing effects and found to be effective when compared to placebo group.[13] Sussansoltini in their study have shown that preoperative rectal Paracetamol reduces Propofol consumption and postoperative pain in infertile women undergoing oocyte retrieval for in vitro fertilization treatment[19]. J Benito et al have demonstrated that Paracetamol and Remifentanil produced a maximum degree of MAC reduction (p = 0.002) of Sevoflurane in anesthetized rats which was clinically and statistically highly significant.[14] Human studies are scarce and we have attempted to compare effect of paracetamol on Sevoflurane consumption. MAC Sevoflurane in Paracetamol group 1.38 ± 0.07 is significantly higher than Fentanyl group1.28 ± 0.08 (p < 0.005).

Sevoflurane consumption in our study was 16.01 ± 2.28 ml/hour in Fentanyl groupand in Paracetamol group is 16.9 ± 2.2 ml/hour. Hence Sevoflurane consumption in paracetamol group was significantly higher than Fentanyl group (p value < 0.012). Thus the reduction of consumption of sevoflurane in paracetamol group is less compared to fentanyl group.

Recovery characteristics: Postoperative recovery characteristics among both the groups were assessed by fast track scoring system.In our study we found that at 4th and 5th minute 4- 5 patients were arousable to minimal stimulation in Group- F when compared to none in Group- P where all the patients were awake and oriented and statistically significant.

Physical activity score was comparable in both the groups. Haemodynamicaly both the groups were comparable, except at 3rd (44) and 4th (42) minute in Group- P where there was significant rise blood pressure in Group- Pas compared to patients in Group- F (28) and (27) & p value was < 0.001). In our study, we found that at the end of 1st and 2nd min 47 pts were tachypneic in Group- F and 26 in Group- P. Similarly at the end of 3rd minute 46 pts in Group- F, 25 pts in Group- P at 4th min 41 in Group- F and 16 in Group- P, at 5th min 4 in group F and 0 in

Group- P werefound statistically significant. At the end of 6th minute most of the patients were able to breathe deeply without discomfort and was found statistically in significant. Oxygen saturation was maintained > 90% in both the groups.

In our study, 16 patients experienced persistent pain. Majority of them were from Group- P (13), and as compared to Group- F (3pts). Seventy eight patients experienced moderate pain which was relieved by IV analgesics. Among them 41 patients were belonged to Group- P and 37 from Group- F. It was found to be statistically significant when compared to Group F (p value < 0.02). In Group-F transient retching was present in 6 patients as compared to 3 in Group P and found statistically insignificant.

We found at the end of 5th minute, all patients of Paracetamol group attained score of 12 whereas 56% of patients of Fentanyl group attained score 12 but at the end of 8th minute all patients of Group-F attained at score of 12, as assessed by fast track criteria. Hence recovery was better and faster in Paracetamol group than Fentanyl group. SBP in both the groups were comparable. During intubation, there was significant rise in SBP in Group-P (127 ± 7.6) when compared to group F(121 ± 10). (p value < 0.001). MAP in both the groups were comparable except during intubation where in Group- P (90 ± 10.27), there was significant rise in MAP when compared to Group- F (87 ± 7.8) was found significant (p value <0.001). O ibhraiem et al. in their study on post-operative recovery and Sevoflurane consumption determined that the time to wakening and extubation was 6.8 ± 2.4 min.[12] Brestin etal in their study Sevoflurane--nitrous oxide anaesthesia supplemented with remifentanil:effect on recovery and cognitive function determined that eye opening of patient was 6.5 min and patients were oriented by the end of 8.3 min.[18] In our study we found that by the end of 6th minute most of the patients were awake, oriented and moving all the four limbs. These observations were found concurrent with the above studies.

Conclusion

Consumption of Sevoflurane in Fentanyl group was less. In Fentanyl group, patientswere haemodynamically stable intraoperatively and experienced less pain postoperatively when compared to Paracetamol group. Recovery characteristics were better in Paracetamol group as compared to Fentanyl group.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 734–738
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.12

Intravenous Dexamethasone As Adjuvant to Axillary Brachial Plexus Blockade For Forearm Orthopedic Surgeries: A Randomized Controlled Trial

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Abstract

Introduction: perineural dexamethasone prolongs the duration of single injection peripheral nerve block when added to the local anesthetic solution while perineural use of dexamethasone remains off-label. Postulated systemic mechanisms of action along with safety concerns have prompted the investigation of intravenous dexamethasone as an alternative. *Aim:* We aimed to confirm that addition of intravenous dexamethasone will prolong the duration of analgesia after single shot axillary brachial plexus block compared to conventional long acting local anesthetic alone. *Material And Method:* 46 Asa I to III adult patients scheduled for elective forearm and hand surgeries were randomly allocated to 2 groups of 23 patients each. Patients in group D received axillary brachial plexus block with injection of 30 ml bupivacaine 0.5% and 2 ml of dexamethasone (8mg) IV and Patients in control group A received axillary brachial plexus block with injection of 30 ml of bupivacaine 0.5% and 2ml of 0.9% saline IV prior to surgery. *Results:* There was a statistically significant difference in duration of post operative analgesia, duration of motor and sensory blockade and better overall patient satisfaction in group D when compared to group A. *Conclusion:* We concluded that Single shot axillary brachial plexus block with 0.5% bupivacaine and intravenous dexamethasone resulted in prolonged duration of post operative analgesia, sensory and motor blockade and better patient satisfaction

Keywords: Intravenous dexamethasone, Brachial plexus block, Axillary brachial plexus block.

How to cite this article:
Dhananjaya Kumar SM, Shankara Narayana P. Intravenous Dexamethasone As Adjuvant to Axillary Brachial Plexus Blockade For Forearm Orthopedic Surgeries: A Randomized Controlled Trial. Indian J Anesth Analg. 2020;7(3):734–738

Introduction

Optimization of postoperative pain control plays an important role in the outcome of orthopedic surgeries, permitting early rehabilitation and accelerating functional recovery.[1] Pain control after surgeries on upper limb can be especially difficult to achieve and this may complicate postoperative care. Pre-operative local anesthetic brachial plexus blockade significantly reduces postoperative discomfort, and can reduce opiate consumption.[2] Dexamethasone is a useful adjuvant in regional anesthesia that is used to prolong the duration of analgesia for peripheral nerve blocks. Recent randomized controlled trials (RCTs) have demonstrated conflicting results as to whether perineural versus intravenous (IV) administration of dexamethasone as an adjuvant to local anaesthetic

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Received on 20.02.2020, **Accepted on** 07.03.2020

brachial plexus blockade is superior in this regard, and the perineural use of dexamethasone remains off-label. The use of additives such as vasoconstrictors, clonidine, ketamine and steroids to local anesthetics to prolong the duration of a single-shot axillary nerve block have been studied, but most of them failed to prolong the duration of peripheral nerve blocks.[3] We, therefore, conducted a prospective, double blind, randomized controlled study to evaluate the effect of intravenous dexamethasone on the duration of a single-shot axillary nerve block with bupivacaine 0.5% for postoperative analgesia after forearm orthopedic surgeries.

Materials and Methods

After obtaining approval from the institutional ethics committee and written informed consent, 46 adult patients of American Society of Anesthesiologists physical status I to III scheduled for elective orthopedic surgeries on forearm and hand receiving axillary brachial plexus block were selected. Patients with uncontrolled diabetes, pregnant and lactating mothers, patients having contraindication to axillary nerve block (coagulopathy, local infection or axillary lymphadenopathy) and patient refusal or inability to consent were excluded from the study. On the day of surgery, patients were allocated into two groups (Group D and Group A) at random and in equal ratio using closed envelope method. After randomization is done, Drug preparation will be done by another anaesthesiologist who is not involved in the study.

Patient was connected with monitors such as ECG, pulse oximetry and non invasive arterial pressure and sedated with intravenous midazolam at increments of 0.5 mg up to maximum of 3mg. after skin disinfection and infiltration with lidocaine 1%, the axillary brachial plexus was identified using a linear 6-13 MHz ultrasound probe. We inserted a short bevel 50mm, 22 gauge stimulating needle connected to a nerve stimulator. The initial setting was a current of 0.8 mA with a stimulating frequency of 2 Hz. Contractions of any forearm or hand muscles indicated correct placement of needle and drug preparation was injected. The block was performed by resident physicians under supervision of anesthesiologist. Patients in group D received axillary brachial plexus block with injection of 30 ml bupivacaine 0.5% and 2 ml of dexamethasone (8mg) IV and Patients in control group A received axillary brachial plexus block with injection of 30 ml of bupivacaine 0.5% and 2ml of 0.9% saline IV. All patients subsequently underwent planned elective orthopedic surgeries. Intra operatively opioid medications were avoided**.** All Patients were given standardized post operative pain management regimen (intravenous paracetamol 15 mg/kg when VAS score > 4). Duration of analgesia defined as the time between performance of the block and the first analgesic request was designated as the primary outcome was documented. Motor and sensory block duration (strength score; 3 point motor block score MBS and pain scores (VAS) assessed at four time points 8th, 12th, 16th and 20th hour) were noted and documented, administration of 'rescue' analgesic medication (IV Paracetamol) in the first 24 h if given any were noted, patient satisfaction with overall pain management on a 0-10 scale at 24th hour was recorded and tabulated. Recovery room discharge criteria were assessed such as stable vital parameters, absence of nausea and VAS score less than 3 and motor blockade score more than 2 and patient was discharged after they met recovery room discharge criteria. Proportions were compared by using the Pearson chi - square test; Fisher's exact test was used instead of the Pearson chi-square test if the minimum expected cell count was less than five. Duration of blockade was analysed by using Cox Regression proportional hazard method.

Results

A total of 46 patients were enrolled in the study and distribution of patients according to gender and sex are shown in Table 1.

The axillary brachial plexus block along with dexamethasone IV (group D) as adjuvant lasted longer period when compared to axillary brachial plexus block with saline IV as adjuvant (group A) where p value < 0.001, Table 2. However, the difference among analgesic consumption (1.7g ± 0.58g vs 1.4g ± 0.43g) and patient satisfaction (8.5 ± 0.7 vs 7.9 ± 0.6) were also statistically significant among two groups (Table 3 and Graphs 1-4).

Table 1: Group Statistics of age

	Group			
	D		A	
	Mean	Std. Deviation	Mean	Std. Deviation
Age	46.61	11.965	45.48	12.820

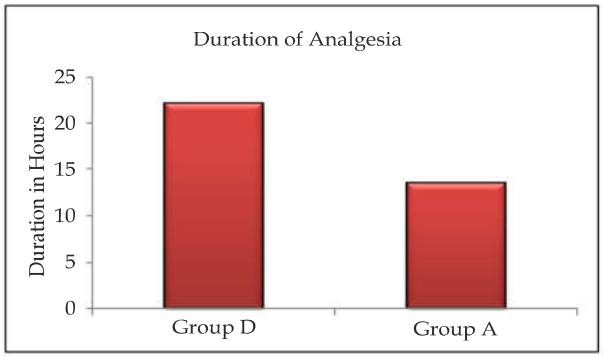
Table 2: Group statistics of gender

		Sex		Total
		F	M	
Group	D	11	12	23
		47.8%	52.2%	100.0%
	A	11	12	23
		47.8%	52.2%	100.0%

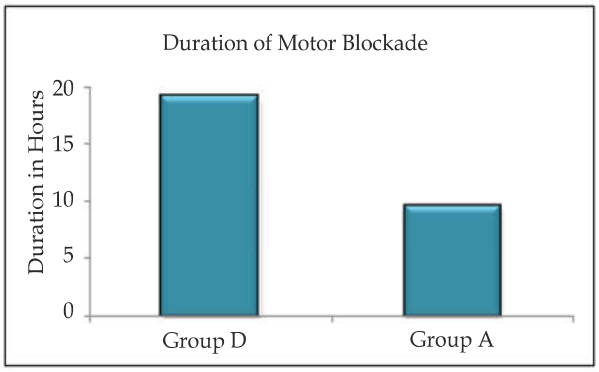
Table 3: Primary and secondary outcomes following forearm and hand surgeries

	Group				
	D		A		
	Mean	Std. Deviation	Mean	Std. Deviation	*p*-value
Duration of Analgesia	22.13	2.768	13.39	1.588	<0.001
Duration of Sensory Blockade	21.26	4.059	11.57	1.441	<0.001
Duration of Motor Blockade	19.04	3.444	9.52	1.410	<0.001
Analgesics Consumption(in g)	0.696	0.357	1.391	0.4252	0.048
Patient Satisfaction 0-10 scale	8.52	0.730	7.96	0.638	0.008

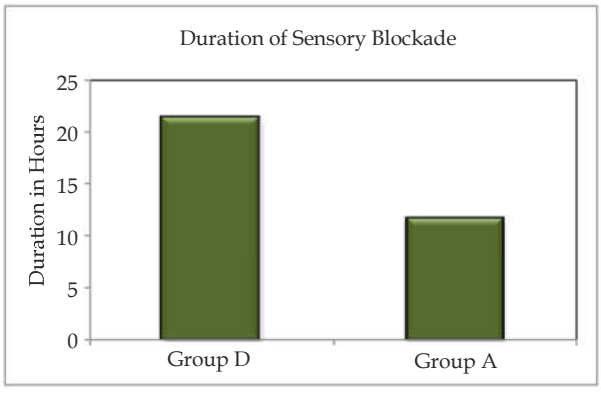
$p < 0.05$ indicates significant difference between the groups



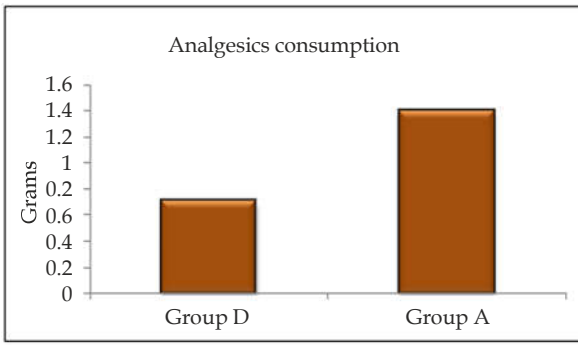
Graph 1: Comparison between group D and group A of duration of analgesia



Graph 3: Comparison between group D and group A of duration of motor blockade



Graph 2: Comparison between group D and group A of duration of sensory blockade



Graph 4: Comparison between group D and group A of analgesic consumption

Discussion

This clinical trial builds on a limited number of studies examining the efficacy of systemic dexamethasone administered at the time of upper extremity regional block compared with perineural administration of the drug in the block anaesthetic solution[4].

Table 4:

	Post operative analgesia	Sensory and motor blockade	Analgesic consumption and Patient satisfaction
Present study	22.13 ± 2.768, statistically significant with *p* value of <0.001	21.26 ± 4.059, statistically significant with *p* value of <0.001 19.04 ± 3.444,statistically significant with *p* value of <0.001 respectively	Paracetamol (0.696 ± 0.357), statistically significant with *p* value of <0.048 and patient satisfaction scale (8.52 ± 0.730, statistically significant with *p* value of <0.008).
Choi and colleagues[5] in 2015 conducted meta-analysis on perineural dexamethasone as an adjuvant	Prolonged analgesic duration to 21.76 hours from 12.17 hours.	Motor blockade duration 18.37 hours from 11 hours.	No statistically significant on analgesic consumption.
Desmet and his colleagues[7] in 2015, RCT of IV dexamethasone 1.25mg, 2.5mg, 10mg and IV saline.	12.2 hours with IV saline, prolonged to 17.4 hours (dexamethasone 10mg), 20.1 (2.5mg dexamethasone) hours, 14 hours (1.25mg dexamethasone) respectively		
M. Desmet and colleagues[4] in 2013, RCT on IV vs perineural dexamethasone	perineural and IV dexamethasone were 23.41 hours and 21.25 hours respectively		Paracetamol consumption was 2.6g in perineural vs 2.3g in IV dexamethasone.
Rosenfeld and colleagues[6] in 2016, RCT on perineural vs IV dexamethasone	perineural (16.9 hours) vs IV (18.2 hours)		opioid consumption in perineural (12.2 mg) vs IV (17.1 mg)
	IV dexamethasone (25 hours) vs IV saline (13.2 hours) vs perineural (25 hours)	Motor blockade was IV dexamethasone (30.1 hours) vs perineural dexamethasone (25.5 hours) vs IV saline (19.7 hours).	IV dexamethasone and perineural dexamethasone had reduced opioid consumption and better patient satisfaction.

In our study, we found that duration of analgesia was prolonged in pts who received dexamethasone as an adjuvant along with axillary brachial plexus block when compared to control group. Secondary outcomes in our study such as motor and sensory blockade were prolonged in pts who received IV dexamethasone along with axillary brachial plexus block when compared to sole axillary brachial plexus block. Analgesic consumption during first 24 hrs was lesser when compared to control group. Overall patient satisfaction was better in IV dexamethasone group when compared to control group and was statistically significant (Table 4).

Conclusion

We concluded that single shot axillary brachial plexus block with 0.5% bupivacaine and intravenous dexamethasone resulted in prolonged duration of post operative analgesia, sensory and motor blockade and better patient satisfaction.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 739–742
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.13

Evaluation Safety and Efficacy of Chloroprocaine V/S Chloroprocaine With 20µg Fentanyl in Subarachnoid Block in Participants Undergoing Lower Limb Ambulatory Surgery

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Abstract

Aims: To Investigate the efficacy and safety profile of the Fentanyl when added to Chloroprocaine for outpatient spinal anaesthesia in terms of quality and duration of sensory and motor blockade and effective analgesia. *Settings and Design:* prospective, randomized, double blind study *Methods and Material:* After institutional review board approval and informed written consent from patients,100 participants, aged 18 to 60 years, of ASA Physical status I, II or III scheduled for lower limb ambulatory surgery under subarachnoid block, were randomly divided into two groups (n = 50 each); Group C received 4.0ml (40 mg) 1% isobaric Chloroprocaine + 0.4ml Normal Saline (0.9%) and Group F received 4.0ml (40mg) 1% isobaric Chloroprocaine + 0.4ml Fentanyl (20µg). Degree of sensory and motor block, postoperative analgesia (VAS score), time of 1st rescue analgesia (effective analgesia), time of ambulation, voiding of spontaneous urine, hemodynamic variables and side effects were evaluated and compared. At VAS ≥ 4, rescue analgesic Inj. Diclofenac Sodium I.V. was given. *Results:* Participants in Group F had prolonged onset (3.91 ± 1.09 min), peak (7.54 ± 1.30 min) and duration (110.74 ± 9.78 min) of sensory block than group C (3.02 ± 0.97 min), (6.53 ± 1.34 min), (104.64 ± 10.83 min) respectively. Motor characteristics were comparable in both groups with onset, peak and duration respectively in group C was (4.01 ± 1.42 min),(7.48 ± 1.89 min) and(79.6 ± 8.42 min) and in group F was (4.52 ± 0.83 min), (9.05 ± 0.52 min),(90.76 ± 5.59 min). Duration of analgesia was longer in Group F (148.36 ± 2.84 min) than in Group C (145.12 ± 2.78 min). Time of ambulation was early in group C (110.62 ± 5.25) than group F (115.42 ± 5.8 9min). Voiding of spontaneous urine was early in group C (112.8 ± 4.69) than group F (115.76 ± 5.92 min). Incidence of side effects was comparable in both groups.

Keywords: Subarachnoid Block; Fentanyl; isobaric Chloroprocaine; Lower-limb Ambulatory Surgery.

How to cite this article:
Dhruvika Viradiya, Shilpa Doshi. Evaluation Safety and Efficacy of Chloroprocaine V/S Chloroprocaine With 20µg Fentanyl in Subarachnoid Block in Participants Undergoing Lower Limb Ambulatory Surgery. Indian J Anesth Analg. 2020;7(3):739–742.

Introduction

Ambulatory surgery as a day care procedure, continues to gain popularity day by day in today's era as it cuts down the total cost, decreases the hospital stay, better patient satisfaction because of their early return to daily routine.[1] So, for this purpose the interest in available and emerging local anaesthetic drugs for outpatient spinal anaesthesia is being increases.[1] The properties for ideal anaesthetic agent for ambulatory surgery includes,

1. Rapid onset
2. Adequate potency
3. Predictable duration

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Received on 13.02.2020, **Accepted on** 16.03.2020

4. Decreased neurotoxicity and other systemic side effects.

When going through literature, procaine having high failure rate is unreliable for outpatient spinal anaesthesia.[1] Though lignocaine was a popular among all as it matched ideal characteristics for ambulatory surgery, increasing incidence of transient neurologic syndrome (TNS) has decreased the drug use.[1] Bupivacaine has been studied in smaller doses but results in unpredictable duration of block, which can lead to delay in discharge and that's why not suitable for ambulatory procedures.[2]

Spinal anaesthesia performed with preservative free 2-chloroprocaine produced blocks with rapid onset, relatively increased potency than procaine, no evidence of toxicity.[3] In early 1980, due to reports of neurologic deficits from 2-chloroprocaine after accidental intrathecal injection, 2-chloroprocaine was discontinued from market for intrathecal use.[4] In 2003, 2-chloroprocaine was once again available in preservative free and anti-oxidant free form and this has regenerated the interest in its use for outpatient spinal anaesthesia.[4]

A combination of intrathecal opioids with local anaesthetics permits reduction in the dosage of both components, minimizing the side effects of the local anaesthetic (motor blockade) and the opioid[5] (i.e. urinary retention, itching and delayed respiratory depression in the case of morphine). An important benefit to their spinal use is that, because of their rapid clearance, these agents at analgesic spinal doses can produce effect at blood levels that are similar to those producing effects after systemic administration.[6]

So, this study was aimed to investigate the efficacy and safety profile of the Fentanyl when added to 2-chloroprocaine for outpatient spinal anaesthesia in terms of quality and duration of sensory and motor blockade as well as effective analgesia.

Materials and Methods

After approval from the Institutional Review Board and informed written consent from all the patients, this prospective, randomized, double blind study was carried out in the Department of Anaesthesiology, Govt. Medical College and Sir T. Hospital, Bhavnagar, Gujarat. We enrolled 100 patients, aged 18–60 yr and ASA Class I, II and III, who underwent spinal anaesthesia for lower limb ambulatory surgery with duration of surgery 30-45 min. Written informed consent was obtained from all patients before randomization. Patients were not admitted to the study if any of the following criteria were present: Patients with psychiatric disorder, spinal cord and peripheral nerve diseases, drug/alcohol abuse, un-cooperative patients, pregnant lady and lactating mother. After proper preoperative evaluation like history, clinical examination, routine baseline investigations and electrocardiogram (ECG) patient shifted in pre-anaesthetic room were Heart rate (HR), noninvasive blood pressure (NIBP), peripheral arterial oxygen saturation (SpO_2) measured. Patients were randomly allocated in the two groups by computer generated random number sequence in sealed envelopes. Patient was asked to pick one envelope in pre-anaesthetic room. One member from the team except from principle Investigator (PI), asked to open the envelope and filled up the drug as per group assigned to patient. PI was responsible for performing the procedure (SAB)

Group C (n = 50): received 4.0ml (40 mg) 1% chloroprocaine + 0.4ml NS (0.9%)

Group F (n = 50): received 4.0 ml (40 mg) 1% chloroprocaine + 0.4ml Fentanyl (20µg)

18G intravenous venous (IV) cannula inserted and pre-medicated with Inj. Ondansetron 0.08mg/kg iv 15 minutes prior to procedure. In the operation theater: Preloading was done with Inj. Ringer Lactate 10 ml/kg. Under strict aseptic and antiseptic precaution subarachnoid block was performed with study drug in left lateral position, using midline approach with 25G spinal needle in L3 – L4 intervertebral space. After the block, patient was turned supine. The time of injection was noted as time "0". The sensory block was assessed by skin sensation to pinprick with 23G needle. The motor block was assessed according to Modified Bromage Scale. After the completion of surgery: Patients were shifted to PACU where sensory and motor blockade were assessed till regression of blockade. Time of analgesia request were noted with 'Visual Analog Scale' (VAS) Inj. Diclofenac Sodium (1.5mg/kg) intravenous was given at VAS ≥ 4.

Statistical analysis

Sample size calculation done with alpha and beta error. Data will be presented as Mean ± Standard Deviation (SD) or numbers. Comparison between two groups will be done using Mann-Whitney test (for non-parametric data) or unpaired Student's t-test (for parametric data). p value < 0.05 is considered statistically significant.

Results

In Demographic data Patients characteristics in terms of age, gender, weight and height were comparable among both the groups. (p > 0.05). There is statistically significant difference in mean time for onset, peak and duration of sensory block in two groups (p < 0.001). There was earlier onset and peak of sensory block (Fig. 1) achieved in group C than in group F. Duration of sensory block (Fig. 2) was prolonged in group F. On comparison, between group C and group F, there is statistically significant difference in onset, peak and Duration of motor block (Fig. 3, Fig. 4) among two group, earlier in group C rather than group F. Addition of 20µg of Fentanyl to chloroprocaine (Group F) produced statistically significant prolonged duration of effective analgesia (Fig. 5) than chloroprocaine group. Mean time for Ambulation (Fig. 6) was comparable in both the groups. (p > 0.05) HR was comparable in both the groups. (p > 0.05) Mean Arterial Blood Pressure was comparable in both the groups at different time points (p > 0.05) 15 participants in group C, while 10 participants in group F developed hypotension. 2 participant developed bradycardia in group F. 2 participants in group C experienced nausea and vomiting, which was statistically not significant. 1 participant developed sheivering in group F and 3 participants developed pruritus and it does not required any treatment (Fig. 7).

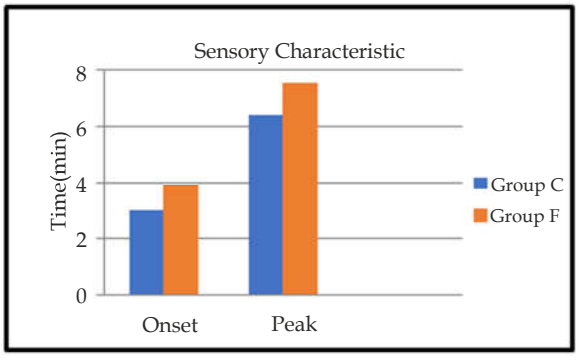

Fig. 1: Onset and Peak of Sensory Block Characteristic

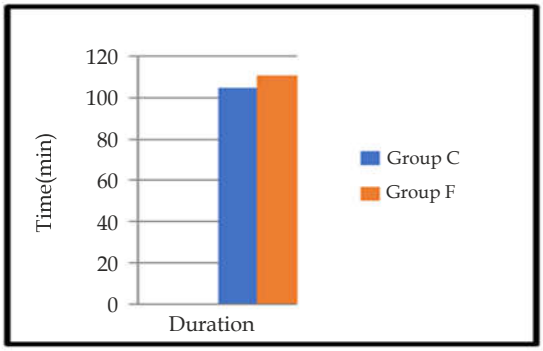

Fig. 2: Duration of sensory block

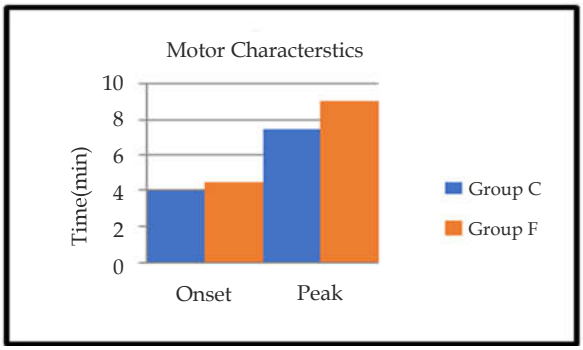

Fig. 3: Motor Characterstics

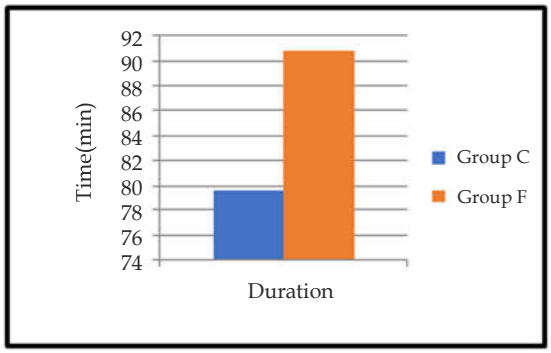

Fig. 4: Duration of motor block

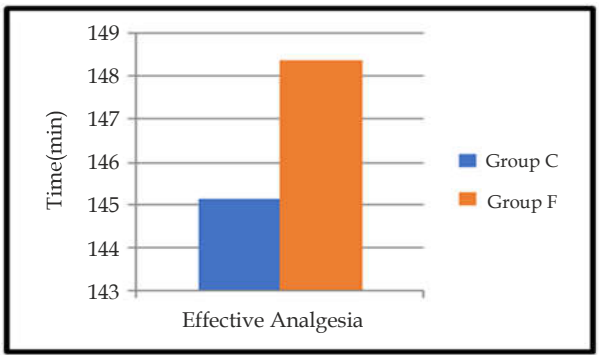

Fig. 5: Duration of Effective Analgesia

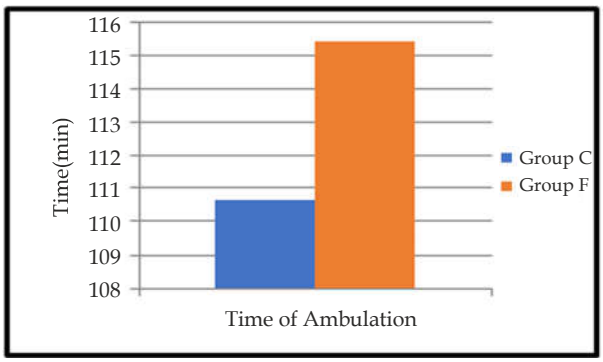

Fig. 6: Mean time for Ambulation

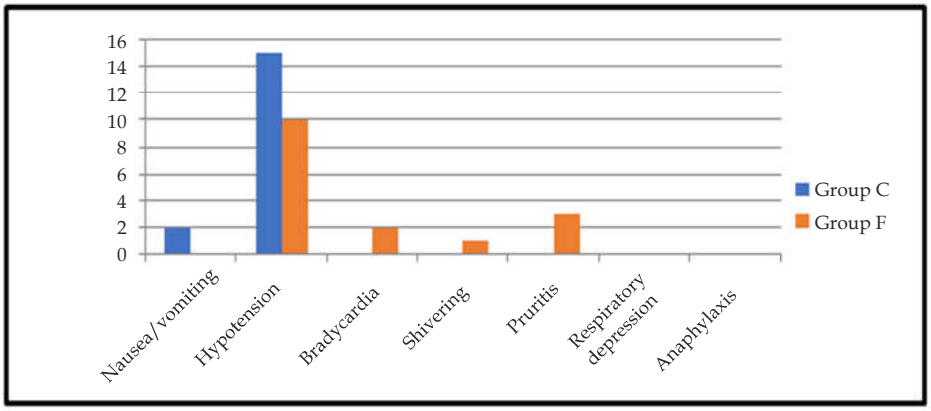

Fig. 7: Side-effects

Discussion

Chloroprocaine is an ideal agent which can be used as an ambulatory surgery.[1] The use of opioids As an adjuvant with local anaesthetics in subarachnoid block has been associated with improved blockade quality and reduced analgesic requirement in postoperative period.[1] In this study, result showed that there was early time of onset and peak of sensory blockade with Chloroprocaine group and there was prolong duration of sensory blockade with fentanyl group. Past studies showed that peak of sensory blockade with saline or fentanyl was contrast to our study and total duration of sensory blockade was comparable to our study.[1] In this study, the mean time of onset, peak and duration of motor blockade were statistically significant in both the groups. Past studies showed that Chloroprocaine with saline or fentanyl , duration of motor blockade was comparable to our study.[1,7] In this study, the duration of effective analgesia was comparable in both the group, prolong analgesia seen with fentanyl group. Past studies showed that Chloroprocaine with saline or fentanyl suggested that there was prolong effective analgesia seen with fentanyl group.[1] In this study, time of ambulation was comparable among both the groups. Past studies showed that when Lidocaine, Bupivacaine and Chloroprocaine compared, there was early ambulation with Chloroprocaine.[5] In this study, side-effects observed were nausea, vomiting, hypotension, bradycardia and shivering, were treated accordingly. Past studies showed that Chloroprocaine with saline or fentanyl suggested that there was only pruritus noted with fentanyl group.[1]

Conclusion

Addition of 20µg Fentanyl as an adjuvant with 1% isobaric Chloroprocaine, in subarachnoid block for lower limb ambulatory surgery, has prolongs sensory block without influencing motor blockade; improves postoperative analgesia with less requirement of rescue analgesic, with minimal side effects. It has no effect on time of ambulation, so it is recommended for day care surgery.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 743–749
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.14

An Observational Study To Compare The Efficacy of Oral and Intranasal Midazolam as Premedication in Children

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Abstract

Context: Preoperative period exposes to anxiety and stress to children and their parents resulting in emotional and psychological disturbances. To alleviate this midazolam has been found to be effective premedication. The purpose of this study is to compare the efficacy of oral versus nasal route and acceptance by children. *Aims:* To compare efficacy of oral and intranasal midazolam as premedication in children. *Settings and Design:* comparartive study, observational study in tertiary health care set up. *Methods and Material:* Fifty patients of age 2-5years of either gender of ASA I and II were assigned to two groups of 25 each undergoing elective surgeries of 1.5-2 hours under general anaesthesia. In Oral group - midazolam formulation 0.5 mg/kg (preservative free plus sweetener) and in intranasal group - midazolam nasal spray as 0.2 mg/kg with half the dose in each nostril was administered 30minutes prior to surgery and were assessed for acceptance of drug, level of sedation 30minutes after premedication, behaviour at time of separation from parents and behaviour during mask acceptance at the time of induction which was by a standard intravenous technique. Intraoperatively children were monitored for heart rate and SpO_2. *Statistical analysis used:* unpaired student t test and p value < 0.05 is significant, Statistical Package for the Social Sciences SPSS Statistics for Windows, Version 20.0 software (IBM, Bengaluru, India), Microsoft word and excel have been used to generate graphs and tables. Mean, median and standard deviation have also been used. *Results:* Two routes were statistically insignificant regarding acceptance of drug, sedation after 30min and behavior during parental separation, though oral was slightly better than nasal clinically. Mask acceptance of oral midazolam was better than nasal and significant. *Conclusions:* Both are safe with oral is better than nasal route for premedication in children due to significant mask acceptance.

Keywords: Intranasal spray, midazolam, oral syrup

How to cite this article:
Garima Gupta, Malini Mehta. An Observational Study to Compare The Efficacy of Oral and Intranasal Midazolam as Premedication in Children. Indian J Anesth Analg. 2020;7(3):743–749.

Introduction

The preoperative period can be a stressful time for children and their parent.[1] It has been found that preoperative anxiety of parental separation, overall environment of the hospital and fear of experiencing pain predisposes children to behavioural changes, eating disorder, enuresis, nightmares and sleep disturbances postoperatively.Midazolam is the most common premedication in children and is reportedly safe and effective both at separation and induction of anaesthesia.[2] In children, intravenous (IV) and (intramuscular) i.m. route causes anxiety, therefore, oral or intranasal administration of a sedative agent is preferred for premedication

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Received on 13.01.2020, **Accepted on** 29.02.2020

Formulas

This Calculator Uses the following Formulas to Compute Sample Size and Power,respectively

$$n_A = k n_B \text{ and } n_B = \left(\frac{p_A(1-P_A)}{k} + P_B(1-B^P)\right)\left(\frac{z_{1-\alpha/2} + z_{1-\beta}}{p_A - p_B}\right)^2$$

$$1-\beta = \Phi\left(z - z_{1-\alpha/2}\right) + \Phi\left(-z - z_{1-\alpha/2}\right), \quad z = \frac{pA - pB}{\sqrt{\frac{p_A(1-p_A)}{n_A} \quad \frac{p_B(1-p_B)}{n_B}}}$$

where

K=nA/nB is the Matching Ratio
Φ is the Standard Normal Distribution Function
Φ^{-1} is the Standard Normal quantile Function
a is Type I error
β is Type II error Meaning 1 - β is Power

Materials and Methods

After obtaining approval of the institutional ethical committee, fifty patients were enrolled who underwent elective surgeries under general anesthesia. Informed and written consent was taken from parents. The sample size was determined by above formula.

They were divided into 2 groups.

Group PO (Per oral) was given oral midazolam formulation (parenteral midazolam 5mg/ml preservative free plus sweetener) in the dose of 0.5 mg/kg.

Group IN (Intranasal) was given midazolam intranasal spray in the total dose of 0.2 mg/kg with half the dose administered in each nostril (through metered doses inhaler delivering 1.25mg per spray and containing total 16 metered doses).

Patients below 2 years and above 5 years, with ASA III or more, with known allergy, sensitivity or any other form of reaction to benzodiazepines, taking other sedatives,with upper respiratory tract infections and with nasal pathology, on anticonvulsant therapy, scheduled for neurosurgical procedures and with mental retardation were excluded from the study.

After detailed pre-anaesthetic check-up of all the children posted for planned surgery, they were kept nil by mouth for about 6 hours before surgery and clear fluids were permitted up to 3hrs prior to the procedure. The children were kept in a silent, undisturbed area along with the parent. Pulse rate and oxygen saturation were monitored and recorded.

The anesthesiologist administered the study drug to the child orally to 25 children and intranasaly to 25 children 30 minutes prior to surgery.

The Following parameters were assessed to find the efficacy of premedication

1. Acceptance of drug
2. Level of sedation 30minutes after premedication.
3. Behaviour at the time of separation from parents.
4. Behaviour during mask acceptance

Acceptance of the drug was assessed by using the compliance score by Parnis et al.[3]

1. Poor – Refuses to accept medicine
2. Moderate – accepts medicine with (persuasion) difficulty
3. Good – accepted medicine without complaint

Level of sedation was assessed at 30 minutes after the administration of study drug by four point sedation score by Filos et al.[4]

1. spontaneous eye opening (awake and alert)
2. Drowsy, responsive to verbal stimuli
3. Drowsy, arousable to physical stimuli
4. Unresponsive

The behaviour at the time of separation from parents was assessed when the child was separated from parents to shift to operating room using the separation score by Pandit et al.[5]

1. Excellent - happily separated
2. Good - separated without crying
3. Fair - separated with crying

4. Poor - need for restraint

After shifting to operation theatre, they were premedicated with inj. glycopyrrolate 0.004mg/kg IV and inj. ondansetron 0.1 mg/kg IV. Child was preoxygenated with face mask with 100% oxygen for 3 minutes.

Acceptance of face mask was graded on a four point score[6]

1. Poor – afraid, combative, crying
2. Fair – moderate fear of mask, not easily calmed
3. Good – slight fear of mask, easily calmed
4. Excellent – unafraid, cooperative, accepts mask easily

Anesthesia was induced by a standard technique of intravenous induction. Endotracheal intubation with appropriate endotracheal tube was done after giving inj. succinylcholine (2mg/kg) IV and was maintained on O_2, N_2O, sevoflurane and atracurium. Intraoperatively children were monitored for heart rate, SpO_2 every 15 minutes till end of surgery. At the end of surgery neuromuscular blockade was reversed with inj. Neostigmine (0.05mg/kg) and inj. Glycopyrolate (0.008mg/kg) IV. Extubated was done after fulfilling the recovery criteria and child was shifted to recovery room. Postoperatively they were watched upto 6 hours for any complication.

Data collected was analysed using unpaired student t test, p value < 0.05 is significant, Statistical Package for the Social Sciences SPSS Statistics for Windows, Version 20.0 software (IBM, Bengaluru, India). Microsoft word and excel have been used to generate graphs and tables. Mean, median and standard deviation have also been used.

Results

Demographically the distribution of patients with respect to gender, age, weight, height and ASA grading was comparable amongst both the groups. (p value > 0.05) (Table 1).

The overall difference between the groups was statistically insignificant. (p = 0.865) 3 children who spitted drug in oral route were not included in study (Table 6).

Table 1. Gender distribution between the groups

Gender	Oral	Nasal	Total
	Number of patients (%)	Number of patients (%)	
Male	17(68%)	15(60%)	32
Female	8(32%)	10(40%)	18
Total	25(100%)	25(100%)	50

Table 2. Age distribution between the groups

Group	Mean Age	Sd
Oral	3.92	1.28
Nasal	3.90	1.25

Table 3. Weight distribution between the groups

Group	Median Weight (kg)	Mean Weight	SD	p value
Oral	8.00	9.08	1.79	0.835
Nasal	9.00	8.25	2.12	

Table 4. Height distribution between the groups

Group	Mean Height (Cm)	SD	p value
Oral	109.89	6.98	0.985
Nasal	110.54	8.54	

Table 5. American Society of Anaesthesiologists (ASA) grade distribution between the groups

Group	ASA I	ASA II
Oral	17.00	19.00
Nasal	8.00	6.00
Total	25.00	25.00

Table 6. Compliance scores between the groupsTable 6

Score 1	Oral Group	Nasal Group	P value
	Number of patients (%)	Number of patients (%)	
Poor	0 (0%)	0(0%)	-
Moderate	18(72%)	19(76%)	0.869
Good	7(28%)	6(24%)	0.781
Total	25(100%)	25(100%)	0.865

Sixteen percent (16%) in nasal group as compared to only 8% in oral group were awake and alert, therefore oral group was clinically better although statistically not significant (p > 0.05) (Table 7).

Table 7. Level of sedation scores (four point sedation score by Filos et al) between the groups

Score 2	Oral Group	Nasal Group	p value
	Number of patients (%)	Number of patients (%)	
1 (awake & alert)	2(8%)	4(16%)	0.414
2 (respond to verbal stimuli)	3(12%)	3(12%)	1.0
3 (respond to physical stimuli)	17(68%)	16(64%)	0.862
4 (unresponsive)	3(12%)	2(8%)	0.655
Total	25(100%)	25(100%)	0.537

Table 8. Separation score between the groups

Score 3	Oral Group	Nasal Group	*p* value
	Number of patients (%)	Number of patients (%)	
1 (excellent)	6(24%)	3(12%)	0.317
2 (good)	14(56%)	13(52%)	0.847
3 (fair)	5(20%)	9(36%)	0.285
4 (poor)	0	0	-
Total	25(100%)	25(100%)	0.336

None of the patients were required to be restrained (score 4). The overall difference between the groups was statistically not significant (p =0.336) (Table 8).

Table 9. Behaviour during mask acceptance between the groups (Four Point Score)

Score 4	Group		*p* value
	Number of patients in Oral (%)	Number of patients in Nasal (%)	
1 (poor)	1(4%)	7(28%)	0.034
2 (fair)	5(20%)	9(36%)	0.285
3 (good)	17(68%)	9(36%)	0.117
4 (excellent)	2(8%)	1(4%)	0.564
Total	25(100%)	25(100%)	0.038

Good to excellent mask acceptance score was observed in 76% children in oral group as compared to only 40% in nasal group. The overall difference between the groups was statistically significant (p= 0.038) (Table 9).

Discussion

Children are at risk of various behavioural problems like nightmares, emotional stress due to hospitalization, while undergoing surgical operations and during anaesthesia induction[7] therefore, adequate premedication is required for successful management of anaesthesia in the children. An ideal premedication calms children down, decreases their fear, makes induction for anaesthesia smooth and even rapid recovery.

Midazolam which is a water soluble benzodiazepine has emerged as a widely used pre medication due its fast onset of action and short elimination half life.[8] Some studies suggest effective route for premedication with midazolam to be intramuscular (Taylor et al., 1986), rectal (Maurice et al., 1986), intranasal (Hartgraves and Primosch 1994) and oral (Cox et al., 2006). Kogan et al. (2002) and Yildririum et al. (2006)[9] found no difference between oral and intranasal route. Hence, we have used oral and intransal route in this study.

We have selected pediatric patients of age group 2-5 years because they face maximum risk of separation anxiety as they are not able to understand things around them.[7]

Mac Milan et al. also studied the efficacy of different doses of oral midazolam on 80 children of age 1-6 years and concluded that 0.5mg/kg dose is safe and effective with no additional benefits provided by 0.75mg/kg and 1mg/kg, in fact they may cause more side effects like loss of balance, head control, blurred visions and dysphoric reactions.[10]

Hence, in our study we have used oral midazolam in the dose of 0.5mg/kg given with a sweetener as the drug is bitter in taste. Maximum 5ml was given as it is less than residual gastric volume limit.[8]

Davis PJ et al.[11] (1995) conducted a study on 88 children of 10-36 months and found that both the doses of 0.2 mg/kg and 0.3mg/kg of intranasal midazolam are similar in sedation, parental separation and induction. Pradipta Bhakta et al.[12] (2007) found that 0.2mg/kg of intranasal midazolam produce effective sedation and no added advantage is provided by 0.3mg/kg.

Hence we have selected 0.2mg/kg dose of intranasal midazolam spray in our study.

In our study we found that the compliance score (drug acceptability) was similar for both the groups (p value 0.865). R K Verma et al.[13] (2012) and Raval and Gunga[14] (2014) also found drug acceptance in oral route to be comparable with nasal ($p > 0.05$).

Nainegali et al.[15] (2016) found drug acceptance to be significantly better in oral group 90.9% than nasal 12.1% ($p < 0.001$) and Devulapalli et al.[16] (2015) concluded that acceptability of drug was much better in oral route compared to nasal route (92% Versus 60%) ($p = 0.021$).

Better acceptability of oral route could be due to the ease of administration and palatability of midazolam syrup as it is cumbersome to educate the child regarding a deep breath and sniffing position when sprayed in nose and also due to nasopharyngeal irritation.

Nasopharyngeal irritation was seen in 8% patients in the form of sneezing in our study. Deshmukh et al.[17] (2006) found 40%, Bhakta P et al.[12] (2007) observed 45%, Ramesh Koppal et al.[18] (2011) found 10% and R Abhishek et al.[19] (2015) found 10% patients having nasal irritation in the form of rubbing, sneezing, watering and lacrimation with no redness or ulcer. having nasal irritation. Raval and Gunga[14] (2014) also reported 20% patients with nasal irritation and sneezing in nasal group and

attribute it to acidic preparation of midazolam (pH = 3.34). 3 patients spitted the drug out and were not included in the study.

Kamar et al.[9] (2014) and Jayshree and Milin[8] (2017) observed excellent sedation at 30 minutes after premedication with midazolam. Therefore we have also compared sedation score at 30 minutes after its administration.

Our study showed that sedation score was comparable amongst the two groups (p = 0.537). Only 8% were awake and alert in oral as compared to 16% in nasal, making oral midazolam syrup better sedative agent clinically than nasal spray in the present study.

A study by Lee-kim et al. (2004) demonstrated that there is no statistical difference between the oral and intra nasal midazolam group for overall behaviour however intra nasal subjects showed more movements and decreased sleep, therefore less sedation.[9] Sunny Alex et al.[20] (2008), Verma RK et al.[13] (2012) found 53.33% in nasal versus 43.3% in oral, R Abhishek et al[19] (2015) and P V Deshmukh et al.[17] in 2016 also reported sedation score to be similar between the two groups at 30 min. Devulapalli et al.[16] (2015) evaluated both the groups for sedation and found mean sedation score (Wilson grading) higher in oral than nasal but statistically not significant.

Ramesh Koppal et al.[18] (2011) observed sedation was better through trans nasal route at 30 min with p = 0.003 which could be due to the higher dose of 0.5mg/kg intranasaly. Raval and Gunga[14] (2014) evaluated oral and trans nasal midazolam and concluded that sedation was higher in trans nasal group. Nainegali et al.[15] (2016) reported sedation better through trans nasal route (p <0.001) at 20 minutes which may have been due to the higher dose (0.4 mg/kg) and with the use of an atomizer for delivering the drug. Mehdi et al.[21] (2019) also reported sedation score to be significantly higher in intranasal group as compared to oral they confer this to high bioavailability (55-83%) and better and rapid absorption through nasal mucosa (p < 0.001).

Drug gets absorbed nasally better due to high vascularity of nasal mucosa as compared orally due to low bioavailability.[7] This rapid absorption avoids the high first-pass metabolism of midazolam. But there can be problem with volume retention in nasal cavity and effective dose availability which is removed by using concentrated nasal spray[22].

Since midazolam is a benzodiapene, it binds to $GABA_A$ receptor triggering chloride channel and hyperpolarization of cells thus causing resistance to excitation of neuron, hence producing sedation.

In the present study *parental separation* score was good to excellent 80% of children in oral group as compared to 64% in nasal group. The overall difference was statistically insignificant. (p = 0.336)

Sunny Alex et al.[20] (2008), Raval and Gunga[14] (2014), Devulapalli et al.[16] (2015) and P V Deshmukh et al.[17] found separation from parents at 30min to be comparable between the two groups (p>0.05). Ramesh Koppal et al.[18] (2011) found equally effective parental separation by both the routes (weakly significant p value of 0.03). R Abhishek et al.[19] (2015) found satisfactory parental separation score in nasal group more than oral group (86% versus 83%) (p = 0.616). Nainegali et al.[15] (2016) also reported good parental separation in nasal group (93.9%) but statistically insignificant.

Kamar et al.[9] found parental separation statistically significantly better in oral group as compared to nasal group (p = 0.046).

In the operation theatre the acceptance of mask (four point score) was good to excellent in 76% patients in oral group as compared to only 40% in nasal group. The overall difference was statistically significant (p value = 0.038).

Mehdi et al.[21] (2019) also found ease of induction higher in oral group in contrast to nasal group (p < 0.001).

Sunny Alex et al.[20] (2008), Devulapalli et al.[16] (2015) and R Abhishek et al.[19] (2015) found the mask acceptance to be similar between two groups (p value > 0.05). R K Verma et al.[13] (2012) reported ease of induction score higher in nasal group compared to oral group (80% vs 43.3%) (p < 0.05). PV Deshmukh et al.[17] (2016) found 87% patients in intranasal group with satisfactory mask acceptance as compared to 77% in oral group (p > 0.05).

Lower scores in nasal route could be due to difficulty in positioning while spraying in nostrils and also due to hydrophilic vehicle and acidic pH as better absorption may occur with more concentration of midazolam in a lipophilic vehicle and non-acidic neutral pH.[13]

In most studies, the undiluted, commercially available parenteral fluid containing 5 mg/ml midazolam has been used intranasaly which has accounted for lacrimation, burning and general discomfort but this is not the case with intranasal midazolam spray, which we have used in this study.

Heart rate and SpO_2 were comparable between

the groups at any time intervals during the entire study period. No complications like nausea, vomiting, bradycardia and respiratory depression were recorded during the study in any patients as also observed in the studies compared.

Oral route is better to nasal route for premedication with midazolam in children between ages of 2-5 years as it produces satisfactory ease of induction by successful mask acceptance.

Limitations of our study included small sample size, drug administration facilitated by parent and not able to monitor the onset of sedation which could have some effect on efficacy.

Conclusion

From the present study it is concluded that oral midazolam formulation (0.5mg/kg) and commercially available intranasal spray (0.2mg/kg) are relatively safe as premedication in the pediatric age group of 2-5 years. Oral midazolam is clinically better in terms of drug acceptance, sedation and parental separations but statistically not significant and mask acceptance is statistically significantly better with oral midazolam thereby, making oral midazolam formulation more effective premedication than intranasal spray.

Financial support: Nil

Conflicts of interest: Nil

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 750–756
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.15

Comparison of Hemodynamic Response to Laryngoscopy and Tracheal Intubation in Hypertensive Patients Using Macintosh, McCOY and Truview Video Laryngoscope: A Clinical Study

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Abstract

Background: Laryngoscopy and intubation produce an exaggerated and unpredictable stress response in hypertensive patients which may lead to the development of life-threatening complications such as pulmonary edema, cerebrovascular hemorrhage and myocardial infarction. It is possible to reduce these harmful and undesirable hemodynamic responses to intubation by using different intubation techniques. The objective of this study was to compare the hemodynamic response to laryngoscopy and endotracheal intubation in hypertensive patients aged 40 years to 60 years using Macintosh, McCoy and Tru View Video laryngoscopes. *Materials and Methods:* We studied the hemodynamic response to laryngoscopy and intubation in 90 hypertensive patients posted for elective surgeries requiring general anesthesia, with ASA grading 2 or 3 aged between 40 and 60 years and Mallampati grade 1 and 2 using Macintosh, McCoy and Truview video laryngoscope. The changes in heart rate, systolic and diastolic blood pressure were observed in the post intubation period, every minute for the first 10 minutes. *Results:* Patients intubated using Macintosh or McCoy laryngoscope showed significantly greater ($p < 0.05$) rise in heart rate, systolic and diastolic blood pressure during first ten minutes in post-intubation period as compared to patients intubated using TruView video laryngoscope. Changes in SpO_2 were statistically insignificant and ECG remained within normal limits. Although time taken to intubate was longer with TruviewVideoaryngoscope. *Conclusions:* We conclude that Truview Video laryngoscope provides a better laryngeal view while producing the least hemodynamic response during laryngoscopy and intubation in hypertensive patients as compared to McCoy and Macintosh blades

Keywords: Hemodynamic response in hypertensive patient, Laryngoscopy and intubation, Macintosh, McCoy, Truview videolaryngoscope.

How to cite this article:

Madhurima Singh, Vikas Gupta, Aditya Agarwal. Comparison of Hemodynamic Response to Laryngoscopy and Tracheal Intubation in Hypertensive Patients Using Macintosh, McCOY and Truview Video Laryngoscope: A Clinical Study. Indian J Anesth Analg. 2020;7(3):750–756.

Introduction

Laryngoscopy is the most frequently performed procedure in anaesthesiology to help visualize vocal cords and glottis for endotracheal intubation during general anesthesia and cardio pulmonary resuscitation. Laryngoscopy induces profound stress response[1,2,3] due to sympathetic stimulation and increase in catecholamine concentration[1,4-6] manifesting as tachycardia, hypertension and dysrhythmias.

However, in hypertensive patients, these changes are more pronounced and unpredictable and may further lead to development of life-threatening complications like pulmonary edema, cerebrovascular hemorrhage and myocardial infarction.

Many studies have been conducted in the past comparing stress response and ease of endotracheal intubation in patients with difficult airway using various laryngoscopes. But there is less data

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Received on 29.01.2020, **Accepted on** 29.02.2020

available comparing the hemodynamic changes seen in hypertensive patients during laryngoscopy and intubation.

Materials and Methods

After obtaining Institutional Ethical Committee approval and written informed consents, 90 hypertensive patients of either sex undergoing elective surgeries under general anesthesia requiring endotracheal intubation were allocated to one of the three groups of 30 patients each. All the patients were explained in their colloquial language about the procedure.

Inclusion criteria: Age 40 yrs - 60 yrs**,** ASA grades 2 and 3**,** Mallampati grades 1 and 2, Hypertensive patients.

Exclusion criteria: Age < 20 yrs and > 60 yrs, ASA grades 4 and more, Mallamapti grades 3 and 4.

Sample Size:

Group M: Patients intubated with Macintosh laryngoscope (n-30).

Group C: Patients intubated with McCoy laryngoscope (n-30).

Group T: Patients intubated with TruView video laryngoscope (n-30).

Procedure Planned

After a detailed preanesthetic checkup, a written informed consent was obtained from patient.

All the patients received their anti-hypertensive medications on the morning of surgery with sip of water.

In the operation theatre, intravenous line, pulse oximeter, electrocardiograph and a non invasive blood pressure monitor were attached. The baseline values of aforementioned hemodynamic parameters were recorded following a stabilization period of 3-5 minutes.

Patients were premedicated with Inj. Ondansetron 0.08mg/kg, Inj. Glycopyrrolate 0.01mg/kg, Inj. Midazolam 0.05mg/kg, Inj. Fentanyl 2 microgram/ kg. Preoxygenation with 100% oxygen was done for 3 minutes. Pre Induction HR, SBP and DBP, SpO_2 and ECG were noted.

Anesthesia was induced with Inj. Propofol 2mg/ kg. Inj Succinylcholine 1.5 mg/kg was used for facilitation of induction and muscle relaxation.

Post Induction HR, SBP and DBP, SpO_2 and ECG were noted.

1. Patients in group M were intubated in "Sniffing Position".
2. Patients in Groups T and C Were Intubated in "Neutral Position".

Post-intubation HR, SBP and DBP, SpO_2 and ECG were noted every minute, till 10 minutes after intubation.

Patients were given 50% O_2 with 50% N_2O and 0.6–1.0% Isoflurane for maintenance of anesthesia.I/v Inj. Atracurium 0.5mg/kg loading dose was followed by 0.1mg/kg every 20 minutes to maintain muscle relaxation.

After the completion of surgery, neuromuscular blockade was reversed with Inj. Neostigmine 0.05 mg/kg and Inj.Glycopyrrolate 0.01 mg/kg, given intravenously.

Broken teeth, soft tissue edema, bleeding from gums or lips, stridor or hoarseness, sore throat and any other complications were noted.

Data Collection Methods: Data was collected by an independent person and entered in the patient proforma and finally entered in the master chart. Data was presented as mean with standard deviation.One way ANOVA test was used as the statistical tool to test for the significance of observed mean differences.

Results

The demographic profile of patients in the three groups was comparable. There were no significant differences for gender ratio, age, weight, baseline heart rate, systolic, diastolic and mean blood pressure. ASA grading and Mallampati scores were also similar in all the three groups (Table 1).

The baseline values of heart rate were comparable in all the three groups.There were no statistically significant differences in heart rate at pre-induction and post-induction periods amongst the three groups. Group M had the greatest rise in heart rate after intubation and difference in heart rate was statisticallyhighly significant ($p < 0.01$) as compared with the other two groups (i.e. Group C and Group T) during first seven minutes after intubation. At 8 and 9 minutes postintubation, the differences were statistically significant ($p < 0.05$).Thereafter, the heart rates in the three groups were comparable (Table 2).

The baseline values of mean systolic blood pressure were comparable in all the three groups. There were no statistically significant differences in mean SBP at pre-induction and post-induction periods amongst the three groups. Group M had the greatest rise in mean SBP after intubation and difference in mean SBP was statistically highly

Table 1: Mean Heart Rate Per Minute At Various Time Intervals (Beats/Minute)

Time interval	Heart Rate (Beats/Minute)						*p* value
	Group M		Group C		Group T		
	Mean	SD	Mean	SD	Mean	SD	
Baseline	79.67	7.32	78.23	5.87	78.43	5.68	0.6358 (NS)
Preinduction	81.47	7.40	80.37	6.15	80.43	6.01	0.7659 (NS)
Postinduction	84.3	7.28	82.37	6.30	83.07	5.84	0.5105 (NS)
Postintubation	106.87	5.92	94.33	6.42	90.57	6.20	<0.01 (HS)
1 Min	104.83	5.60	91.20	5.65	88.37	5.77	<0.01 (HS)
2 Min	100.67	4.85	89.07	5.09	86.57	5.45	<0.01 (HS)
3 Min	96.87	5.00	86.23	4.58	83.67	5.01	<0.01 (HS)
4 Min	92.97	4.35	83.87	4.26	79.63	4.64	<0.01 (HS)
5 Min	88.73	4.57	81.77	4.22	79.30	4.09	<0.01 (HS)
6 Min	85.07	5.56	80.10	4.30	78.73	3.91	<0.01 (HS)
7 Min	82.63	6.21	79.53	4.63	77.40	3.96	<0.01 (HS)
8 Min	80.93	6.54	78.73	4.93	77.13	3.84	0.0217 (S)
9 Min	79.47	6.79	77.73	5.20	76.27	4.08	0.0821 (S)
10 Min	78.57	6.64	76.37	5.33	75.83	4.17	0.1275 (NS)

significant ($p < 0.01$) as compared with the other two groups (i.e. Group C and Group T) during first nine minutes after intubation. Thereafter, the mean SBP in the three groups were comparable (Table 3).

The baseline values of mean diastolic blood pressure were comparable in all the three groups. There were no statistically significant differences in mean DBP at pre-induction and post-induction periods amongst the three groups. Group M had the greatest rise in mean DBP after intubation and difference in mean DBP was statistically highly significant ($p < 0.01$) as compared with the other

Table 2: Systolic Blood Pressure At Various Time Intervals (mmHg)

Time interval	Systolic Blood Pressure (mmHg)						*p* value
	Group M		Group C		Group T		
	Mean	SD	Mean	SD	Mean	SD	
Baseline	135.67	6.93	134.73	6.51	135.17	6.30	0.8583 (NS)
Preinduction	130.70	6.61	129.77	6.59	130.73	6.37	0.8110 (NS)
Postinduction	124.43	6.63	125.13	6.50	125.53	6.30	0.8016 (NS)
Postintubation	155.80	6.80	147.63	6.77	140.77	6.72	<0.01 (HS)
1 Min	152.93	6.69	145.17	6.94	137.77	6.40	<0.01 (HS)
2 Min	149.53	6.57	142.93	6.66	135.60	6.12	<0.01 (HS)
3 Min	145.70	6.69	139.37	6.10	134.27	5.67	<0.01 (HS)
4 Min	142.80	6.76	137.73	6.10	132.27	5.45	<0.01 (HS)
5 Min	140.73	6.75	135.77	5.59	131.40	5.01	<0.01 (HS)
6 Min	139.20	7.10	134.87	5.49	130.40	4.64	<0.01 (HS)
7 Min	137.40	6.96	133.83	5.56	130.10	4.40	<0.01 (HS)
8 Min	136.47	6.64	133.63	5.63	129.70	4.15	<0.01 (HS)
9 Min	134.27	6.10	133.17	5.50	129.13	4.22	<0.01 (HS)
10 Min	131.43	5.82	131.07	5.58	129.27	4.53	0.2498 (NS)

Table 3. Diastolic Blood Pressure At Various Time Intervals (mmHg)

Time interval	Diastolic Blood Pressure (mmHg)						P value
	Group M		Group C		Group T		
	Mean	SD	Mean	SD	Mean	SD	
Baseline	90.23	4.50	89.60	4.31	89.83	4.62	0.8592 (NS)
Preinduction	88.40	4.08	88.03	3.96	88.93	4.44	0.7029 (NS)
Postinduction	84.93	4.02	84.57	3.98	85.20	4.36	0.8387 (NS)
Postintubation	107.37	4.77	99.90	4.38	94.77	4.16	<0.01 (HS)
1 Min	104.70	4.74	96.87	4.45	91.73	4.40	<0.01 (HS)
2 Min	101.70	4.43	93.83	4.33	89.87	4.10	<0.01 (HS)
3 Min	98.50	4.29	92.37	3.90	89.23	4.01	<0.01 (HS)
4 Min	94.50	4.04	91.87	3.83	88.07	4.05	<0.01 (HS)
5 Min	89.70	4.19	86.73	3.85	84.17	4.21	<0.01 (HS)
6 Min	84.87	4.30	82.63	3.85	80.80	4.04	<0.01 (HS)
7 Min	81.73	4.14	79.73	3.62	78.77	3.80	0.0126 (S)
8 Min	79.87	4.07	78.37	3.48	77.37	3.62	0.0374 (S)
9 Min	78.67	3.55	77.57	3.34	76.33	3.20	0.0306 (S)
10 Min	77.47	3.07	76.77	3.13	75.73	3.07	0.0959 (NS)

two groups (i.e. Group C and Group T) during first six minutes after intubation. During seven to nine minutes post intubation, the differences were statistically significant ($p < 0.05$). Thereafter, the mean DBP in the three groups had no statistically significant differences and were comparable (Table 4).

Discussion

There are several studies focusing on the use of pharmacological agents for blunting the stress response to laryngoscopy and intubation. However, there is only little information regarding the influence of different types of laryngoscope blade on hemodynamic stress response.

McCoy blade has an advantage over Macintosh blade as it has a flexitip, a lever at its proximal end, a spring loaded drum and a connecting shaft. The flexitip controlled by the lever allows for lifting of epiglottis while decreasing the overall movement and force required for performing laryngoscopy and hence, may alter the associated hemodynamic response.

Video laryngoscopes were developed recently with the aim of improving the view of larynx. They have high resolution micro- cameras and small portable screen. They give a view of laryngeal inlet without the need to align the oral, pharyngeal and tracheal axis. Considering the wide variety of video laryngoscopes currently available, we have used Truview video laryngoscope in our study. It is a newly introduced device with an exaggerated curvature and viewing lens. It gives an indirect view of the glottis with a 46 degree anterior refraction.

Table 4. Complications

Complications	Group M		Group C		Group T	
	N	%	N	%	N	%
Soft Tissue Injury	3	10	3	10	3	10
Teeth Injury	1	3.33	1	3.33	0	0
Sore Throat	1	3.33	0	0	0	0
Hoarseness Of Voice	2	6.66	1	3.33	0	0

The observations of this study were compared with other similar studies under the following headings.

Changes In Heart Rate

The mean baseline heart rate in group M was 79.67 ± 7.32 beats per minute, 78.23 ± 5.87 beats per minute in group C and 78.43 ± 5.68 beats per minute in group T. The differences in these values were statistically insignificant.

Similarly, in pre induction period the mean heart rate in group M was 81.47 ± 7.40 beats per minute, 80.37 ± 6.15 beats per minute in group C and 80.43 ± 6.01 beats per minute in group T. The differences in these values were statistically insignificant.

In the postinduction period,the mean heart rate in group M was 84.30 ± 7.28 beats per minute, 82.37 ± 6.30 beats per minute in group C and 83.07 ± 5.84 beats per minute in group T. These values were comparable and statistically insignificant.

However, immediately after intubation, mean heart rate (beats/minute) in Group M rose to 106.87 ± 5.92, in group C to 94.33 ± 6.42 and in group T to

90.57 ± 6.20. The difference in the rise in heart rate was statistically highly significant ($p < 0.01$).

These differences in mean heart rate remained highly significant for the first seven minutes in the post intubation period.

At eight minutes in post intubation period the mean heart rate dropped down to 80.93 ± 6.54 in group M, 78.73 ± 4.93 in group C and 77.13 ± 3.84 in group T. The differences were statistically significant ($p < 0.05$).

At nine minutes in post intubation period the mean heart rate further dropped down to 79.47 ± 6.79 in group M, 77.73 ± 5.20 in group C and 76.27 ± 4.08 in group T. The differences were statistically significant ($p < 0.05$).

Thereafter, the values dropped down to near baseline by the end of ten minutes and the differences in mean heart rate were statistically insignificant.

Our findings were similar to the studies conducted by McCoy EP et al., Nishiyama T et al., Joseph J et al., Mehtab et al.

McCoy et al.[8] noted that there was an increase in heart rate and arterial pressure during first five minutes after laryngoscopy while using Macintosh blade. There were no significant changes in hemodynamic parameters with McCoy blade.

Nishiyama T et al.[9] conducted a study using Macintosh, McCoy and Miller blades to compare the hemodynamic response produced by them and noted that McCoy laryngoscope blade produced the least stress response followed by Macintosh and maximum stress response by Miller blade.

Joseph J et al.[10] compared McCoy and TruView EVO_2 video laryngoscope in 60 patients with cervical spine immobilization and found that TruView video laryngoscope produced comparatively less hemodynamic response.

Mehtab et al.[11] compared Macintosh and McCoy laryngoscope blades and found that the hemodynamic changes produced were less in magnitude and transient with the use of McCoy blade as compared to Macintosh blade.

On the contrary, Roman J et al.[12] did not find any significant differences in hemodynamic parameters with either Macintosh or McCoy blades at any time during the study.

Similarly, Shimoda O et al.[13] did not find any difference in hemodynamic response with Macintosh or McCoy blades.

Nishant et al.[14] compared Macintosh, McCoy and Truview video laryngoscope and did not find any significant differences in the change in heart rate produced by them.

Kanchi M et al.[15] compared hemodynamic response to laryngoscopy and intubation in patients with coronary artery disease undergoing CABG surgery using direct and video laryngoscope and concluded that there were no significant differences in the stress response produced amongst the two groups.

Timanaykar RT et al.[16] conducted a study comparing Truview blade with Macintosh blade for laryngoscopy and intubation and observed that the hemodynamic response produced was comparable among the two groups.

Changes In Mean Systolic Blood Pressure

The mean baseline systolic blood pressure in group M was 135.67 ± 6.93 mmHg, 134.73 ± 6.51 mmHg in group C and 135.17 ± 6.30 mmHg in group T. The differences in these values were statistically insignificant.

In the pre induction period, the mean systolic blood pressure in group M was 130.70 ± 6.61 mmHg, 129.77 ± 6.59 mmHg in group C and 130.73 ± 6.37 mmHg in group T. The differences in these values were statistically insignificant.

In the post induction period, the mean systolic blood pressure in group M was 124.43 ± 6.63 mmHg, 125.13 ± 6.50 mmHg in group C and 125.53 ± 6.30 mmHg in group T. The differences in mean systolic blood pressure values were statistically insignificant.

Immediately after intubation, the mean systolic blood pressure in Group M rose to 155.80 ± 6.80 mmHg, in group C to 147.63 ± 6.77 mmHg and in group T to 140.77 ± 6.72 mmHg. The difference in the rise in mean systolic blood pressure was statistically highly significant ($p < 0.01$).

These differences in mean systolic blood pressure remained highly significant for the first nine minutes in the post intubation period.

The values dropped down to near baseline by the end of ten minutes and the differences in mean systolic blood pressure were statistically insignificant.

Shribman AJ et al.[7] concluded that there is a significant increase in arterial pressure and circulating catecholamine concentration after performing laryngoscopy with or without

intubation.

McCoy EP et al.[8], Nishiyama et al.[9], Joseph et al.[9], Mehtab et al.[11] also observed similar outcomes in their studies.

In contrast, Roman J et al.[12] and Shimoda O et al.[13] (both of whom compared Macintosh and McCoy blades), Nishant et al.[14] (compared Macintosh, McCoy and Truview video laryngoscope), Kanchi M et al.[15] and Timanaykar RT et al.[16] did not find any significant differences in hemodynamic response.

Changes In Mean Diastolic Blood Pressure

The mean baseline diastolic blood pressure in group M was 90.23 ± 4.50 mmHg, 89.60 ± 4.31 mmHg in group C and 89.83 ± 4.62 mmHg in group T. The differences in these values were statistically insignificant.

In the pre induction period, the mean diastolic blood pressure in group M was 88.40 ± 4.08 mmHg, 88.03 ± 3.96 mmHg in group C and 88.93 ± 4.44 mmHg in group T. The differences in these values were statistically insignificant.

In post induction period, the mean diastolic blood pressure in group M was 84.93 ± 4.02 mmHg, 84.57 ± 3.98 mmHg in group C and 85.20 ± 4.36 mmHg in group T. the differences in these values were statistically insignificant.

The mean diastolic blood pressure in Group M in immediate post intubation period rose to 107.37 ± 4.77 mmHg, in group C to 99.90 ± 4.38 mmHg and in group T to 94.77 ± 4.16 mmHg. The difference in the rise in mean diastolic blood pressure was statistically highly significant ($p < 0.01$).

These differences in mean diastolic blood pressure remained highly significant for the first six minutes in the post intubation period.

At seven to nine minutes post intubation the mean diastolic blood pressure dropped down and the differences in the values between the groups remained statistically significant ($p < 0.05$).

The values dropped down to near baseline by the end of ten minutes and the differences in mean diastolic blood pressure were statistically insignificant.

Our findings were similar to the studies conducted by Shribman et al.[7], McCoy EP et al.[8], Nishiyama T et al.[9], Joseph J et al.[10], Mehtab et al.[11].

On the contrary, Roman J et al.[12], Shimoda O et al.[13], Nishant et al.[14], Kanchi M et al.[15] and Timanaykar RT et al.[16] did not find any significant differences in hemodynamic response to laryngoscopy and intubation with the three blades.

One of the reasons for this difference in hemodynamic response to laryngoscopy and intubation may be that, all the above studies were conducted in normotensive patients while our study is done in hypertensive patients.

Also, the degree of muscle relaxation during laryngoscopy and intubation has some effect on the hemodynamic stress response. None of the studies conducted have measured the degree of muscle relaxation in the patient.

The differences in anti-hypertensive medications taken by the patients may also be one of the reasons resulting in differences in the observations in various studies.

The expertise of the anesthesiologist performing laryngoscopy and intubation and the time taken may be other factors leading to varied hemodynamic response in different studies.

Complications

No statistical differences were found in the complications like soft tissue injury, teeth injury, sore throat, and hoarseness of voice.

One of the limitations of our study was that we did not use all the three blades in the same patient. Further, we did not blind the anesthesiologist performing the intubation for data collection as it was difficult, hence observer bias may exist.

Another limitation of our study was that we also did not measure the degree of muscle relaxation at the time of tracheal intubation which may affect the hemodynamic response produced.

Conclusion

Truview video laryngoscope offers a better laryngeal view for intubation while producing least hemodynamic response to laryngoscopy and intubation in hypertensive patients as compared to Macintosh and McCoy laryngoscope blades.

Complications like soft tissue injury, teeth injury, sore throat and hoarseness of voice were similar with video laryngoscope, McCoy and Macintosh blades.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 757–763
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.16

Efficacy of Intramuscular Ephedrine in Reducing the Incidence of Hypotension After Spinal Anaesthesia

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Abstract

Context: Spinal anaesthesia remains one of the basic and important technique in the modern period, but associated with adverse effects like hypotension, bradycardia, post-spinal headache. Several options have been tried to prevent spinal induced hypotension but the problem continues. Therefore this study was conducted to see the efficacy of prophylactic intramuscular ephedrine in reducing the incidence of spinal induced hypotension. *Aims:* To observe the outcome of prophylactic IM ephedrine on intraoperative hemodynamic changes after spinal anaesthesia and also to see the incidence of hypotension after spinal anaesthesia *Settings and Design:* Prospective Randomised Controlled study *Methods and Material:* Study was conducted on 108 patients posted for elective lower abdominal and lower limb surgeries under spinal anaesthesia. Group A received intramuscular ephedrine 30mg (1ml), group B received intramuscular normal saline (1ml) as placebo 10 minutes before spinal anesthesia. Patients were monitored for intraoperative hemodynamics, to see the incidence of hypotension and also to see any adverse side effects during intraoperative period. *Statistical analysis used:* To find the significance on continuous scale between two groups, Student t test was used. Leven`s test used to find the homogeneity of variance. Chi-square/Fisher Exact test: used for significance of categorical scale study parameters between the groups, Fisher exact test is applied when samples are very small. *Results:* Incidence of hypotension was more in group B and proven to be statistically significant when compared to ephedrine group from 2 – 20 minutes. The numbers of patients receiving the rescue vasopressor therapy was higher among in group B. There was no side effects observed in both the groups. *Conclusions:* Intramuscular ephedrine when given prophylactically 30mg, 10 minutes before spinal anaesthesia provides better haemodynamic stability during intraoperative period without any side effects.

Keywords: Ephedrine,Hypotension, Intramuscular, Spinal Anaesthesia

How to cite this article:

Nagaraj Sharanabasappa Kalla, Ravi Madhusudhana. Efficacy of Intramuscular Ephedrine in Reducing the Incidence of Hypotension After Spinal Anaesthesia. Indian J Anesth Analg. 2020;7(3):757–763.

Introduction

Spinal anaesthesia is one of the basic and important technique since it came into the daily practice. It is widely practiced regional anaesthesia technique for many lower abdominal and lower limb surgeries [1]. But also associated with significant adverse effects like hypotension, bradycardia, post-spinal headache. Despite of its fast revival, prevention of post spinal hypotension still continues to be a

Major problem faced by Anaesthesiologists. Fall in Systolic Blood pressure by 30% from the baseline record is considered as hypotension.

Many methods came into existence to counter the spinal induced hypotension like preloading

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Received on 20.02.2020, **Accepted on** 16.03.2020

with colloid/crystalloids, leg elevation with compression bandages, stockings or inflatable boots, premedication with IV Atropine 0.6mg, IM Glycopyrolate, Ondansetron, Vasopressors[2,3,4,5,67].

For treating the hypotension after spinal anaesthesia, vasopressors are the choice. Effect of vasopressor should reduce the rise in level of sympathetic blockade, which is difficult to obtain because the alpha and beta adrenergic activities may act independently during blockade.

The Vasopressors used commonly (phenylephrine, ephedrine) have systemic effects and may have effects on organs, vascular system or fetus. One of the vasopressor is Ephedrine, which is commonly used drug in the treatment of hypotension following spinal anaesthesia. Its mechanism involves stimulating both alpha and beta adrenergic receptors and releases norepinephrine from sympathetic neurons.

It has slow onset and long duration of action than phenylephrine. It does not cause uterine vasoconstriction further preserving utero-placental blood flow while maintaining maternal blood pressure.

By increasing cardiac output and heart rate due to its action on beta-1 adreno receptor, it maintains arterial pressures and having less chance of utero-placental insufficiency even if we plan to go for general anaesthesia in case failure of spinal blockade.

Reactive increase in HR, BP in underweight patients and inadequate control of hypotension in overweight patients are some observation. IM dose less than 25 mg is ineffective to prevent decrease in BP and 50 mg is associated with increased incidence of reactive rise in BP and fetal acidosis are some of the observations made by several studies[8].

When compared mephentermine, ephedrine and phenylephrine are equally effective in preventing hypotension from SAB. Requirement of less maintenance dose with ephedrine is observed[9].

In comparison, the use of phenylephrine was associated with better fetal acid-base status, but the risk of maternal bradycardia (responsive to atropine) was larger than in those women given ephedrine[10].

Daily for treating spinal induced hypotension in our hospital many treatment options have been tried, but problem still continues. This study was conducted and proven to be effective against spinal induced hypotension earlier, but found to be controversial in pregnant patients (due to its inconclusive effect on fetal outcome, this study is avoided in pregnant patients).

Therefore this study, conducted in our hospital in patients undergoing elective lower abdomen and lower limb surgeries under spinal anaesthesia to observe the outcome of prophylactic intramuscular ephedrine and to reduce the further incidence of spinal induced hypotension.

The aim of our study was to observe the outcome of prophylactic intramuscular ephedrine on the hemodynamic changes after spinal anaesthesia and also to mark the incidence of spinal induced hypotension.

Materials and Methods

Study was conducted on 108 patients undergoing lower abdominal and lower limb surgeries at tertiary care hospital during the academic year from January 2018 to May 2019.

The selection of patients were carried out randomly. Patients were briefed in the understandable language the anaesthesia procedure they are going to undergo. Pre-anaesthetic checkup was done one day before the surgery which included general physical examination, systemic examination and examination of spine.

Basic investigations like haemoglobin percentage, total blood count, differential blood count, serum electrolytes, renal function tests, urine routine, bleeding and clotting time, blood Sugars (if urine sugar positive) were advised.

On the day of surgery, drugs and resuscitation equipment checked and kept ready. The baseline Heart rates (HR) Systolic blood pressure (SBP), Diastolic blood pressure (DBP) were recorded.

Patients then were randomly allocated into two groups. 18 gauge intravenous line was secured. Group A received IM ephedrine 30 mg (1ml) 10 minutes before spinal anaesthesia. Group B received injection normal saline (1ml) (placebo) 10 minutes before spinal anaesthesia along with preloading of 15ml/kg of ringer lactate in each group.

Patients then shifted to the operation theatre. The pre subarachnoid block heart rate, systolic blood pressure, diastolic blood pressure were recorded for all patients and continuous monitoring done.

Under strict aseptic precaution lumbar puncture was done using 25-gauge disposable quincke type of spinal needle at L3-L4 spinal intervertebral space by midline approach. After the continuous

free back flow of cerebrospinal fluid, 3.2ml (0.5% 5mg/ml) heavy bupivacaine hydrochloride plus 0.3ml (90mcg) of buprenorphine was injected intrathecally irrespective of weight and height of the patients and the time noted.

Heart rate, systolic blood pressure, diastolic blood pressure were recorded in all patients at every 2 minutes interval for 10 minutes, then at every 10 minutes interval up to 45 minutes and then at every 15 minutes till the end of surgery or up to 90 minutes.

Level of sensory blockade was checked using a 23G hypodermic needle, Success of the block was defined as pinprick analgesia extending cranially to the desired dermatome. Ringer lactate was infused at the rate of 15 ml/min upto 1 hour after starting the operation in both groups then reduced to 10 ml/min if operation continued beyond 1 hour.

Following subarachnoid block, patient are monitored for any decrease in BP, nausea, vomiting, desaturation (SpO2 < 90%) or any other side effects. Hypotension was defined as a decrease in systolic blood pressure (SBP) more than 30% from the base line. If hypotension occurred, then they were treated first with 200 ml rapid infusion of ringer lactate was done. If hypotension continued they were treated with rescue vasopressor (mephentermine) administered intravenously in 6mg boluses.

Injection Atropine 0.6mg was administered intravenously if the heart rate goes below 50 per minute. Tachycardia was defined as HR more than 100 beats per min, and hypertension was defined as rise of MAP more than 20 mmHg over the baseline.

Statistics: To find the significance on continuous scale between two groups, Student t test was used. Leven`s test used to find the homogeneity of variance. Chi-square/Fisher Exact test: used for significance of categorical scale study parameters between the groups, Fisher exact test is applied when samples are very small.

Results

All patients were monitored clinically in the intraoperative period. It was noticed that none of the patients in both the groups had changes in oxygen saturation ($p = 0.372$, Not Significant, Fisher Exact Test) as shown in Table 1.

The occurrence of hypotension was more in placebo group when compared to ephedrine group and proven to be significant [Strongly significant (P value: $p \leq 0.01$)]. It was observed that hypotension occurred more in the first 20 minutes (from 2 minute) after subarachnoid block in placebo group (Table 2).

Table 1: Comparision of oxygen saturation

SpO_2%	Total	Group I	Group II
97	3(2.8%)	2(3.7%)	1(1.9%)
98	14(13%)	8(14.8%)	6(11.1%)
99	54(50%)	27(50%)	27(50%)
100	37(34.3%)	17(31.5%)	20(37%)
Total	108(100%)	54(100%)	54(100%)

Table 2: Mean arterial pressures among two groups

MAP (mm Hg)	Total	Group I	Group II	P value
Basal	96.89 ± 10.07	97.3 ± 9.81	96.48 ± 10.41	0.676
Imme-diately after sab	94.9 9 ± 10.23	96.2 ± 9.89	93.78 ± 10.5	0.219
2 mins	90.99 ± 10.25	93.2 ± 9.22	88.78 ± 10.82	0.024*
4 mins	88.06 ± 11.99	91.43 ± 11.15	84.69 ± 11.94	0.003**
6 mins	85.48 ± 11.55	88.65 ± 11.45	82.31 ± 10.85	0.004**
8 mins	83.80 ± 01.59	87.8.110.91	79.80 ± 10.94	<0.001**
10 mins	83.20 ± 10.63	86.44 ± 10.53	79.96 ± 9.79	0.001**
20 mins	83.03 ± 9.94	86.39 ± 9.62	79.67 ± 9.17	<0.001**
30 mins	83.35 ± 9.49	85.07 ± 10.00	81.63-8.71	0.059+
40 mins	84.67 ± 8.79	84.56+9.65	84.78 ± 7.94	0.896
60 mins	84.70 ± 8.24	85.00+8.79	84.41 ± 7.73	0.711
80 mins	85.72 ± 7.51	84.98+8.37	86.46 ± 6.53	0.308
90 mins	87.22 ± 8.19	86.81+9.28	87.63 ± 7.00	0.608

Table 3: Rescue agents used among two groups

Drugs Used	Total (n = 108)	Group I (n = 54)	Group II (n = 54)
Nil	69 (63.9%)	48 (88.9%)	21 (38.9%)
Yes	39 (36.1%)	6 (11.1%)	33 (61.1%)
Mephentermine 6 mg	6 (5.6%)	28 (51.9%)	34 (63%)
Atropine .6 mg	0 (0%)	4 (7.4%)	4 (7.4%)
Mephentermine at 30 mm, atropine .6 mg at 80. Min	0 (0%)	1 (1.9%)	1 (1.9%)

Table 4: Heart rate among two groups

Heart Rate (beats/min)	Total	Group I	Group II	P value
Basal	83.31 ± 12.32	85.74 ± 14.23	80.91 ± 9.58	0.041*
Immediately after sab	84.03 ± 13.83	87.07 ± 16.26	80.98 ± 10.14	0.021*
2 mins	82.96 ± 14.48	87.04 ± 17.12	78.89 ± 9.82	0.003**
4 mins	82.26 ± 14.16	86.74 ± 16.37	77.78 ± 9.81	0.001**
6 mins	80.2 ± 12.81	84.22 ± 14.3	76.19 ± 9.7	0.001**
8 mins	78.99 ± 12.65	82.7 ± 14.02	75.28 ± 9.91	0.002**
10 mins	78.56 ± 14.54	83.21 ± 16.68	73.91 ± 10.23	0.001**
20 mins	78.55 ± 13.4	82.94 ± 4.55	74.15 ± 10.56	<0.001**
30 mins	78.64 ± 12.71	82.98 ± 11.7	74.3 ± 12.28	<0.001**
40 mins	78.21 ± 11.85	81.04 ± 11.93	75.39 ± 11.18	0.013*
60 mins	78.16 ± 12.38	81.17 ± 13.71	75.15 ± 10.16	0.011*
80 mins	77.85 ± 10.9	79.87 ± 11.29	75.79 ± 10.19	0.053+
90 mins	78.1 ± 11.31	80.19 ± 11.76	76.02 ± 10.54	0.055+

The requirement of rescue agent is seen in 39 patients, in which 6 patients were from ephedrine group and 33 patients were from placebo group. Our study is similar to the below studies done with prophylactic ephedrine.

It is observed that heart rate when compared to two groups, placebo group shows drop in heart rate between (2 to 30) minutes and proven to be statistically significant using student t test [Strongly significant (p value ≤ 0.01)] as shown in Table 3.

There was no incidence of nausea, vomiting and any other side effects in both the groups.

Discussion

In view of lesser efficacy of mechanical and volume expansion methods to correct spinal induced hypotension, pharmacological methods have come into practice to reduce the occurrence of spinal induced hypotension. Several studies have done and proven that administration of vasopressors prophylactically in correcting hypotension are effective.

Among the Vasopressors Ephedrine, has better results in correcting the non-cardiac circulatory complications of spinal anaesthesia than a single alpha or beta-adrenergic agonist.

But intramuscular use of vasopressor is in borderline particularly when given before spinal anaesthesia because of rise in blood pressure risk and placental perfusion inadequacy, if subarachnoid block fails. But spinal anaesthesia procedure is easy to perform and <1% is its failure rate [11] and thus we excluded those patients who have spine anomalies to perform subarachnoid block in turn limiting the chances of block failure.

Ephedrine maintains arterial pressure by increasing cardiac output and heart rate. Due to its action on beta1 adreno receptor there is small chance of utero-placental insufficiency even if we have to go for general anaesthesia due to spinal anaesthesia failure.

We have used prophylactic intramuscular ephedrine 30 mg, in lesser dose when compared to other studies which have shown positive effect and also to see the potency of the drug in reducing the spinal induced hypotension and to look after any adverse side effects associated with it.

All patients were monitored clinically in the intraoperative period in our study. It was noticed that none of the patients in both the groups had changes in oxygen saturation (p = 0.372, Not Significant, Fisher Exact Test).

We defined hypotension as 30% decrease in mean arterial pressures from baseline. We observed that

occurrence of hypotension was more in placebo group when compared to ephedrine group and proven to be significant. It was observed that hypotension occurred more in the first 20 minutes (from 2 minute) after subarachnoid block in placebo group.

Even in our study, ephedrine has proven to be effective but the difference is other studies have compared between the dosages and timing of giving ephedrine along with preloading. Results showed that giving ephedrine 10 minutes before SAB is more effective [7,12].

In our study, the rescue agent used is mephentermine 6mg IV boluses when the MAP is less than 30% from the baseline. Whenever the baseline MAP is between 20-30%, initially resuscitated with crystalloids. But when the MAP is below 30% of the baseline, rescue agent was given in IV bolus and observed for the pressures to improve. But even if pressures fail to improve, patient was given the repeated IV bolus of mephentermine 6mg.

We noticed that the requirement of rescue agent is seen in 39 patients, in which 6 patients were from ephedrine group and 33 patients were from placebo group. Our study is similar to the below studies done with prophylactic ephedrine.

Bhar D in 2011, noted that ephedrine requirement was significantly less ($p<0.05$) in group E10 compared to other groups. Total dose of rescue IV ephedrine and delayed hypotension was less in both group E10 and E20 compared to group C but no difference was seen in E10 and E20 group. Time of first requirement of ephedrine was more in both group E10 and E20 compared to group C [7].

Ahmed H O, Hossam M, Adel A in 2016, made observations that hypotension was significantly more in fluid group when compared to ephedrine group. P value was 0.03. Ephedrine bolus dose required to correct hypotension was significantly lower in ephedrine group (0.3 ± 0.54) when compared to fluid group (0.6 ± 0.8) *p* value 0.046* [13].

In our study, it is observed that heart rate when compared to two groups, placebo group shows drop in heart rate between (2 to 30) minutes and proven to be statistically significant using student t test.

Bhar D in the year 2011, noticed that HR intraoperatively was more in ephedrine group E10 and E20 significantly compared to group C ($p < 0.05$). No difference was seen among group E10 and E20 [7].

Heart rate was higher in Ephedrine group when compared to Fluid group. But it was not statistically significant, P value more than 0.05 was the observations made by Ahmed HO, Hossam M, Adel A in 2016.[13]

Nausea and Vomiting side effects may because of the decrease in flow of blood to the trigger zone, and Ephedrine is the drug which increases mean arterial pressure and tries to improve the medullary blood flow. Due to the preganglionic sympathetic denervation, increase in peristalsis may also stimulate during spinal anesthesia, but whether Ephedrine could prevent or reduce thisaction is unknown.

Double blinded randomized prospective study done by Iqbal M S, Ishaq M, Masood A, Khan M Z in 2010 drawn a conclusion that the occurrence of nausea and vomiting wasmore in group-I (ephedrine 10 mg IV) and was related to hypotension (53%) whencompared to other groups with 15 mg and 20 mg IV prophylactically[14].

In 2011, Bhar D in his study noted that due to improved hemodynamic stability in E10 group (Ephedrine 30 mg, 10 minutes before SAB), occurrence of nausea and vomiting was significantly less compared to other groups.[7]

With above studies conducted and stating that with better stability of hemodynamic status, the occurrence of nausea and vomiting is reduced. In our study we didn't notice any occurrence of nausea and vomiting in both the groups.

Golakiya H N in 2016, in their randomized double blinded parallel study on 150 parturient with comparison between mephentermine, ephedrine, and phenylephrine. It was noted that, there is no difference between mephentermine, ephedrine and phenylephrine immediately after the SAB. It was found that, there was less requirement of maintenance dose with ephedrine. Phenylephrine have shown episodes of maternal bradycardia.[15]

Yadav A S, Shakya M L, Dwivedi S in 2016, on their comparative evaluation of prophylactic IM ephedrine and mephentermine made the observations that ephedrine and mephentermine when given IM prophylactically before SAB reduces the occurrence of hypotension. Apgar score was lower in mephentermine group 50.[16]

Kaur D, Khan A L, and Pathak A in 2018, on the comparative study between the three vasopressors, Phenylephrine, ephedrine, mephentermine concluded that phenylephrine is fast -acting

and short-lived normotensive effect added with a bradycardia effect. However, ephedrine and mephentermine had a steady progression and stable normotensive effect with no bradycardia effect. Hence, mephentermine and ephedrine were similar in performance, had a better hemodynamics control and had less recurrence when compared to phenylephrine.[17]

When topic comes to the standard vasopressor for the treatment of spinal induced hypotension, the above studies have concluded their observations of the advantages and disadvantages. In our hospital we traditionally use mephentermine intra-operatively to treat hypotension. There were lot of studies conducted on phenylephrine with its advantages being on good fetal outcome. But studies regarding ephedrine were reduced, may be because of poor fetal outcome which was still controversial. But when compared to ephedrine and phenylephrine, both have shown their efficacy on reducing the incidences on hypotension but with regard to phenylephrine, it has shown episodes of bradycardia and also the requirement of maintenance rescue agent is more. Hence we used prophylactic ephedrine IM 30 mg aiming to reduce the incidence of post spinal hypotension and also to have good hemodynamics intra-operatively. Our study have shown the expected results.

Study conducted on comparison between prophylactic ephedrine and preloading with fluids by Varathan S, Ekanayake U S, Amarasinghe U in 2009, in patients undergoing elective cesarean section under spinal anesthesia have come with conclusion that APGAR scores at 1min and 5min was found to be in the normal range in either of the groups. No association was found between the IM ephedrine and fetal acidosis.[12]

Varghese N, Gurumurthy T in 2013, studied the effect of prophylactic ephedrine infusion and compared it with crystalloid preloading on neonatal acid-base outcome in elective caesarean section following SAB and concluded that, the APGAR score at 1 min and 5 min were good in both the groups. There were no case of fetal acidosis. There was ($p > 0.05$) no difference significantly in the umbilical blood gas values between Group Iand Group II.[18]

With the above conclusions made on the efficacy of ephedrine on fetal outcome by various studies, it is still inconclusive to use ephedrine in pregnant females undergoing cesarean section under spinal anesthesia. Therefore we have carried out this study on ephedrine in patients undergoing lower abdominal and lower limb surgeries under spinal anaesthesia excluding cesarean sections.

Strengths and Limitations

We have used very low dose of ephedrine that was effective in preventing hypotension and bradycardia without causing any side effects and the drug was cost effective.

We have excluded parturients in our study, may be low dose ephedrine in this group of patients may reduce incidence of hypotension and fetal acidosis.

Conclusion

The prophylactic administration of IM Ephedrine in ASA Grade I & II patients undergoing lower abdominal and lower limb surgeries under spinal anaesthesia, is a potent measure in bringing down and arresting the incidence of hypotension without causing any predicted side effects like central nervous system stimulation, tachycardia or arrhythmias.

To conclude, this study demonstrates that prophylactic IM Ephedrine is a simple, easy, effective and reliable method in reducing the occurrence of hypotension.

Key Messages: Ephedrine has faired better in maintaining blood pressures and heart rate when given pre-emptively, thus preventing unwanted hypotension that may result because of sympathetic blockade secondary to subarchnoid block.

Conflict Of Interest: ***None***

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 764–773
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.17

A Comparative Study of Intravenous Dexmedetomidine Versus Intrathecal Dexmedetomidine With Heavy Bupivacaine in Spinal Anaestheia

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Abstract

Introduction: Dexmedetomidine is a highly selective α2 adrenoceptor agonist recently introduced to anesthesia. It produces dose dependent sedation and analgesia without respiratory depression. The purpose of this study was to compare the effect of intravenous versus intrathecal low dose dexmedetomidine on bupivacaine spinal block in patients undergoing lower abdomen and lower limb surgeries. *Methodology:* This prospective randomized clinical study was conducted on 60 patients of age 20 to 60 years posted for elective lower abdomen and lower limb surgeries. All patients were divided into 3 groups of 20 each. *Results:* Three groups were demographically comparable. Onset of sensoryblockade was statistically not significant between the three groups. Onset of motor blockade was not statistically significant between group A and B but statistically significant when compared with group C. Duration of sensory blockade, duration of analgesia and two segment regression time were significantly prolonged in group A followed by group B when compared with group C. Duration of motor blockadewas significantly prolonged in group Awhen compared with group B and group C. *Conclusion:* Dexmedetomidinewhen administered intravenously or intrathecallyalong with intrathecal hyperbaric bupivacaine produced a significant prolongation in the duration of sensory and motor block, but that administered intrathecally produced more significant prolongation of effect than that administered intravenously, with preserved hemodynamic stability and satisfactory arousable sedation.

Keywords: Intrathecaldexmedetomidine, Spinal anaesthesia, heavy bupivacaine

How to cite this article:
Nagaraj Gajagouni, CH Nagaraju . A Comparative Study of Intravenous Dexmedetomidine Versus Intrathecal Dexmedetomidine With Heavy Bupivacaine in Spinal Anaestheia. Indian J Anesth Analg. 2020;7(3):764–773.

Introduction

Perioperative pain management has been a major challenge for anaesthesiologists and there has been a constant struggle to bring out the best possible analgesic technique with least side effects. Regional anaesthesia and analgesia has the potential to provide excellent operating conditions and prolonged Postoperative pain relief.[1] However, post- operative pain control is a major problem because spinal anaesthesia using only local anesthetics is associated with relatively short duration of action and thus early analgesic intervention is needed in post-operative period. Various adjuncts such as benzodiazepines, Opioids, ketamine, neostigmine and many other drugs have

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Received on 22.01.2020, **Accepted on** 29.02.2020

been used with local anesthetics to provide better Post- operative analgesia, thereby facilitating rehabilitation and accelerating functional recovery. But these adjuvants (especially opioids) are associated with side effects which limit their use.

Dexmedetomidine is a highly selective α2-adrenoceptor agonist recently introduced to anesthesia. Administration of α2-agonists through the intrathecal route by acting as an adjuvant drug to local anesthetics provided an analgesic effect in postoperative pain without sedation. They potentiate the effect of the local anesthetic and allow a decrease in the required doses. Its addition to local anesthetics prolongs the duration of both sensory and motor spinal blockade.[2] Dexmedetomidine when added to intrathecal bupivacaine resulted in prolongation of the duration of spinal anesthesia. When dexmedetomidine was given intravenously before spinal anesthesiaor as a single intravenous dose after spinal anesthesia[3], it also lengthened the duration of spinal anesthesia. The purpose of this study was to compare the effect of intravenous versus Intrathecal low dose dexmedetomidine on bupivacaine spinal block in patients undergoing lower limb and lower abdomen surgeries.

Materials And Methods

After obtaining institutional ethical clearance and written informed consent from the patients, a prospective, randomized comparative study was conducted in 60 patients of ASA grade 1 and 2 aged between 18 and 60 years of either sex posted for elective lower limb and lower abdominal surgeries in the Department of anesthesiology, at MNR Medical College and Hospital, Sangareddy. 60 patients were divided into three groups of 20 patients each.

Exclusion Criteria: Age less than 18yrs or greater than 60yrs, Patient refusal, Emergency surgeries, Known case of hypersensitivity reactions to drugs, Patients with medical complications like anemia, heart disease, severe hypovolemia, shock, septicaemia, hypertension,Local infection at the site of proposed puncture for spinal anesthesia.

Preanaesthetic examination and preparation: Pre-anestheticcheckup was done one day prior to the surgery. Patients were evaluated for any systemic diseases and laboratory investigations recorded. The procedure of subarachnoid block was explained to the patient and informed written consent was obtained for the same.

After meeting inclusion criteria and taking written valid and informed consent, 60 patients were randomly divided into 3 groups of 20 each

Group A: (n = 20) were injected with 10 ml isotonic saline intravenously over 5 min in supine position immediately after patient has received intrathecal hyperbaric bupivacaine 15 mg and intrathecaldexmedetomidine 5µg.

Group B: (n = 20) were injected with dexmedetomidine 0.5 µg/kg intravenously diluted in 10 ml isotonic saline over 5 min in the supine position immediately after patient has received intrathecalhyperbaric bupivacaine 15mg.

Group C: control group (n = 20) were injected with 10 ml isotonic saline intravenously over 5 min in the supine position immediately after patient has received intrathecal hyperbaric bupivacaine 15mg.

After shifting patients to operating room, IV access was obtained on the forearm with No 18G cannula. All subjects were preloaded with 20ml/kg of ringer lactate solution over 10min. Baseline hemodynamic parameters were noted after applying standard monitors (pulse oximetry, NIBP and ECG). Patients were placed in the sitting position and a 25-G Quincke needle was placed in the L3–L4 or L4–L5 interspaces for spinal block.

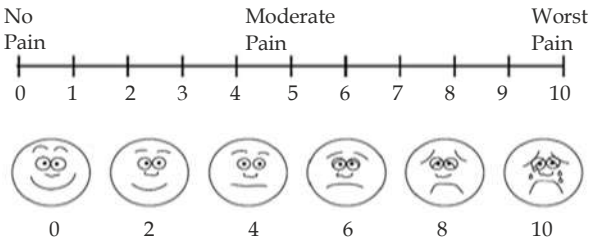
Under strict aseptic conditions, group-A were injected with 10 ml isotonic saline intravenously over 5 min in supine position immediately after patient has received intrathecal hyperbaric bupivacaine 15 mg and dexmedetomidine 5µg; group-B were injected with dexmedetomidine 0.5 µg/kg intravenously diluted in 10 ml isotonic saline over 5 min in the supine position immediately after patient has received intrathecal hyperbaric bupivacaine; group-C (control group) were injected with 10 ml isotonic saline intravenously over 5 min in the supine position immediately after patient has received intrathecal hyperbaric bupivacaine 15mg. Intraoperatively, the parameters monitored included Onset of sensory blockade, Onset of motor blockade, Duration of sensory blockade, Duration of motor blockade, Maximum dermatome level of sensory blockade, Duration of analgesia, Hemodynamic changes like SpO_2, heart rate, systolic blood pressure, diastolic blood pressure, Mean blood pressure. All the parameters were recorded at 0, 1, 3, 5, 10, 20, 30, 45, 60, 120 &180 min

following block.Level of sedation was observed at 15, 30, 45, 60, 75, 90,105, 120, 135, 150, 165,180 minutes after injection of spinal drug (by using Ramsay sedation score)

Ramsay sedation scale

1. Agitated, restless
2. Cooperative, tranquil
3. Responds to verbal commands while sleeping
4. Brisk response to glabellar tap or loud noise while sleeping
5. Sluggish response to glabellar tap or loud noise while sleeping
6. No response to glabellar tap or loud noise while sleeping

Pain was assessed using "visual analogue scale" advocated by Revill and Robinson in 1976. It is linear scale, consists of 10 cm line anchored at one end by a label such as "No pain" and other end by Worst pain imaginable". Intravenous tramadol 100mg was given when the VAS was at least 3 or upon patient's request.



Visual Analogue Scale was considered as 0 = no pain, 10 = severe pain

Statistical Analysis

Data was entered into Microsoft Excel and statistical analysis were done using IBM SPSS Statistics for Windows. Level of significance was set at $p < 0.05$. A "p" value less than 0.05 was considered as the minimum value for statistical significance. p value <0.0001 was considered to be highly significant. Demographic data like age and weight were compared using student's t test. Sex distribution was compared using Pearson Chi Square test.

Results

The two study groups (A-IT and B-IV) were comparable with regard to age, sex, and preoperative hemodynamics.

Age was comparable between the three groups (Table 1). The mean age was 46.65 ± 9.37 for the GROUP A, 44.9 ± 7.66 for the GROUP B, and 43.45 ± 9.24 for the GROUP C ($p = 0.646$). The subjects in study were comparable with regard to their ASA grade and gender.

All the basal vitals (parameters) (Table 2) were comparable in the study groups except in the SpO_2 levels where we found a little variation [$p = 0.01$].

There was no statistically significant differencein thetimetaken for the onset of sensory blockade between any two groups ($p > 0.05$) (Table 3).

Table 1: demographic data

Parameters	Group A- IT (n=20)	Group B-IV (n=20)	Group C-CONTROL (n=20)	*p*
	Mean +SD	Mean +SD	Mean +SD	
AGE (in Years)	46.65 +9.37	44.9 +7.66	43.45 +9.24	0.260
ASA Status				
ASA I	13	14	14	0.925
ASAII	7	6	6	
Gender				
Male	11	8	11	0.548
Female	9	12	9	

Table 2: Pre-subarachnoid block (basal) vital parameters

Basal Parameters	Group A-IT (n=20)		Group B-Iv (N=20)		Group C- Control (N=20)		*p*
	Mean	SD	Mean	SD	Mean	SD	
PR (Per Min)	77.20	9.96	82.10	9.71	84.70	16.27	0.123
SBP (mmHg)	128.70	12.65	131.45	13.28	126.80	14.16	0.506
DBP (mmHg)	82.10	8.25	84.30	8.77	80.90	.8.42	0.418
RR	20.80	2.86	22.05	4.31	21.25	2.90	0.286
SPO2	99.60	0.75	98.80	1.11	99.35	0.81	0.01

Table 3. Comparision of sensory and motor blockade characteristics

Parameters	Group A-IT (N=20)		Group B-IV (N=20)		Group C (N=20)		*p* value		
	Mean	SD	Mean	SD	Mean	SD	A& B	A & C	B & C
Onset of sensory blockade in mins	2.6	0.66	2.85	0.95	3.06	1.02	0.367	0.129	0.619
Onset of motor blockade in mins	8.15	0.96	8.5	1.37	11	1.85	0.365	< 0.00001	0.00038
Two dermatome sensory regression in mins	171	15.61	144	12.83	96	13.63	0.00004	< 0.00001	< 0.00001
Duration of sensory blockade in mins	450	13.38	342.7	12.66	220.5	15.47	< 0.00001	< 0.00001	0.00035
Duration of motor blockade in mins	419	15.78	196	14.74	184.8	17.05	< 0.00001	< 0.00001	0.081

There was no statistically significant difference in thetime taken for the onset of motor blockade between Group A and B (p = 0.365). However, it was statistically highly significant between group Aand group C (p < 0.00001) and also between group B and group C (p = 0.00038).

The mean time taken for regression of sensory block by two dermatomes (TDSR) was statistically highly significant between any two groups. (p = 0.00004 between A and B groups, $p \leq 0.00001$ between A and C groups, $p \leq 0.00001$ between B and C groups).

There was a statistically highly significant difference in the duration of sensory blockade when inter group analysis was conducted. ($p \leq 0.0001$ between A and B groups and also A and C groups; p = 0.00035 between B and C groups). The duration of sensory blockadewas more in the A group, followed by the B group and the C group.

There was a statistically highly significant difference in the duration of motor blockade between group A and group B (p < 0.00001) and group A and group C (p < 0.00001) but there was no statistically significant difference between the group B and group C (p = 0.081).

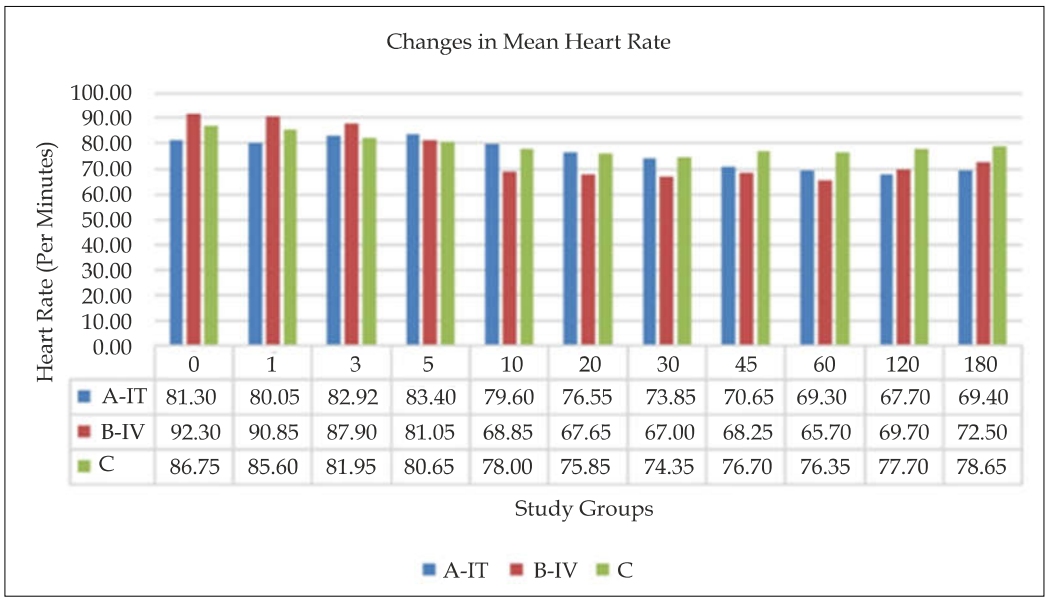
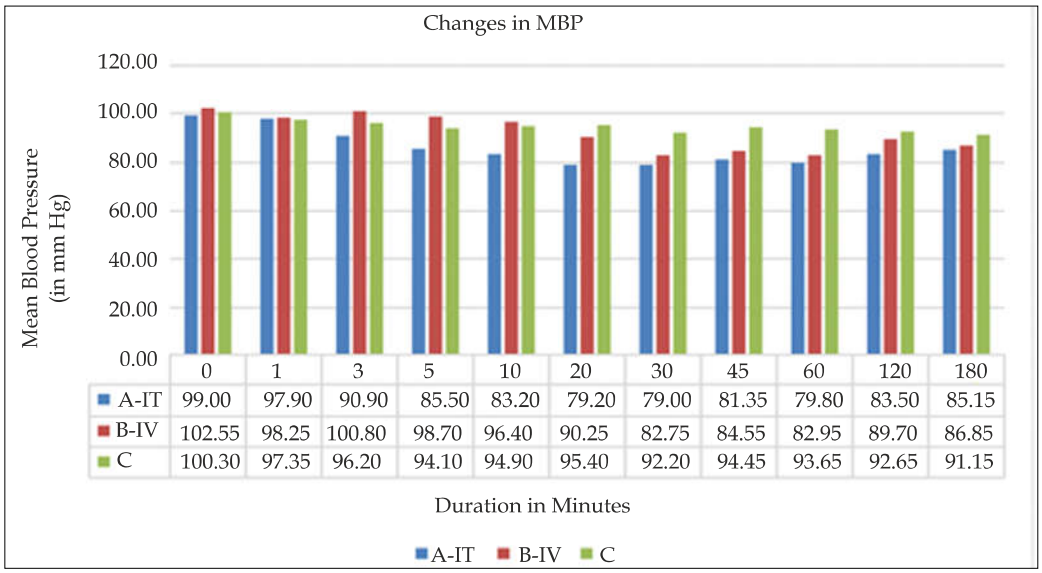
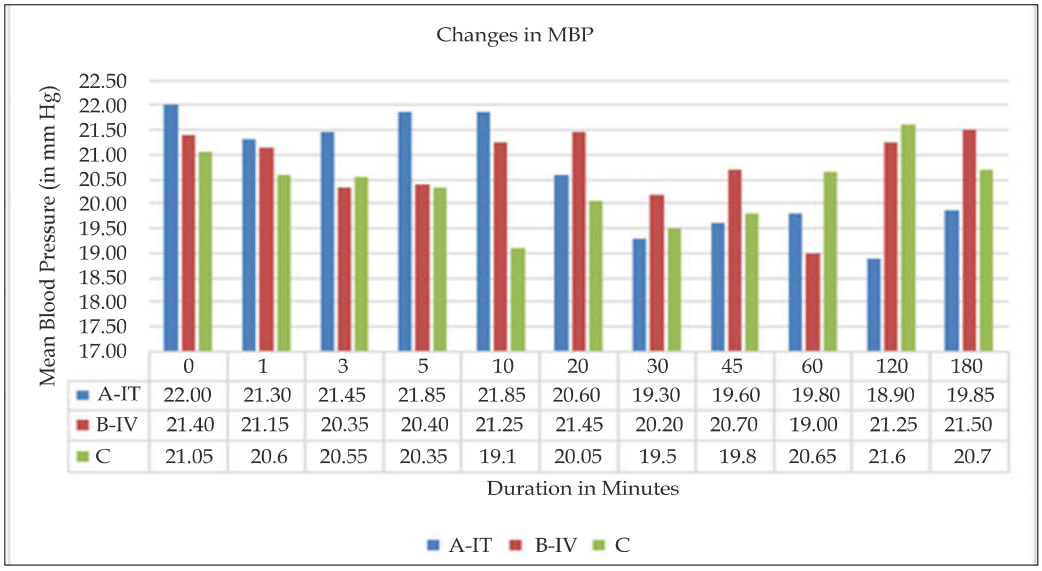


Fig. 1: Changes in mean heart rate



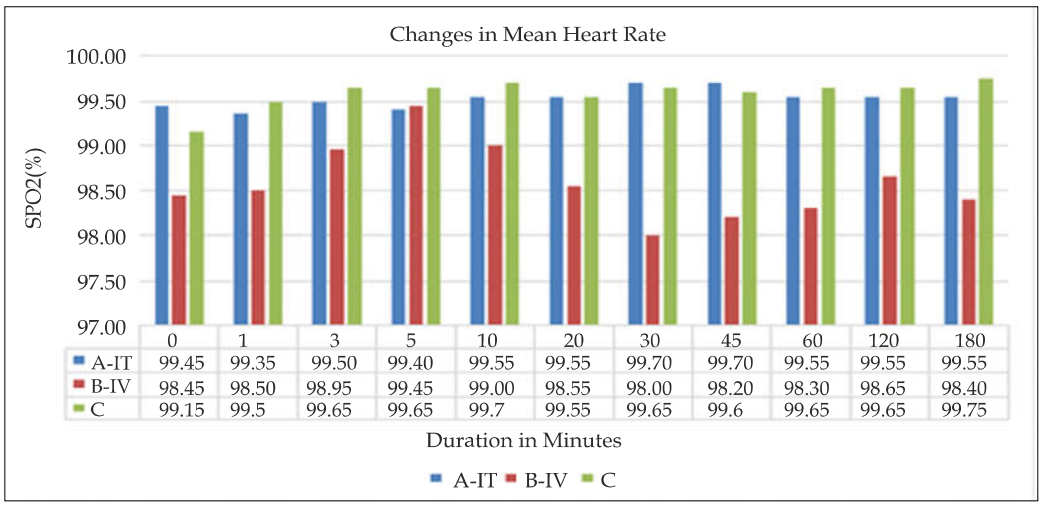
	0	1	3	5	10	20	30	45	60	120	180
A-IT	99.00	97.90	90.90	85.50	83.20	79.20	79.00	81.35	79.80	83.50	85.15
B-IV	102.55	98.25	100.80	98.70	96.40	90.25	82.75	84.55	82.95	89.70	86.85
C	100.30	97.35	96.20	94.10	94.90	95.40	92.20	94.45	93.65	92.65	91.15

Fig. 2: Changes in mean arterial pressure



	0	1	3	5	10	20	30	45	60	120	180
A-IT	22.00	21.30	21.45	21.85	21.85	20.60	19.30	19.60	19.80	18.90	19.85
B-IV	21.40	21.15	20.35	20.40	21.25	21.45	20.20	20.70	19.00	21.25	21.50
C	21.05	20.6	20.55	20.35	19.1	20.05	19.5	19.8	20.65	21.6	20.7

Fig. 3: Changes in respiratory rate



	0	1	3	5	10	20	30	45	60	120	180
A-IT	99.45	99.35	99.50	99.40	99.55	99.55	99.70	99.70	99.55	99.55	99.55
B-IV	98.45	98.50	98.95	99.45	99.00	98.55	98.00	98.20	98.30	98.65	98.40
C	99.15	99.5	99.65	99.65	99.7	99.55	99.65	99.6	99.65	99.65	99.75

Fig. 4: Changes in SpO_2

We have noticed only two instances of bradycardia (1 each in group B and group C). However, none of them was clinically significant (Fig. 1).

The basal Mean Arterial Pressure (MAP) in the Group A was 99.00 mm Hg, 102.55mm Hg in the B-IV group, and 100.30mm Hg in the C group – all the groups were comparable (Fig. 2).

In the intergroup analysis, there were 2 instances of statistically significant difference between A and B groups (p = 0.04; 0.034), two instances of difference between B-IV and C groups (p = 0.031; 0.0001), at one instance between A-IT and C groups

Table 4. Adverse effects in present study

Adverse Event	A-IT	B-IV	Control
Only Hypotension	9	4	4
Only Bradycardia	0	1	1
Both Hypotension & Bradycardia	0	5	0

(p = 0.049). However, in none of the instances it was clinically significant (Fig. 3).

The basal SpO_2 in the A-IT group was 99.45%, it was 98.45% in the B-IV group, and 99.15% in the C group – all the groups were comparable at the basal level. On the inter and intra group analysis, we did not find any statistically and/or clinically significant differences (Fig. 4).

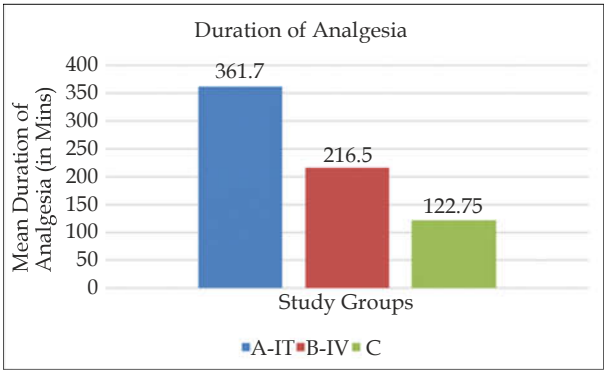


Fig. 5: Duration of analgesia

We have noted the incidents of Hypotension, Bradycardia, and in some patients both (Hypotension and Bradycardia). However, the occurrence of these events were neither statistically significant nor clinically significant. We did not notice any incident of intraoperative or postoperative nausea or vomiting in any of the three groups of patients (Table 4).

The mean duration of analgesia (the duration from the time of spinal anesthesia until the requirement of 1st rescue analgesia) [DOA] was 361.7 ± 39.89 minutes in the A-IT, 216 ± 27 minutes in the B-IV group, and 122.75 ± 15.85 minutes in the control group.

The intergroup analysis showed that there is statistically very significant difference between A and B groups (p < 0.00001), A and C groups (p < 0.00001), and B and C groups (p < 0.00001) (Fig. 5).

Table 5. Ramsey score distribution in groups

Ramsey Score Distribution (A-IT Group)	Ramsey 1	Ramsey 2	Ramsey 3	Ramsey 4
15 Mins	0	20	0	0
30 Mins	0	20	0	0
45 Mins	0	0	20	0
60 Mins	0	0	20	0
75 Mins	0	0	12	8
90 Mins	0	0	12	8
105 Mins	0	20	0	0
120 Mins	0	20	0	0
135 Mins	0	20	0	0
150 Mins	0	20	0	0
165 Mins	0	20	0	0
180 Mins	0	20	0	0
Ramsey Score Distribution (B-Iv Group)				
15 Mins	1	16	3	0
30 Mins	0	5	15	0
45 Mins	0	3	14	3
60 Mins	0	2	13	5
75 Mins	0	14	6	0
90 Mins	0	16	4	0
105 Mins	0	20	0	0
120 Mins	0	20	0	0
135 Mins	0	20	0	0
150 Mins	0	20	0	0
165 Mins	0	20	0	0
180 Mins	0	20	0	0
Ramsey Score Distribution (C Group)				
15 Mins	2	18	0	0
30 Mins	0	19	1	0
45 Mins	0	19	1	0
60 Mins	0	18	2	0
75 Mins	0	18	2	0
90 Mins	0	18	2	0
105 Mins	0	19	1	0
120 Mins	0	20	0	0
135 Mins	0	20	0	0
150 Mins	0	20	0	0
165 Mins	0	20	0	0
180 Mins	0	20	0	0

In the A-IT group, the patients had the RSS score of "3" (responded to commands) when it was measured at 45 minutes and 60 minutes, thereafter at 75 minutes and 90 minutes of measurement 60% (12) patients had the RSS of "3" and 40% (8) had the RSS of "4" (patients had a brisk response to a light glabellar tap or loud auditory stimulus). From 105 minutes until 180 minutes, the RSS settled to "2". None of the patient had the RSS of "1" at any point of measurement. All patients were in the state of satisfactory arousable sedation no evidence of respiratory depression. No patient crossed beyond Ramsey Score 4 intraoperatively (Table 5).

In the B-IV group all patients were in the state of satisfactory arousable sedation, and comparatively level of sedation was less than that in the IT group.

In the Control (C) group,the patients reached a maximum Ramsey score of 3 unlike the IT and IV groups in which the patients were more sedated.

Discussion

We demonstrate the comparative analgesic efficacy and safety profile of 0.5% 15mg Bupivacaine and intrathecal Dexmedetomidine (5µg) injected with 10 ml isotonic saline intravenously over 5 min in supine position immediately after patient has received intrathecal hyperbaric Bupivacaine 15 mg and Dexmedetomidine 5µg] and – 0.5% Bupivacaine & Dexmedetomidine (0.5µg/kg) as an adjuvant administered through intravenous route diluted in 10 ml isotonic saline over 5 min in the supine position immediately after patient has received intrathecal hyperbaric Bupivacaine. The groups (A-IT, B-IV, and C) were comparable with regard to age, gender, ASA grading and the preoperative haemodynamics.

The time of onset of sensory block was quickest in the A-IT group (2.6 ± 0.66 minutes) compared to the B-IV group (2.85 ± 0.95 minutes), followed by the control group (3.06 ± 1.02 minutes) however the difference was not statistically significant between the groups (p = 0.367 between A-IT and B-IV; p = 0.129 between A-IT and C; p = 0.619 between B-IV and C). This was in very much corroboration with the study (Ahmed M.S. et al., 2013) in which the onset of sensory block was 2.6 ± 0.66 minutes in the intrathecal (3µg) group, 2.8 ± 1.7 minutes in the intravenous (0.5 µg/kg) group, and 2.9 ± 1.3 minutes in the control group. [4]

Our findings were also in corroboration with the study conducted by Mahamoud M AL-Mustafa et al. (in 2009)[5] in which the researchers concluded that Dexmedetomidine has a dose dependent effect on the onset and regression of sensory and motor block when used as an adjuvant to Bupivacaine in spinal anesthesia.

In 2013, Harsoor SS et al[6][who assess the effects of IV Dexmedetomidine on sensory, motor, haemodynamic parameters and sedation during subarachnoid block (SAB)] concluded that administration of IV Dexmedetomidine during SAB hastens the onset of sensory block and prolongs the duration of sensory and motor block with satisfactory arousable sedation. Furthermore, our findings are in congruence with the study conducted by Aliye E et al.[7] in 2013 in which the investigators have concluded that intrathecal Dexmedetomidine addition to levo Bupivacaine for spinal anaesthesia shortens sensory and motor block onset time and prolongs block duration without any significant adverse effects.

The time to regression of sensory block by two dermatomes (TDSR) was 171 ± 15.61 minutes in the A-IT group, 144 ± 12.83 minutes in the B-IV group, and 96 ± 13.63 minutes in the C group. There was very statistically significant difference between the groups with regard to TDSR (p = 0.00004 between A and B groups, p ≤ 0.00001 between A and C groups, p ≤ 0.00001 between B and C groups). Our study findings were in corroboration with the findings of the study conducted by Ahmed M.S. et al.[4], 2013 in which TDSR was noted as 142 ± 41 minutes in the IT group, 105 ± 39 minutes in the IV group, and 70 ± 22 in the C group. Similar to our study, there was high statistically significant difference between group C and IV, C and IT (p < 0.001). Jung et al. (single dose Dexmedetomidine) also found that TDSR was significantly increased with IV Dexmedetomidine 0.25 – 0.5µg/kg

Similar to the onset of the sensory blockade, the onset of motor blockade was quickest in the A-IT group (8.15 ± 0.96), it was 8.5 ± 1.37 in the B-IV group, and 11 ± 1.85 in the C group. On intergroup analysis, there was no statistically significant difference between Group A-IT and B-IV (p = 0.365), however, it was very statistically significant between A and C Groups (p < 0.00001), and B and C groups (p = 0.00038).

Our study findings were in congruence with those noted by Ahmed M.S. et al. in 2013 in which the time to onset of motor blockade was 8.1 ± 3.1 minutes in the IT group, 8.5 ± 3.4 minutes in the IV group, and 11.1 ± 3.8 minutes in the Control group (p < 0.05; statistically significant difference between IT and C, and IV and C groups). Although the time to reach the Bromage 3 motor block was

significantly shorter in both IT and IV groups when compared with the Bupivacaine group, there was no statistically significant difference between the study groups (IT and IV).

Similar to the sensory block duration, in our study, the mean motor block duration was the highest in the A-IT group (419 ± 15.78), followed by the B-IV group (196 ± 14.74) and C group (184 ± 17.05). However, there was no statistically significant difference between the B-IV and C group (p=0.081) but, a very statistically significant was found to be present between A and B ($p < 0.00001$) and A and C ($p < 0.00001$). Similar results were noted in the Ahmed M.S. et al.[4] (2013) study. It was 251 ± 74 in the IT group, 210 ± 32 in the IV group, and 152 ± 41 in the Control group. The findings were statistically very significant between IT and C, and IV and C groups ($p < 0.001$). Difference in the duration of motor blockade in the similar groups in both the aforementioned studies may be dose related.

Al-Mustafa et al.[5] also observed prolongation of motor blockade while using a higher intravenous dose 1mcg/kg bolus followed by 0.5mcg/ kg/h infusion of Dexmedetomidine. Conflicting the evidence, Lugo et al.[9] in their study noted prolongation of sensory block and duration of analgesia without significant effect on motor block while using 1 mcg/kg bolus followed by 0.5 mcg/ kg/h infusion of Dexmedetomidine. In addition, Kaya et.al[3], reported that the use of a single dose of 0.5 mcg/kg of Dexmedetomidine did not affect the duration of motor block.

Kanaziet al.[10] study is in agreement with our study. They studied the effect of intrathecal low-dose Dexmedetomidine or clonidine on the characteristics of Bupivacaine spinal block. They found that Dexmedetomidine (3µg) or clonidine (30µg) when added to intrathecal Bupivacaine had a significantly shorter onset time of motor block and significantly longer sensory and motor regression times, with preserved hemodynamic stability and lack of sedation. Kalso et al.[11] as well showed that a small intrathecal dose of Dexmedetomidine (3µ g), used in combination with Bupivacaine in spinal anesthesia, produced a shorter onset of motor block and a prolongation in the duration of sensory and motor block.

The efficacy of Dexmedetomidine was objectively visible on the analysis of requirement of rescue analgesia. The mean time to 1st rescue analgesia was 361.7 ± 39.89 minutes in the A-IT, 216 ± 27 minutes in the B-IV group, and 122.75 ± 15.85 minutes in the control group. The intergroup analysis showed that there is statistically very significant difference between A and B groups ($p < 0.00001$), A and C groups ($p < 0.00001$), and B and C groups ($p < 0.00001$). In congruence with our study, in another study[4] (Ahmed M.S. et al. 2013), the time to first analgesic needed was significantly prolonged in groups IV and IT in comparison with group B, without significant difference between groups IV and IT. In the same study, the mean total consumption of the analgesic postoperatively in the first 24 h was significantly decreased in groups IV and IT in comparison with group B, without significant difference between groups IV and IT.

This is in corroboration with the study conducted by Saadawy and coworkers[12] who added Dexmedetomidine (1µg/kg) to Bupivacaine for caudal anesthesia in pediatrics and achieved longer analgesia, less rescue analgesic consumption, and improved sleep quality with no adverse clinically relevant side effects.

Similarly, El-Hennawy and colleagues[13] found that both Dexmedetomidine and clonidine medications mixed with Bupivacaine significantly prolonged analgesia when compared with using Bupivacaine alone 16 h (15–19 h) for Dexmedetomidine, 12 h (3–21 h) for clonidine, and 5 h (4–6 h) with plain Bupivacaine; $p < 0.001$). However, the study showed no difference with analgesia duration ($p = 0.796$) between either Dexmedetomidine or clonidine when added to Bupivacaine.

Some recent investigations have studied the effects of mixing Dexmedetomidine with local anesthetics during peripheral nerve and nerve plexus blockade. A study by Obayah and colleagues[14] added Dexmedetomidine to Bupivacaine during placement of a greater palatine nerve block for cleft palate repair. The addition of Dexmedetomidine to Bupivacaine provided lower pain scores and prolonged analgesia (approximately 50%) with no negative effect on hemodynamics when compared with Bupivacaine alone.

Jung et al.[8] also noticed significant increase in sensory and motor anesthesia. In another study, the investigators reported that sensory block was prolonged by at least 34%, motor block duration was prolonged by at least 17%, and time to first analgesic request was increased by at least 53%. The results of Mohamed et al.[5] study were concomitant with the present study. The investigators of the study concluded that Dexmedetomidine 5µg given intrathecally improved the quality and the duration of postoperative analgesia and also provided an analgesic-sparing effect.

Reduction in Heart Rate was significant with intravenous Dexmedetomidine at 20, 45, and 60 minutes in another study.[5] Transient reversible bradycardia was increased in the Dexmedetomidine group, but there was no difference in the incidence of hypotension or post-operative sedation. In the study conducted by Harsoor SS[6] intraoperative heart rate was significantly decreased with intravenous Dexmedetomidine from 30 to 60 min.

There was a statistically significant difference evident between the study groups (A-IT and B-IV) at 5 instances (3, 5, 10, 20, and 120 minutes) [p = 0.012; 0.006; 0.0007, 0.029, 0.049 respectively] with regard to MBP. This statistically significant difference was present between B-IV and C group from 5 through 120 minutes. On comparing B and C groups, significant difference was present at 45 and 60 minutes (p = 0.043; 0.012).

In another study[6], MAP was significantly low from 60 min until end of surgery and for the initial 2 h postoperatively, and this may be because of the continuous Dexmedetomidine infusion 0.5μg/kg/h. In the intergroup analysis of Respiratory Rate, we found 2 instances of statistically significant difference between A and B groups (p = 0.04; 0.034), two instances of difference between B-IV and C groups (p = 0.031; 0.0001), at one instance between A-IT and C groups (p = 0.049). However, in none of the instances it was clinically significant.

JyotsnaKubre et al.[17] (2016) observed lesser incidence of bradycardia and hypotension intraoperatively as well as postoperatively with IV Dexmedetomidine as an adjuvant with Bupivacaine. We did not find any statistically and/or clinically significant differences within and/or between the groups with regard to SpO_2, intraoperative or postoperative nausea or vomiting in any of the three groups of patients. We also did not notice any evidence of clinical criteria suggesting local anesthetic toxicity (lightheadedness, dizziness, tinnitus, disorientation, drowsiness, generalized muscle twitching, convulsions, respiratory depression, cardiovascular depression, and collapse) in addition to possible systemic effects of Dexmedetomidine.

In our study, the intrathecal group were more sedated (all the patients in Ramsey score 3 or 4 from 45 minutes through 90 minutes intraoperatively) while the patients in the IV group reached a lesser level of sedation comparatively. In the control group, patients mostly reached Ramsey level 2 score only – indicating that intrathecal route of administration of Dexmedetomidine induced more and quicker sedation when compared to the IV and the control groups. In conclusion, in our study, Dexmedetomidine produced satisfactory arousable sedation without causing respiratory distress.

Our findings were in corroboration with JyotsnaKubre et al.[17] (2016) concluded that IV Dexmedetomidine produces satisfactory arousable sedation without causing respiratory depression. In agreement with the aforementioned studies, in 2013, Harsoor SS et al.[6] [who assessed the effects of IV Dexmedetomidine on sensory, motor, haemodynamic parameters and sedation during subarachnoid block (SAB)] concluded that administration of IV Dexmedetomidine during SAB hastens the onset of sensory block and prolongs the duration of sensory and motor block with satisfactory arousable sedation.

Conclusion

Dexmedetomidine when administered in higher doses intrathecally (5 micrograms in our study, compared to 0.5 micrograms to 3 micrograms used in other previous studies) is more effective with no unpredictable adverse effects. We found various combinations and permutations of statistically very significant, statistically significant, statistically insignificant, and clinically significant results with regard to various parameters we have studied in general, but, very specifically, we have found statistically and clinically significant results with regard to the onset of sensory and motor blockade, duration of analgesia, and the requirement of rescue analgesics. We found that dexmedetomidine is hemodynamically stable and produces no significant undesirable side effects.

Finally, we conclude that, adding dexmedetomidine intravenously (0.5 μg/kg) or intrathecally 5μg to bupivacaine, as an adjuvant provides Significant enhancement of onset of sensory and motor blockade, Increases the duration of sensory and motor blockade, Prolonged duration of analgesia, Reduces the use of supplemental opioidrequirements and causes satisfactory and arousable sedation. Improved parameters of analgesic efficacy support the use of dexmedetomidine as an adjunct intrathecally with local anaesthetics (bupivacaine in specific) to improve pain management and prolong anesthesia duration of local anaesthetics

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 774–779
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.18

Comparison of Dexamethasone and Magnesium Sulphate with Plain Bupivacaine in Pectoral Nerve Block for Postoperative Analgesia: A Randomised Double Blind Controlled Trial

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Abstract

Background and Aims: Patients undergoing breast cancer surgeries face significant postoperative pain. We aimed to compare the analgesic efficacy of plain bupivacaine and plain bupivacaine with magnesium sulphate and dexamethasone in pectoral nerve block (PECS). *Methods:* Sixty ASA status I and II female patients between age 18 to 60 years scheduled for unilateral modified radical mastectomy (MRM) under general anaesthesia, were enrolled in this prospective randomised double blind controlled study. All patients received USG guided PECS block. Patients in group C were given a total of 30 cc 0.25% bupivacaine while group D received total of 30 cc 0.25% bupivacaine with 4 mg dexamethasone and group M received 150 mg of magnesium sulphate with 0.25% of bupivacaine 30cc in total. General anaesthesia was administered in a standardised manner to all three groups before giving block. The various parameters observed included duration of analgesia, VAS score, number of rescue analgesics required and any adverse effects. The primary outcome was to compare total duration of analgesia between the three groups. *Results:* The mean duration of analgesia was 778.95 ± 94.735 min (13 hrs) in group D, 519.90 ± 66.607 min (9.3 hrs) in group M and 384.30 ± 49.558 min (6.4 hrs) in group C. At 12 and 24 hrs, VAS scores were significantly lower in group D as compared to group M and group C ($p > 0.001$). The difference in VAS scores between group M and group C at 12 and 24 hrs was not statistically significant. At 48 hrs VAS scores among the three groups were comparable. *Conclusion:* In the postoperative period, the use of dexamethasone and magnesium sulphate as adjuncts to bupivacaine in PECS block results in lower VAS scores, decreased demands for rescue analgesia and prolonged duration of analgesia. The use of these adjuvants provides better patient satisfaction without causing any noticeable side effects.

Keywords: Analgesia, Pectoral Nerve Block, Modified Radical Mastectomy, Dexamethasone, Magnesium Sulphate

How to cite this article:
Nisha Sharma, Sonali Kaushal, Surinder Singh, et al. Comparison of Dexamethasone and Magnesium Sulphate with Plain Bupivacaine in Pectoral Nerve Block for Postoperative Analgesia: A Randomised Double Blind Controlled Trial. Indian J Anesth Analg. 2020;7(3):774–779.

Introduction

Modified radical mastectomy for breast cancer treatment is associated with a significant postoperative pain. Hence achieving adequate postoperative analgesia is very important as acute post-operative pain is not only debilitating but is an important risk factor for the development of persistent chronic pain after breast surgery.[1]

Breast surgery is generally performed under general anaesthesia with regional anaesthetic techniques like thoracic epidural and paravertebral blocks for post-operative analgesia. These techniques may be

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Received on 05.02.2020 **Accepted on** 29.02.2020

associated with complications like pneumothorax, vascular puncture, nerve damage etc. [2]However these complications have widely been overcome with advent of USG. Another USG guided block pectoral nerve block (PECS) has been introduced for MRM which provides better safety profile and comparable pain relief. PECS block is an interfacial plane block where local anaesthetic is deposited into the plane between the pectoralis major muscle and the pectoralis minor muscle (PECS I block) blocking lateral and medial pectoral nerves and between pectoralis minor and serratus anterior muscle (PECS II block) blocking the intercostobrachial, intercostals III, IV, V, and VI; and long thoracic nerves.[3,4] Adjuvants like dexamethasone, dexmedetomidine, adenosine and magnesium have been used in PECS block to prolong the analgesic effect of block.[5-8] However, no comparative study till date is available comparing dexamethasone and magnesium sulphate. Therefore in view of providing safe, long and effective postoperative analgesia along with patient comfort we planned to conduct a study comparing analgesic efficacy of dexamethasone and magnesium sulphate as adjuvants to bupivacaine in ultrasound guided pectoral nerve block for modified radical mastectomy.

Materials and Methods

After obtaining approval from our Institutional Ethical Committee, 60 patients belonging to the ASA physical status I-II undergoing modified radical mastectomy (MRM) with axillary dissection over a period of 24 months were selected for the study.

Sample size was calculated using pain scores as the primary variable. Literature review revealed an average difference of 10 mm on VAS of 10 cm with standard deviation of 10 mm. Assuming a standard deviation of 10 mm, the minimum needed sample size to detect a difference of 10 mm on the VAS of 10 cm, with alpha error of 0.05 and power of study 80% was 54. Thus, each group required at least 18 patients. Hence, a total of 60 patients were enrolled to compensate for any probable block failures and dropouts.

All patients were explained the purpose of the study along with the procedure and thereafter written, informed consent was obtained from all the patients. Exclusion criteria included history of allergy to local anaesthetics, bleeding disorder or receiving anticoagulants, pregnancy, infection at the block site, BMI >35kg/m^2 and patients refusal. The patients were randomly allocated by a computer-generated random number table to three groups of 20 each: Group C (receiving PECS block with 30 cc of 0.25% bupivacaine), Group D (receiving PECS block with 0.25% bupivacaine with dexamethasone 4mg, total volume 30cc) and Group M (receiving PECS block with bupivacaine 0.25% and magnesium sulphate 150 mg, total volume given 30cc) of 20 patients each. Allocation concealment was ensured by having the random group assignment enclosed in a sealed opaque envelope. The sealed envelope was opened by an anaesthesiologist not involved in the study. The observer who collected the peri-operative data as well as the patient was masked to the technique of analgesia and the drug used.

During the pre-anaesthetic visit, patients were explained about the study purpose, advantages and risks of procedure and instructed to demand analgesia as per requirement. Patients were educated about the 10 cm visual analogue scale (VAS) during the pre-operative assessment. All the patients were kept nil orally for 8 hours before surgery, and pre-medication with oral alprazolam 0.5 mg and oral ranitidine 150 mg was given night before surgery.

All patients received midazolam 1–2 mg before induction of anaesthesia and monitored with fiveleads ECG, pulse oximetry, non-invasive bloodpressure and capnography. General anaesthesia was induced with fentanyl 2 μg/kg, Propofol 1.5–2 mg/kgand endotracheal intubation was facilitated withatracurium 0.5 mg/kg. Anaesthesia was maintained with isoflurane and O_2/NO_2 mixture with a fractionof 33% inspired oxygen.

After induction, USG guided PECS block was performed with patient in supine position and placing ipsilateral upper limb in abduction position using a linear US probe of high frequency (6-13 MHz, Sonosite). The USG probe was placed at infra-clavicular region after skin sterilization and moved laterally to locate the axillary artery and axillary vein directly above first rib where pectoralis minor and pectoralis major muscles were identified at this US window. A 22G spinal needle was inserted in plane with US probe to the fascial plane between pectoralis muscles and 10ml of total drug was injected after negative aspiration according to the groups allocated.

Then US probe was moved towards axilla till serratus anterior muscle was identified above second, third and fourth ribs and then the needle was reinserted into fascial plane between pectoralis minor and serratus anterior and 20 ml of the remaining drug was injected after negative aspiration according to the groups allocated.

Throughout the surgery, non-invasive mean arterial blood pressure, heart rate and oxygen saturation was monitored continuously and recorded every 5 minutes till completion of the procedure. Intraoperatively fentanyl 1µg/kg I.V. in bolus doses was given to the patients whenever the mean arterial pressure (MAP) or heart rate exceeded 20% above the preoperative value. Diclofenac sodium 75 mg I.V. was also administered before incision. Ondansetron 0.1mg/kg was given for antiemesis. After completion of surgery neuromuscular blockade was reversed with I.V. neostigmine 50µg/kg and glycopyrrolate 10µg/kg.

After recovery from anaesthesia, patients were shifted to Post anaesthesia care unit (PACU). postop pain assessement was done at 0 min (on being shifted to recovery), 15 min, 30 min , 45 min and 60 min in PACU and at 2hrs, 4hrs, 6hrs, 12hrs, 24hrs, 36hrs and 48hrs postoperatively in ward by VAS score. Whenever the VAS score was > 4 rescue analgesic was given with I.V. diclofenac 75 mg, supplemented with I.V. tramadol 50 mg. Amount of doses of diclofenac and tramadol were recorded.

The level of postoperative nausea and vomiting (PONV) was assessed with the Numerical Rating Scale (NRS 0-4; 0- no nausea, 1- nausea, 2- retching, 3-vomiting, 4- severe vomiting (4-5 episodes). Injection metoclopramide 10 mg I.V. was given whenever PONV NRS score was greater than two. Patient satisfaction for post-operative analgesia wasrecorded according to satisfaction score: Poor = 0; Fair = 1; Good = 2; Excellent = 3. Any untoward side effects or complications related to procedureand local anaesthetic were recorded.

Statistical analysis was performed using SPSS software version 20. The one-sample Kolmogorov–Smirnov test was employed to determine whether data sets differed from a normal distribution. Normally distributed data were analysed using a repeat-measures general linear model analysis of variance for time-related variables, whereas non-normally distributed data were analysed using Kruskal-Wallis test. $p < 0.05$ was considered statistically significant.

Results

The total number of patients enrolled during the study period was 60 in three groups being 20 in each group. Group C (30 cc of 0.25% bupivacaine), Group D (30cc of 0.25% bupivacaine with 4mg of dexamethasone) and Group M (30 cc of 0.25% bupivacaine with 150 mg of magnesium sulphate) were comparable to each other with respect to age, weight and duration of surgery (Table 1). Mean duration of analgesia, that is, duration to first analgesic requirement was found to be significantly prolonged in Group D {778.95 ± 94.735 min (13hrs)} compared to Group M {519.90 ± 66.607 min (9.3 hrs)} and Group C {384.30 ± 49.558 min (6.4 hrs)}($P < 0.001$) (Table 2).

Mean VAS scores were significantly lower in group D than group M at 2, 4, 6, 12 and 24 h while values were lower in group M as compared to group C at 0, 2, 4 and 6 hrs (Tables 3) (Fig. 1).

The mean number of doses of I.V. Diclofenac/Tramadol required were maximum in group C (3.20 ± 0.616) followed by group M (2.50 ± 0.688) and least in group D (1.90 ± 0.641) and the difference was found to be statistically significant between the groups (Table 4).

No complications such as vascular puncture, hypotension, pleural puncture or pneumothorax were observed in any of the groups.

Table 1. Demographic Profile

Parameter	Group D Mean ± SD	Group M Mean ± SD	Group C Mean ± SD	*p* value
Age (Yrs.)	50.35 ± 9.505	50.75 ± 7.656	50.20 ± 9.070	0.979
Weight (kg)	54.13 ± 5.620	53.95 ± 7.037	58.50 ± 9.655	0.105
Duration of Surgery (min)	90.80 ± 17.961	86.30 ± 15.597	86.70 ± 16.633	0.645

p-value: >0.05 not significant, <0.05 significant, <0.001 highly significant

Table 2. Duration of Analgesia

Group D Mean ± SD (min)	Group M Mean ± SD (min)	Group C Mean ± SD (min)	*p* value intergroup		
			D vs M	M vs. C	D vs C
778.95 ± 94.735	519.90 ± 66.607	384.30 ± 49.558	<0.000*	<0.000*	<0.000*

* Highly significant

Table 3: Postoperative VAS Scores

Time Interval	Group D	Group M	Group C	*p* value		
				D vs M	M vs C	D vs C
0 min	0	0	0			
15min	0	0	0.15 ± 0.366	1	0.73	0.73
30min	0	0.05 ± 0.224	0.45 ± 0.510	0.876	<0.000*	<0.000*
45min	0	0.40 ± 0.503	1.30 ± .470	.007	<0.000*	<0.000*
60min	0	1.15 ± 0.48	1.65 ± 0.489	<0.000*	<0.000*	<0.000*
2 hrs	0.65 ± 0.489	2.05 ± 0.510	3.25 ± 0.639	<0.000*	<0.000*	<0.000*
4 hrs	1.60 ± 0.503	2.95 ± 0.510	4.30 ± 0.571	<0.000*	<0.000*	<0.000*
6 hrs	2.40 ± 0.503	3.70 ± 0.470	5.05 ± 0.605	<0.000*	<0.000*	<0.000*
12 hrs	3.25 ± 0.550	4.10 ± 0.852	4.45 ± 0.510	<0.000*	0.218	<0.000*
24 hrs	2.85 ± 0.671	3.45 ± 0.605	3.70 ± 0.470	0.006	0.377	<0.000*
36 hrs	2.15 ± 0.671	2.05 ± 0.605	2.50 ± 0.607	0.870	0.069	0.192
48 hrs	0.65 ± 0.587	0.60 ± 0.578	0.65 ± 0.671	1	0 .965	1

* Highly significant

Table 4: Total Doses of Rescue Analgesic (I.v. Diclofenac / I.v. Tramadol)

Group D Mean ± SD	Group M Mean ± SD	Group C Mean ± SD	*p* value	*p* value inter group		
				D vs M	M vs. C	D vs C
1.90 ± 0.641	2.50 ± 0.688	3.20 ± 0.616	<0.000*	0.014	0.003	<0.000*

* Highly significant

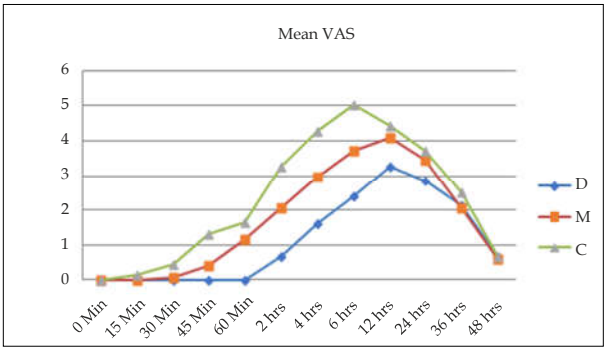

Fig. 1: Comparison of Mean Vas Scores

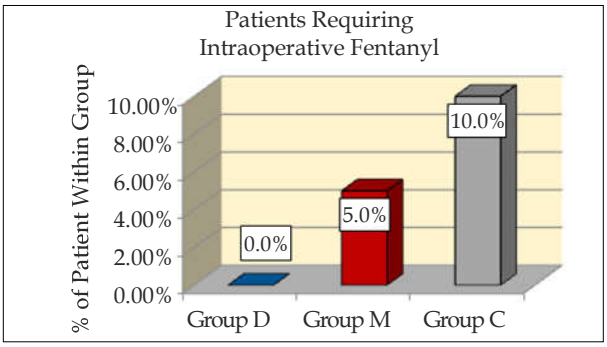

Fig. 2: Percentage Of Patients Requiring Intraoperative Fentanyl (Single Dose)

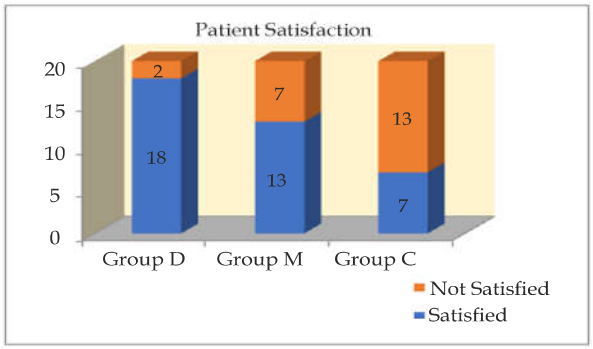

Fig 3: Patient Satisfaction Score (p = 0.001)

Discussion

In recent years, there has been increasing interest on a novel, less invasive nerve block, the pectoral nerve (PECS) block. Compared with general anaesthesia (GA) alone, PECS block when combined with GA are more advantageous in reducing intraoperative opioid consumption, postoperative opioid consumption, postoperative early pain, incidence of PONV, and the need for postoperative rescue analgesia.[9,10] Postoperative pain can reduce the quality of life of patients.[11] Controlling postoperative pain can help patients participate actively in postoperative rehabilitation and improve short-term and long-term recovery after surgery. Various studies have demonstrated that early postoperative pain (0–6 hours) is significantly reduced in patients administered PECS block combined with GA as compared with those administered GA alone, but this difference gradually disappeared in the late postoperative period (24 hours), hence advocating the role of

adding adjuvants in PECS block.[3,4,9,10] Though there are reports on use of adjuvants in various other peripheral nerve blocks, there is little systematic research on the comparison of efficacy and tolerability of the addition of adjunctive analgesic agents in PECS block.[12-15] Therefore, the objective of our randomized controlled study was to evaluate the clinical effectiveness and tolerability of dexamethasone and magnesium in combination with bupivacaine in PECS block analgesia after breast surgery.

In this randomised double blind controlled trial, we compared dexamethasone with magnesium sulphate as an adjuvant with bupivacaine in PECS block and found that duration of analgesia was maximum in dexamethasone group {778.95 ± 94.735 min (12.9 hours)} followed by magnesium {519.90 ± 66 min (8.6 hours)} then the bupivacaine group alone {384.30 ± 49.558 min (6.4 hours)}. In addition, we found that VAS scores were significantly lesser in dexamethasone and magnesium group compared to plain bupivacaine group.[5,6]

With regard to total duration of analgesia, most of the authors have claimed a mean duration of analgesia as 4–6 h with plain bupivacaine in PECS block and our study also shows similar results.[2-4] Similarly the mean duration of analgesia in group M in our present study was comparable to study by Ahmed et al, however it was significantly shorter than Group D.

Dexamethasone yields analgesia by three mechanisms. Firstly, it blocks transmission of nociceptive myelinated c fibers and suppressing ectopic neuronal discharge. Secondly, dexamethasone also inhibits the action of phospholipase A and alters the function of potassium channels in the excitable cells via glucocorticoid receptors and lastly, by its local vasoconstrictive effect. Choi et al. (2014) in a meta-analysis of literature of brachial plexus blocks found that dexamethasone in doses of 2mg, 4mg and 8mg was associated with prolonged duration of anaesthesia with no side effects in upper limb surgeries.[16] Hence, we selected dose of 4 mg as 2 mg was having less analgesic effect while 8 mg has similar effect as 4 mg.

Magnesium sulphate blocks the effects of excitatory amino acids (e.g., glutamate, aspartate) on NMDA receptors and contributes to central sensitization. It is proved that the addition of magnesium sulphate to local anaesthetic for neuraxial anaesthesia improves the quality of analgesia and prolongs the duration of anaesthesia.[38] In our study we selected a dose of 150 mg of magnesium sulphate at par with studies by Goyal P et al., Gunduz et al. and Mukherjee K et al., as these authors did not reported any side effects with a dose of 150 mg of magnesium sulphate and found that 150 mg of magnesium sulphate produced significantly increased duration of analgesia compared to 100 mg of magnesium sulphate in axillary plexus block for forearm and hand surgery.[17-19]

Intraoperative pain relief was adequate with PECS block in our three groups as assessed on the basis of heart rate and mean arterial pressure. One patient (5%) in group M and two patients (10%) in group C required only one dose of intraoperative fentanyl in the beginning of surgery which may have been due to delayed onset of block. Bashandy and Abbas reported PECS block patients consumed 50% less intraoperative fentanyl as compared to general anaesthesia without block.[10] Similarly, Wahba et al reported that intraoperative fentanyl consumption was significantly lower in PECS group [105 (95–110) μg] compared with PVB group [127.5 (110–145) μg].[19] Our study showed similar results where the intraoperative fentanyl requirement (Fig. 2) between the three groups was not statistically significant ($p = 0.349$).

Regarding the number of rescue analgesics in PECS block, maximum number of demand boluses were observed between 4 and 24 h with plain bupivacaine in studies, while our study shows maximum demands between 6 and 12 h. This discrepancy may be due the fact that block was given before giving GA in study done by Blanco while we gave block after GA.[3] The bupivacaine group required rescue analgesic after 4 hrs, magnesium group demanded rescue analgesic after 8 hrs postoperatively while dexamethasone group required analgesic after 12 hrs indicating shorter pain-free period and more requirement of postoperative analgesia in the bupivacaine group. Therefore, use of magnesium and dexamethasone in block has a beneficial effect in reducing the number of systemic analgesic requirement.

In our study, the addition of Magnesium sulphate to bupivacaine in a dose of 150 mg and dexamethasone in dose of 4 mg have led to lower VAS pain scores, prolongation of analgesia and lesser requirement of postoperative rescue analgesia. Our results are comparable to other studies in the use of dexamethasone and magnesium sulphate in significantly reducing the post-operative VAS in peripheral nerve blocks. In our study, the nausea vomiting score was comparable in all three groups and was insignificant. Statistically

significant difference was also found in terms of satisfaction score being better in magnesium and dexamethasone group (Fig. 3).

Conclusion

PECS block is an effective technique in reducing post-operative pain in patients undergoing modified radical mastectomy. Our data support the specific action of adjuvants to local anaesthetic such as magnesium and dexamethasone on peripheral nerves leading to decreased pain scores resulting in decreased postoperative analgesic requirement. Dexamethasone has advantages over Magnesium sulphate regarding longer duration of the block and lesser rescue analgesic requirement. Further studies should be carried out to investigate the possibility of using PECS with dexamethasone as sole anaesthetic technique for breast surgery.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 780–786
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.19

A study of Efficacy and Safety of Ropivacaine (0.5%) versus Levo Bupivacaine (0.5%) in Cervical Epidural Anaesthesia for Upper Limb Surgery

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Abstract

Regional anaesthesia is preferred technique over general anaesthesia due to its overall less side effects. Cervical Epidural Anaesthesia (CEA) has been upcoming technique since past few years which provide safe and reliable anaesthesia for upper limb surgery. *Objective:* To compare efficacy and safety of cervical epidural blockade with 0.5% Ropivacaine and 0.5% Levobupivacaine in upper extremity surgeries. *Methods and Material:* 50 patients were divided into two groups:- Group R: CEA block will be given with Injection Ropivacaine 10 ml (0.5%). Group L: CEA block will be given with Injection Levobupivacaine 10 ml (0.5%). Assessment of sensory and motor blockade was done in terms of onset and duration. Perioperative complications were recorded and managed accordingly. *Results:* The onset of sensory block with levobupivacaine was (6.28 ± 1.75min) and with ropivacaine was (5.56 ± 1.62 min) ($p>0.05$). Mean duration of sensory blockage was longer with levobupivacaine (296 ± 31.46 min) than with ropivacaine (192 ± 21.07min).The mean time of onset of motor blockade(9.52±2.04 min) was shorter and duration (219 ± 31.74 min) was longer with Levobupivacaine than Ropivacaine (14.2 ± 3.75 min) and (165 ± 25.45 min) respectively. Postoperative Visual Analogue Score was higher in Ropivacaine. The mean time of duration of analgesia was longer in Levobupivacaine (315.6 ± 48.08 min). *Conclusions:* In an equal dose, Levobupivacaine has a faster onset (sensory and motor block) and longer duration (motor block and analgesia) as compared to Ropivacaine.

Keywords: Cervical Epidural Technique, Levobupivacaine, Ropivacaine, Upper Limb Surgery.

How to cite this article:

Fumakiya Pooja Hasmukhbhai, Asodariya Nidhi Chandreshbhai, Sheikh Iramnaaz Ahmedhussain. A Study of Efficacy and Safety of Ropivacaine (0.5%) Versus Levobupivacaine (0.5%) in Cervical Epidural Anaesthesia for Upper Limb Surgery. Indian J Anesth Analg. 2020;7(3):780–786.

Introduction

Anaesthesia for surgeries of upper extremity is commonly provided using brachial plexus block or general anaesthesia. At the same time epidural anaesthesia can also be used as a regional anaesthesia.[1] Regional anaesthesia is a technique to render part of body insensitive to pain without affecting consciousness. It is preferred technique over general anaesthesia due to its overall less side effects.

CEA was first reported by Dogliotti in 1993.[2] CEA involves the administration of local anaesthetics into the epidural space resulting in the blockage of cervical nerve roots.[2]

Cervical epidurals are predominantly performed by interventional pain physicians. CEA has been

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Received on 03.02.2020**, Accepted on** 29.02.2020

employed successfully for various types of surgical procedures involving upper limb surgeries, thyroid and breast surgery, head and neck surgery.[2]

CEA offers some advantage over brachial plexus block for upper limb surgery like lower total dose of local anaesthetics and single needle insertion with no need to elicit paresthesia or muscle movement. Considering its advantages of stable hemodynamics, early postoperative ambulation with reduction in stress response, less intraoperative blood loss, postoperative morbidity, low cost and postoperative analgesia and better control of tourniquet pain,[3] we used CEA as sole anaesthetic technique to evaluate onset, extent, duration of analgesia and hemodynamic status in upper limb surgery.

Materials and Methods

A study including 50 patients aged 18 to 60 years with ASA grade I-III, either sex, scheduled for upper extremity surgery and shoulder surgery under cervical epidural anaesthesia (CEA). The study was done in a prospective, randomised double blinded comparative manner. Patients refusal, patients with respiratory, CNS and CVS disorders, history of allergy to local anaesthetics, local site infection, intake of anticoagulant drugs, altered coagulation profile, patients with any contraindication to CEA were excluded from the study.

For elimination of bias in the assigned study, randomization was done by computer generated random number table and care was taken that each patient should get equal chance. All patients were divided into two groups:-

Group R (Ropivacaine): CEA block will be given with Injection Ropivacaine 10 ml (0.5%)

Group L (Levobupivacaine): CEA block will be given with Injection Levobupivacaine 10ml (0.5).

All patients were thoroughly assessed day before surgery and screened for any associated medical illness, drug allergy, family history etc. Routine investigations like Hb, blood sugar, serum creatinine, blood urea, chest X-ray and electrocardiogram were documented. Patients were assessed for vitals like temperature, pulse rate (PR), blood pressure (BP) and respiratory rate(RR). Thorough Airway assessment, systemic and Cervical spine examination was done in every patient. All patients were well informed about the benefit and the adverse reaction of the drug under study and surgery and written consent was obtained. Intravenous line was secured with 18 G or 20 G IV cannula and fluids was started (8 ml/kg).

All monitors were attached to the patients including (ECG) leads, BP cuff and pulse oximeter. Baseline PR, BP, RR and SpO_2 were recorded. All patients were premedicated with Inj. Glycopyrolate **(**0.04 mg/kg**)** IV, Inj. Ondansatron (0.08 mg/kg) IV, Inj. Ranitidine (1mg/kg) IV, Inj. Midazolam (0.05 mg/kg) IV and Inj. Tramadol (1mg/kg).

Methods

Under all aseptic and antiseptic precautions CEA was performed in all the patients with 18 G touhy epidural needle at the C7-T1/C6-C7 interspace using loss of resistance technique via a midline cephalic approach in sitting position with neck flexed and chin on the chest(figure 1). Patients were given either Inj. Ropivacaine 0.5% 10 ml or Inj. Levobupivacaine 0.5% 10 ml according to group allotment.

After recording the time of injection patients were immediately placed in supine position on operation table. PR, RR, BP and SpO_2 were recorded every 5 min after block till half an hour than every 30 min till the end of procedure. Sensory and motor function were evaluated after the block at 5, 10, 15, 20, 25, 30, 45 and 60 mins, then every 30 minute till the end of surgery.

Assesment of Sensory blockage was graded via pin prick method**:**

Grade 0: no loss of sensation to pin prick.

Grade 1: analgesia (patient feels touch but not sharp).

Grade 2: anaesthesia (patient does not feel touch).

Onset time for sensory blockade: It is defined as time taken from the end of the injection till the achievement of sensory block. (Grade 2)

Total duration of sensory blockade: It is defined as time interval between onset of sensory block and complete recovery of sensation. (Grade 0)

Assessment of Motor blockage was done by asking the patient to abduct arm at the shoulder and graded as:

Grade 1: Absence of motor block

Grade 2: Weakness appreciable but movement against resistance

Grade 3: Possible movement but not against resistance

Grade 4: Absence of movement

Patient were kept in the state of conscious sedation to alley anxiety with Inj. Dexmedatomidine

1 µg/kg in 100 ml NS over 10 min loading dose followed by infusion drip at the rate of 0.2 to 0.5 µg/kg/hr started and continued till the end of surgery. Ramsay sedation score was assessed intraoperatively.

Ramsay sedation Score (RSS) as follow:

Grade 0: Patient wide awake

Grade 1: Patient is sleeping comfortably, but responding to verbal commands.

Grade 2: Deep sleep, but arousable.

Grade 3: Deep sleep, unarousable.

Post-operatively PR, BP, SpO_2, RSS were assessed in post-operative period and at 30 min, 1 hr, 2 hr, 4 hr, 6 hr, 8 hr and 12 hr. Postoperative pain would be assessed using Visual analogue score (VAS) from 0 to 10 in which score "0" was "No pain" and score "10" was "Unbearable pain". Analgesia was considered satisfactory if the score was <4. If score was ≥ 4, rescue analgesic Inj. Diclofenac sodium 75 mg IV given.

The incidence of perioperative complications like hypotension, bradycardia, nausea, vomiting, respiratory difficulty, shivering were monitored and treated accordingly. All the observations were recorded as mean and standard deviation. All the results were analysed statistically using the student's unpaired `t` test. *p* value <0.05 was considered as significant.

Results

The patients were randomly and equally divided into two groups of 25 each.

Group L(n= 25):- Levobupivacaine 0.5% 10 ml

Group R (n=25):- Ropivacaine 0.5% 10 ml

Demographic data between two groups were comparable (Table 1).

The onset of sensory block with levobupivacaine was (6.28 ± 1.75 min) and with ropivacaine was (5.56 ± 1.62 min) ($p > 0.05$).Not statistically significant (Fig. 2).

Mean duration of sensory blockage was longer with levobupivacaine (296 ± 31.46 min) than with ropivacaine (192 ± 21.07 min) (Fig. 3).

The mean time of onset of motor blockade (9.52±2.04 min) (Fig. 2) was shorter and duration (219 ± 31.74 min) (Fig. 3) was longer with Levobupivacaine than Ropivacaine (14.2 ± 3.75 min) (Fig. 2) and (165 ± 25.45 min) (Fig. 3) respectively.

Postoperative Visual Analogue Score was higher in Ropivacaine (Fig. 4). The mean time of duration of analgesia was longer in Levobupivacaine (315.6 ± 48.08 min) (Fig. 5).

Perioperative complication were comparable between two groups (Table 2).

Table 1. Demographic parameters

	Group L	Group R	*p* value	Significance
Age	40.92 ± 13.79252	39.52 ± 16.53873	0.75154	NS
Weight	60.6 ± 7.657676	59.6 ± 6.05	0.612	NS
Duration of surgery (min)	146.4 ± 35.31	141.6 ± 35.51	0.640834	NS
Sex (m/f)	16:9	18:7	-	NS

Table 2. Perioperative Complications

Types of complication	Group L N=25	Group R N=25
Hypotension	2 (8%)	1 (4%)
Bradycardia	3 (12%)	2 (8%)
Nausea/Vomiting	-	-
Respiratory distress	-	-
Dura puncture	-	-
Diaphragmatic paresis	-	-

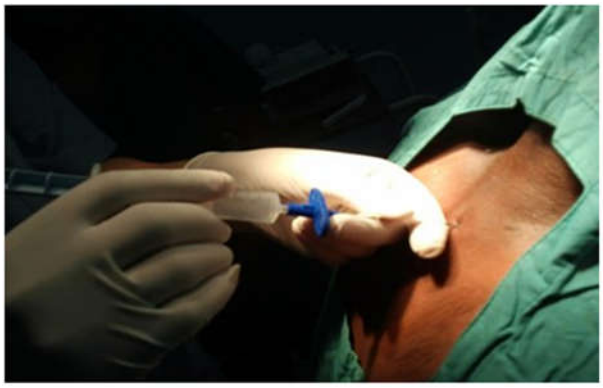

Fig. 1: Technique of Cervical Epidural Anaesthesia.

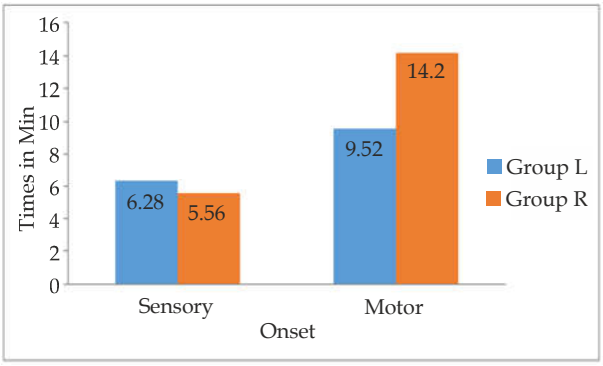

Fig. 2: Duration of Sensory and Motor Block

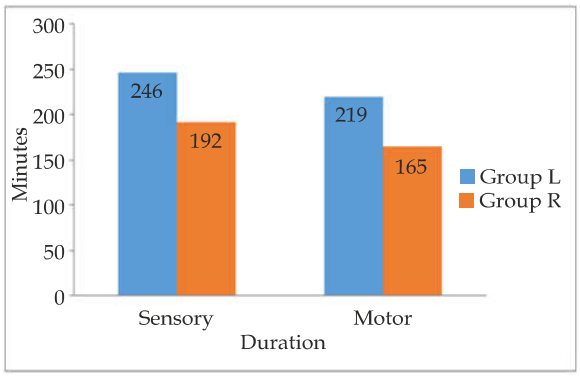

Fig. 3: Duration of sensory and motor block

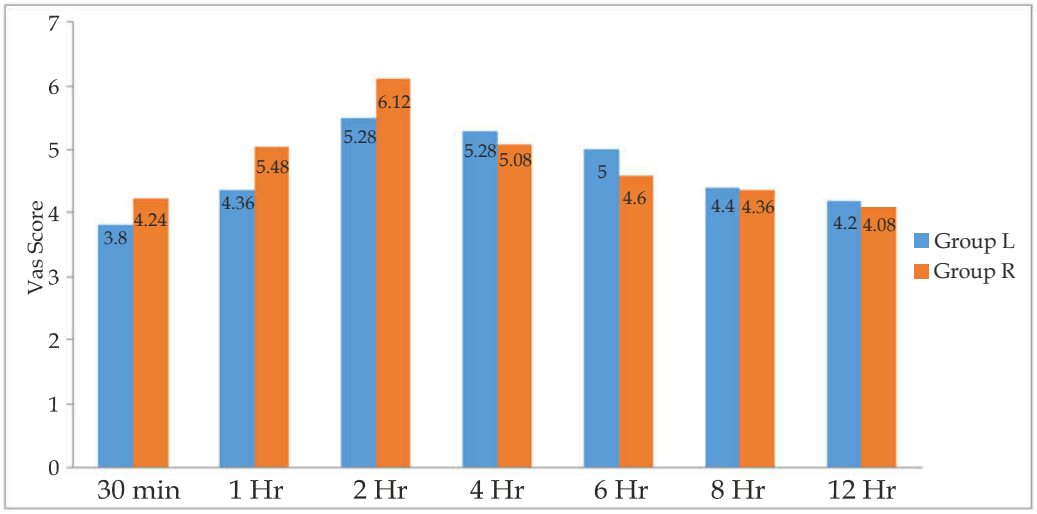

Fig. 4: VAS pain score in postoperative period.

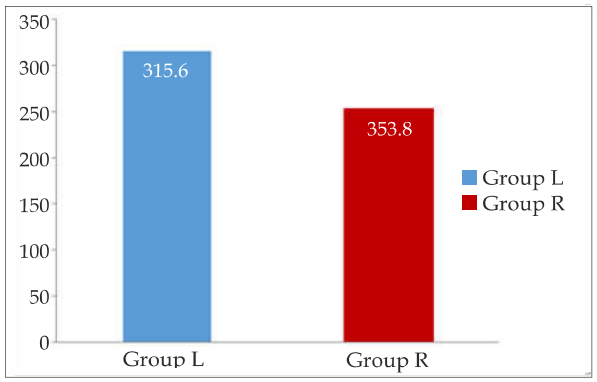

Fig. 5: Duration of Analgesia.

Discussion

There are several modalities used in shoulder surgery and upper extremity surgery such as interscalene brachial plexus block (ISB). ISB and suprascapular nerve block are both effective anesthetic modalities for intraoperative analgesia, but are limited by the duration of local anesthetics and re-admission of the drug for pain control in the postoperative period. CEA was reported in few studies to provide excellent postoperative analgesia for patients undergoing upper extremity surgery.

It is well known that CEA selectively blocks sympathetic fibers followed by sensory fibers and finally motor fibers with an increasing dose of local anesthetics. However, ISB may not achieve the effective separation of motor and sensory block as sensory nerve are in the core bundle, surrounded by motor nerves.[4] Regional anesthesia technique are safer than general anesthesia in high risk patient and old aged patients.

CEA is more effective with patient having bilateral upper limb fracture due to bilateral blockade so,patient are comfortable in positioning throughout procedures as compared to interscalene block.

Kushizak H et al.[5] used CEA for pain management during rehabilitation after surgery of

upper extremities.

On reviewing the literatures, we decided to see anaesthetic safety and the clinical efficacy (onset of sensory and motor block, duration of analgesia and hemodynamic stability) of CEA for upper extremity surgeries by using Levobupivacaine 0.5% with Ropivacaine 0.5% in cervical epidural anaesthesia for upper limb surgery.

CEA blocks the sympathetic cardiac accelerator fibres that arise at T1-T4 consequently decrease heart rate, cardiac output and contractility. Excessive bradycardia and hypotension was found mainly with higher dose and concentration with >12 ml of local anaesthetics.[6] So most of the studies used concentration <15 ml like Agrawal M et al.[6] used 10-12 ml of 0.25% Bupivacaine for neck arm and upper thoracic surgery.

Dominguez F et al.[7] conducted shoulder surgeries under CEA with 10-12 ml of 0.75% Ropivacaine and concluded that Ropivacaine provides an effective sensory block and a restricted motor blockade, reducing the probability of the restrictive pulmonary syndrome associated with cervical epidural anaesthesia**.**

Marodker K et al. studied CEA for shoulder arthroscopy using 8 ml 0.25% Bupivacaine and 25 µg Fentanyl.

Other study done by Michalak P et al.[8] states that CEA with Ropivacaine may be used safely and effectively for combined procedure involving neck and upper limb.

Most of studies have successfully conducted surgeries under CEA using 10-15 ml of local anaesthetic (LA) volumes. The rationale behind using these volume is that the requirement of LA is approximately 1.2 ml/segments in cervical space (i.e., nearly 10-15 ml volume for spread to 8- 10 segments). Therefore, we had choose minimum effective concentration of studied drug in optimal and equal volume 10 ml (to ensure blinding) for our study.[1.]

Characteristic of sensory blockade Onset

Onset, spread, quality and duration of anaesthesia depends on the local anaesthetic agent selection, dose, concentration, volume, and physical characteristics. In our study onset of sensory block is defined as time taken from the end of the epidural injection till the achievement of sensory block (grade 2). The onset of sensory block in Group L was (6.28 ± 1.75 mins) and in Group R was (5.56 ± 1.62 mins) ($p > 0.05$).There were no statistical significant difference between both groups.

Similar results were reported by Kulkarni M et al.[9] They also observed no significant difference in the onset of sensory block (5.05 min and 5.4 min in group B and group R respectively, p>0.05).

Duration

In our study the total duration of sensory blockade is defined as time interval between onset of sensory block and complete recovery of sensation (grade 0). Mean duration of sensory blockage was in Group L (296 ± 31.46 mins) and in Group R (192 ± 21.07 mins) which was statistically significant ($p < 0.001$). The duration of sensory blockade was longer with Levobupivacaine as compared with Ropivacaine because Levobupivacaine is higher lipid soluble and more potent than Ropivacaine when used for epidural analgesia.

In contrast to our study results, Kulkarni K et al.[9] observed that the duration of sensory block was 91.8 min in Bupivacaine (0.25%) group and 90 min in Ropivacaine (0.375%) group. Lower concentration of both the drugs might be the reason for such result.

Characteristic of motor blockade

Onset

Onset of motor block is defined as time from the end of the epidural injection till the patient was unable to abduct arm at shoulder (grade 3). In our study mean time for onset of motor blockade was faster in Group L (9.52 ± 2.04 mins) as compared to Group R (14.2 ± 3.75 mins) $p < 0.001$, which was statistically highly significant. Slower onset of motor block with Ropivacaine might be due to its lesser lipid solubility which may cause the drug to penetrate the large myelinated A fibers more slowly than the more lipid-soluble Levobupivacaine.

Similar to our study result, Michalek P et al.[10] found that the onset of motor blockade was 15 min using 12 mL of 0.75% Ropivacaine plus 10 µg of Fentanyl for upper extremity procedure.

Duration

In our study total duration of motor blockade is defined as time interval between onset of motor block and complete recovery of motor power (grade 0). Mean time of duration of motor blockade in Group L was 219 ± 31.74 mins (3.65 hrs) and in Group R was 165 ± 25.45 mins (2.75hrs), $p < 0.001$. The duration of motor blockade was longer with Levobupivacaine as compared with Ropivacaine

because the Levobupivacaine have intrinsic vasoconstrictor property and high lipid solubility of which is likely to penetrate the large myelinated motor fibres better in comparison to Ropivacaine. This might be the reason for longer duration of motor blockade in Group-L compared to Group-R. Ropivacaine is particularly useful when early mobilization is important to enhance recovery.

With contrary to our result, Kulkarni K et al.[9] observed that the mean time required to achieve motor blockade was significantly longer in group B (22.5mins) as compared to group R (18.3 mins), time to grade I motor recovery was also significantly longer in group B than in group R(79.5 and 66.3 minutes respectively) $p < 0.001$.

Perioperative side effects in both the groups

Although Levobupivacaine has very similar pharmacokinetic properties to those of racemic Bupivacaine, several studies support that its faster protein-binding rate reflects a decreased degree of toxicity. The decreased cardiovascular and central nervous system toxicity makes Ropivacaine and Levobupivacaine interesting alternative to racemic bupivacaine in procedures requiring large doses of local anaesthetic but this might not be true in cervical epidural anesthesia where the dosage of drug is comparatively small.

In our study three patients in Group L and two patient in Group R had bradycardia and hypotension in two patients with Group L and one patient with Group R. Hypotension was managed with vasopressors and rapid IV fluids and bradycardia was treated with Inj. Atropine (0.02 mg/kg). SpO_2 remained stable throughout the observation period in both the groups. None of the patient had respiratory dysfunction, dural puncture, nausea, vomiting. Eight patients who had failed epidural block were converted to GA and excluded from the study.

Similarly, Agrawal M et al.[6] also observed hypotension in 30% cases with the Bupivacaine 10-12 ml of 0.25%.

Post operative visual analogue score

In our study, Visual Analog Score (VAS) was higher in Group R as compared with Group L for up to 2 hrs postoperatively which was statistically significant ($p < 0.05$) than it was comparable between both groups. Higher VAS scores with Ropivacaine might be due to wearing off the effect of cervical epidural anesthesia due to shorter action. Total duration of analgesia was defined as interval between end of injection and first requirement of rescue analgesic dose.

Kulkarni K et al.[9] observed equal mean VAS score upto 24 hrs in both group B (2.9) and group R (3.1). The reason behind same VAS scores in both groups might be due to postoperative analgesia with 5ml of 0.125% Bupivacaine and 0.2% Ropivacaine in group B and R respectively via epidural catheter, when VAS score reached >3.

Duration of analgesia

In the present study, duration of analgesia was longer in Levobupivacaine (Group L) was 315.6 ± 48.08 mins (5.26 hrs) as compared with Ropivacaine (Group R) was 253.8 ± 28.11mins (4.23 hrs) $p <$ 0.001%. Levobupivacaine is a highly lipid soluble drug and tends to penetrate the nerve membrane more easily, so that less molecules are required for conduction blockade resulting in enhanced potency. This might be the reason for prolonged duration of analgesia with Group L as compared to Group R.

In contrast to our study, Kulkarni K et al.[9] observed that there was no statistically significant difference in mean duration of analgesia between Bupivacaine and Ropivacaine (6.6 hrs vs 6.8 hrs) p > 0.05%.

Conclusion

Cervical epidural anaesthesia is a safe and reliable anaesthetic technique for upper limb surgery with stable hemodynamic and respiratory parameters. In an equal dose (10 ml) Levobupivacaine (0.5%) has a faster onset (sensory and motor block) and longer duration (motor block and analgesia) as compared to Ropivacaine (0.5%). Due to long duration of motor block and analgesia of Levobupivacaine can be used as replacement for other local anaesthetic agent.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 787–790
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.20

Comparison of Clinical Performance of I-Gel With Proseal Laryngeal Mask Airway in Surgical Procedures

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Abstract

Context: LMA is devised as a substitute for the face mask and alternative for endotracheal Intubation. Aims: The objective of the study is to compare I-Gel and Proseal LMA. *Settings and Design:* Randomise prospective comparative study. *Methods and Material:* study was conducted on 72 patients of age group 18-60 years with ASA I /II of either sex, admitted for elective surgery done under GA. All patients were pre-medicated with i.v Glycopyrrolate and Fentanyl. Preoxygenated for 3 mins.Induced with i.v Propofol and Scoline. Group A- Proseal LMA Group B- I-Gel was inserted Statistical analysis used: The collected data was coded in excel spread sheet. Demographic data,was analyzed withunpaired independent student's T test. p values < 0.05 is considered statistically significant. Fisher's exact test or Chi-square was used to compare categorical data. *Results:* The mean airway leak pressure of the Proseal group was 30 cm H2O and significantly higher than I-Gel 23 cm H_2O. There was no statistical difference in the ease of insertion in both the devices. The overall success rate was 100%. The mean insertion time was significantly less for I-Gel (14s) when compared to Proseal (24s). The gastric tube could be inserted easily in all the cases The hemodynamic response was comparable between the two groups. *Conclusions:* We conclude that Proseal has a higher airway leak pressure of 30cm H20 compared to I-Gel (23cm H2O) enabling positive pressure ventilation at higher pressures and therefore for a wider spectrum of patients. However, I-Gel is better than Proseal in terms of faster and easier insertion.

Keywords: Airway Sealing Pressures, I-gel, Proseal

Introduction

How to cite this article:
S Arpitha Mary, Dinesh Krishnamurthy. Comparison of Clinical Performance of I-Gel With Proseal Laryngeal Mask Airway in Surgical Procedures. Indian J Anesth Analg. 2020;7(3):787–790.

The inventor of the "classic LMA", Dr. Archie Brain, devised it as a substitute for the face mask ventilation and Intubation.[1]

Compared to face mask ventilation it enables a relatively "hands-free" method for a leak-free airway and is also less probable to cause gastric insufflations which is a common complication with face mask ventilation.[2]

Securing the patients airway with an endotracheal tube is still the gold standard.[3]

However, this manoeuvre requires skills, continuous training, and practice and usually Requires Direct Laryngoscopy Producing Reflex Sympathetic Stimulation and Can Also Cause

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Received on 20.02.2020, **Accepted on** 16.03.2020

Laryngo - Pharyngeal Trauma.[4, 5]

For all these Reasons, The Asa Has Endorsed Lma as a Rescue Airway, and as a First-Line Airway Management in Those With Limited Airway Management Experience.

Due to the low-pressure seal of LMA when the airway pressure increases above the pharyngeal seal (during controlled ventilation), ventilating gas is lost, leading to a risk of hypoventilation, environmental pollution, and drug wastage.[6]

Equally important, a larger proportion of this leaking gas enters the oesophagus and stomach, likely increasing the risk of regurgitation and aspiration.[6]

To get over the above-said problems in the year 2000 Dr. Archie Brain designed the LMA Proseal with certain modifications targeted to separate Gastro-intestinal tract from the respiratory tract and to increase airway sealing pressure allowing positive pressure ventilation and airway protection.[7,8]

I-gel was developed by Dr. Mohammed Aslam Nasir. Its non-inflatable cuff is soft, gel like and is anatomically designed to fit in the supraglottic space.[9, 10]

A gastric tube channel is placed lateral to the airway.

This study was outlined to practically compare the performance of I-gel and Proseal LMA in elective surgeries.

Aims and Objectives

The objectives of the current study are to compare two supraglottic airway devices, I-gel and LMA Proseal in patients posted for elective surgeries under General Anesthesia in terms of:

1. Airway leak pressure.
2. Number of attempts for insertion.
3. Time taken for the device placement.
4. Ease of insertion of gastric drain tube.
5. Hemodynamic changes.

Materials and Methods

A randomized prospective study was conducted on 72 patients of age group 18-60 years with ASA I /II of either sex, admitted for elective surgery done under GA. All patients were pre-medicated with i.v Glycopyrrolate and Fentanyl. Preoxygenated for 3 Mins. Induced with i.v Propofol and i.v. Succinylcholine.

In group A- Proseal LMA was inserted

In group B- I-Gel was inserted

Statistical analysis used

The collected data was coded in excel spread sheet.

Demographic data,was analysed withunpaired independent student's T test. p values < 0.05 is considered statistically significant.

Fisher's exact test or Chi-square was used to compare categorical data.

Qualitative data is presented in the form of Proportions and pie diagrams, barcharts is used to represent graphically.

Quantitative data is presented as meanand standard deviation.

Results

The mean age, Gender and BMI distribution in both groupswere comparable and there was no statistically significant difference between.

The mean airway pressure in the Proseal group was 30.75cm H_2O compared to 23.28cm H_2O in the I-Gel group. The p-value was <0.001 and is statistically significant (Table 1).

The mean insertion time for Proseal placement was 26.17 compared to 14.33 in the I-Gel group. The *p*-value in <0.001 and is statistically significant (Table 2).

In both, Proseal and I-Gel group the placement of the airway device was done successfully in the first attempt. Effective ventilation was possible in all cases.

Out of the 36 cases, the drainage tube could be easily inserted in all the cases in Proseal group grading it easy. In the I-Gel group also drainage tube could be easily inserted in the first attempt in all the 36 cases. In none of the cases, was there any failure to insert it (Tables 3 and 4).

When compared between the two groups, there was no statistically significant difference in terms of Pulse rate, Systolic, Diastolic or Mean Arterial Blood Pressure and Arterial saturation (Figs. 1-4).

Table 1: Airway Leak Pressure Distribution in between the two groups

Airway leak pressure (cm H_2O)	Proseal	I-GEL
11-20	0	11
21-30	19	23
31-40	17	2
Total	36	36
Mean ± SD	30.75±4.38	23.28±4.26

Table 2: Insertion Time Distribution in between the two groups

Insertion Time(s)	Proseal	I GEL
1-10	0	1
11-20	0	35
21-30	30	0
31-40	6	0
Total	36	36
Mean ± SD	26.17±3.33	14.33±2.23

Table 3: Insertion Attempts in between the two groups

Insertion Attempts	Proseal	I GEL
Nil	0	0
1	36(100%)	36(100%)
Total	36	36

Table 4: Ease Of Insertion of Gastric Drainage Tube in between the two groups

Group	Number	Easy	Difficult	Failure
Proseal	36	36	0	0
I-Gel	36	36	0	0

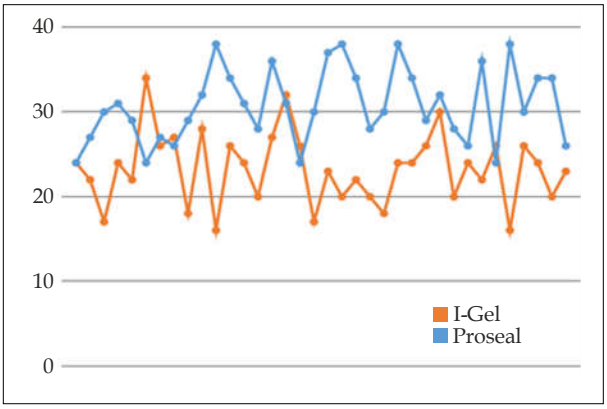

Fig. 1: Graph of airway sealing pressure between the two groups.

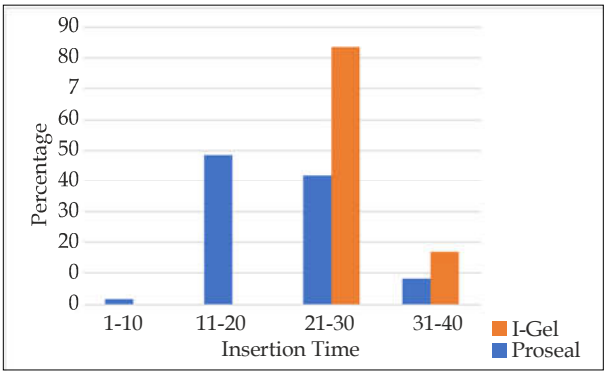

Fig. 2: Graph of Insertion time of LMA between the two groups

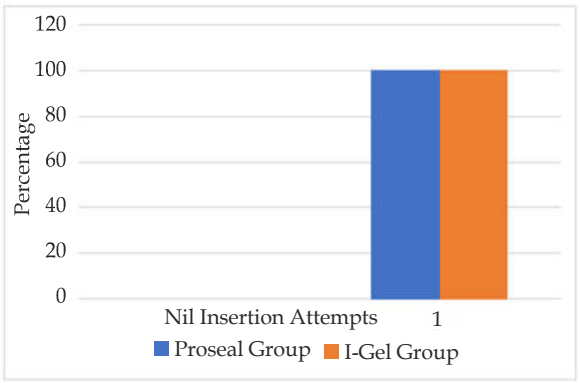

Fig. 3: Graph of insertion attempts between the two groups

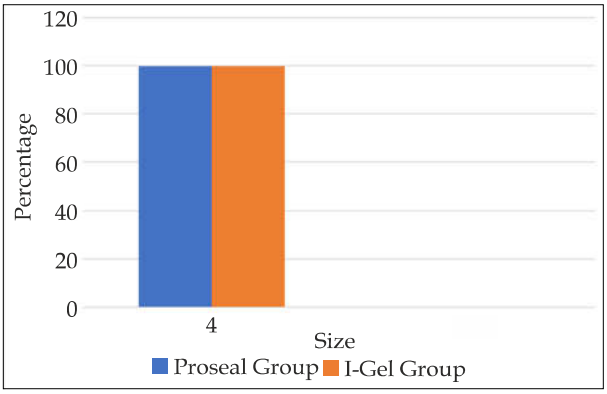

Fig. 4: Graph of Ease of Insertion of NG tube between the two groups

Discussion

In our study the mean age, weight, BMI and sex ratio were comparable among both the groups.

The mean airway leak pressure of the Proseal group was 30 cm H_2O and was significantly higher than I-gel-23 cm H_2O.

The large capacity of Proseal may result in the increased seal pressure by enabling the walls of the cuff to conform with the contours of the pharyngo-laryngeal structures more effectively.[12]

Its potential advantages include minimal risk of tissue compression whereas supraglottic devices with inflatable cuff can absorb anaesthetic gases leading to increased mucosal pressure.[13]

Some studies showed that the sealing pressure of I-Gel improved over time probably due to the warming of the thermoplastic cuff to the body temperature which was not compared in this study.[14]

In our study there was no statistical difference in

the ease of insertion in both the devices. The overall success rate was 100%.

But studies like Singh A et al. showed I-Gel was easier to insert and this may be because the I-Gel insertion does not require the finger into the oral cavity as the device is simply pushed into place.

Single attempt was sufficient to insert both the devices.

This may be due to our prior experience with the devices.

In our study the mean insertion time was significantly less for I-Gel (14s).

In one study it reasoned this difference due to no cuff inflation requirement in the I-gel consequently shorter time required to achieve an effective airway.[14]

Similar studies done showed the gastric tube could be inserted easily in all the cases of both the group in our study.[15]

The hemodynamic response recorded at insertion and at one, three, and five minutes was comparable between the groups, with no statistical significance.

Conclusion

Based on the results of our study we conclude that Proseal has a higher airway sealing pressure of 30cm H_2O enabling positive pressure ventilation at higher pressures and therefore for a wider spectrum of patients when compared to I-Gel which has an acceptable airway leak pressure of 23cm H_2O. However, I-Gel is better than Proseal in terms of easy and faster insertion better suited as for rescue ventilation.

Key Messages: Proseal must be preferred when ventilating a patient in surgical procedures whereas I-gel is better as a rescue device**.**

Conflict of Interest: Nil

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 791–797
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.21

A Comparative Study of Mixture of Clonidine - Fentanyl Compared to Clonidine Alone as an Adjuvant to Intrathecal Hyperbaric Bupivacaine Under Spinal Anaesthesia for Infraumbilical Surgeries

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Abstract

Aims: Use of adjuvant drug along with inj. Bupivacaine for spinal anaesthesia is a well know modality & is being practiced to increase duration of anaesthesia & postoperative analgesia. The present study is carried out to study Clonidine + Fentanyl vs. only Clonidine when used as adjuvant to Bupivacaine increases the duration of spinal analgesia. Also the study was conducted to note the side effects of the adjuvant drugs when used for spinal anaesthesia *Methods:* It was a prospective, randomized, double-blind study, 60 ASA grade I-II patients (30 in each group), who were scheduled for elective infra-umbilical surgery under spinal anesthesia were recruited. Group- M patients received hyperbaric Bupivacaine (2.5ml) + Clonidine 30µg for spinal anaesthesia. Group- C patients received Bupivacaine (0.5%) 2.5ml + fentanyl (15µg) + Clonidine (15µg). The total volume of intra-thecal drug along with adjuvant drugs was constant (i.e. 3 ml, by adding normal saline) in both the groups. Onset and duration of sensory, motor block, effective analgesia, hemodynamic profile, post-operative pain score and side effects if any were recorded. *Results:* Duration of analgesia and duration of sensory and motor block were significantly longer in Group- C (165.02 ± 12.72 min) as compared to Group- M (130.78 ± 5.95 min). Haemodynamic profile showed significant low HR and MAP at certain time intervals in the Group- M as compared to Group- C. Patients of Group- M showed a significantly ($p < 0.05$) higher level of VAS as compared to Group- C at 60 min, 90 min and 120 min interval time. *Conclusion:* Low dose of Clonidine (15mcg) + Fentanyl (15mcg) as an adjuvant to intra-thecal %0.5 Bupivacaine for spinal anaesthesia produced prolonged post-operative analgesia in patients undergoing infra-umbilical surgeries with stable haemodynmics.

Keywords: Clonidine, Clonidine+Fentanyl as adjuvants, Hyperbaric Bupivacaine, Spinal anaesthesia, Infra-umbilical surgeries.

How to cite this article:

Sathesha M, Vandana Hebballi, Sathish Kumar. A Comparative Study of Mixture of Clonidine - Fntany Compared to Clonidine Alone as Adjuvant Intrathecal Hyperbaric Bupivacaine Under Spinal Anaesthesia for Infraumbilical Surgeries. Indian J Anesth Analg. 2020;7(3):791–797.

Introduction

Surgeries below umbilicus (Infra-umbilical surgeries- Lower abdominal surgeries) and lower limb surgeries may be performed under local, regional, or general anaesthesia. Spinal anaesthesia is still the first choice of anaesthesiologists. Local anaesthestic Bupivacaine is the commonest drug used for spinal anaesthesia but its relatively shorter duration of action may lead to early rescue analgesic intervention in the post-operative period.[1] Many adjuvants were being added to local spinal anaesthetic drug for spinal anaesthesia to provide intraoperative as well as post-operative analgesia & to increase the duration of postoperative analgesia. Opioids are commonly used as intrathecal adjuvants

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Received on 13.02.2020, **Accepted on** 16.03.2020

to improve the quality of intraoperative analgesia and to prolong the post-operative analgesia period without significant motor or autonomic blockade. Among them Fentanyl is one of the most common adjuvant used.[2] Clonidine has been used as an adjuvant for regional anesthesia in various settings, including spinal anesthesia as a sole agent as well as in combination with opioids along with local anesthetics for labor analgesia, gynecological surgeries and in other surgeries too.[3] Most of the studies have used clonidine in the dose range of 75µg and above. In higher doses, Clonidine causes side effects e.g. Hypotension and bradycardia. Because of these clinically relevant side effects, there is a tendency to use the smaller doses of clonidine. By using low dose Clonidine and Fentanyl with Bupivacaine for spinal anaesthesia, the incidence of adverse effects/ side effects could be reduced.[4]

We have conducted the present study to evaluate and compare efficacy of addition of low dose Clonidine + Fentanyl vs. Clonidine alone added to Bupivacaine as adjuvants for spinal anaesthesia in patients posted for elective infra-umbilical surgeries.

Material and Methods

Inclusion Criteria

(a) Patients who are willing to give written informed consent

(b) Patients posted for infraumbilical surgeries.

(c) Age group 18- 60 years, of either sex.

(d) American Society of Anaesthesiologists (ASA) grade 1 and 2

(e) Weight 50-80kg.

(f) Height 150cm to 180cm.

Exclusion Criteria

(a) No consent

(b) Allergy to local anesthetics, opioids and clonidine.

(c) Uncontrolled diabetes mellitus, hypertension, recent myocardial infarction.

(d) Pregnancy.

(e) Contraindications/relative contraindications to spinal anaesthesia.

(f) Hypovolemic shock, Bleeding diathesis and coagulopathy.

(g) Psychiatric disorder.

Sixty patients of physical status- ASA grade-1and grade-2 of either sex, undergoing infra-umbilical surgeries lasting more than 30 minutes fulfilling inclusion criteria were included in the study after ethical committee clearance. Preoperative evaluation of the patient was done a day before the surgery day. On explaining the procedure, written and informed consent was obtained. Patients were randomized in to two groups: Group- M & Group- C of 30 patients in each group & these patients received the intrathecal drugs for spinal anaesthesia as follows:

1. Group- M: (n=30) received Bupivacaine (0.5% heavy) 2.5ml with Clonidine 30µg. [Total volume of spinal anaesthetic drug to be deposited was 3ml. The diluent used was normal saline to make the total volume of spinal drug= 3ml]
2. Group- C: (n=30) received Bupivacaine (0.5% heavy) 2.5ml with Clonidine 15µg + Fentanyl 15µg. [Total volume of spinal anaesthetic drug to be deposited was 3ml. The diluent used was normal saline to make the total volume of spinal drug= 3ml]

All patients' were given orally tablet Alprazolam 0.5mg and tablet Ranitidine 150mg a night before the day of surgery. All Patients were kept 6-8 hrs fasting overnight prior to surgery. In the operating room, intravenous line was secured with 18G cannula. Baseline heart rate (HR), non-invasive systolic and diastolic blood pressures (SBP, DBP), percentage of oxygen saturation (SpO2), respiratory rate (RR) and electrocardiogram (ECG) was recorded using multi-parameter monitor. Each patient was preloaded with 500ml of ringer's lactate solution. Later injection Ranitidine 50mg IV was administered. Under strict aseptic precautions the drug under study was injected over a period of 10-15 seconds into subarachnoid space at L3-L4 intervertebral level with sterile 26G Quincke spinal needle & patient in lateral position. The time at which injection was completed was noted as zero time of the study and all measurements were recorded from this point.

Following the subarachnoid block, onset of sensory loss was assessed by loss of pinprick sensation using 23G sterile hypodermic needle and dermatomal levels were tested every 2 minutes until the highest level was achieved and later no change in the highest level for four consecutive tests. Intraoperatively, vital parameters e.g. heart rate, non-invasive blood pressure and oxygen saturation were recorded every 2minute for the first 10 minutes; then every 5minutes till 1hour; then every 15 minutes till the completion of surgery

& postoperatively, every 1hour till the patient complaints of pain. A 20% or more fall in systolic blood pressure from baseline, was managed with intravenous fluids and intravenous Injection ephedrine 6mg and heart rate less than 60 beats per min from baseline was treated with intravenous Injection atropine 0.6 mg.

Post-operatively, the haemodynamic variables and oxygen saturation were recorded in the post anaesthesia care unit (PACU) until complete recovery from sensory and motor blockade. The incidence of adverse events such as hypotension, bradycardia, shivering, nausea, vomiting, pruritus, respiratory depression were noted and treated accordingly.

Results

In the study there was no significant difference in mean age, weight, Height and BMI between two groups (Table 1 and Fig .1).

In the study there was clinically and statistically significant difference in mean 2 Dermatome Sensory Block Regression Time, Total Duration of Sensory Block, Duration of Motor Block and Time For First Analgesic Dose between two groups. All

Table 1: Mean Age,Weight and Height and BMI Comparison Between Two Groups

	Group						*p* value
	Group C		Group M		Total		
	Mean	SD	Mean	SD	Mean	SD	
Age	41.11	7.12	41.07	6.72	41.09	6.88	0.976
Weight (Kg)	62.71	8.18	61.67	6.73	62.19	7.47	0.510
Height (M)	1.60	.05	1.61	.05	1.60	.05	0.324
BMI	24.54	2.59	23.83	2.10	24.18	2.37	0.159

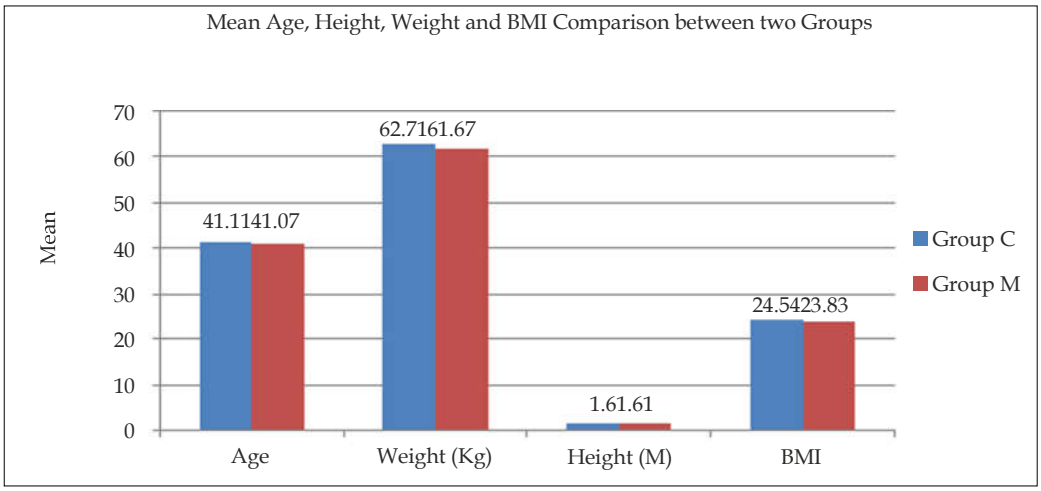

Fig. 1: Bar diagram showing mean age, height, weight and BMI Comparison between two groups

Table 2: Mean of Dermatome Sensory Block Regression Time, Total Duration of Sensory Block, Duration of Motor Block, Time For First Analgesic Dose Comparison between two groups

	Group						*p* Value
	Group C		Group M		Total		
	Mean	SD	Mean	SD	Mean	SD	
2 Dermatome Sensory Block Regression Time (Minute)	122.49	9.76	103.44	8.01	112.97	13.06	< 0.001*
Total Duration Of Sensory Block (Minute)	165.02	12.72	130.78	5.95	147.90	19.85	< 0.001*
Duration Of Motor Block (Minutes)	208.27	21.39	144.00	6.78	176.13	35.96	< 0.001*
Time For First Analgesic Dose (Minutes)	176.29	14.45	140.76	16.17	158.52	23.49	< 0.001*

the above parameters were significantly higher in Group C compared to Group M. (Table 2 and Fig. 2)

In the study there was significant difference in mean HR between two groups from 8 min to 105 min. At these intervals mean HR was significantly lower in Group M compared to Group C. At other intervals there was no significant difference in mean HR between two groups (Table 3 and Fig. 3).

Comparison of Mean Arterial Pressure Between Two Groups

In the study there was significant difference in mean MAP between two groups at 10min and 24hr post op. At these intervals mean MAP was significantly

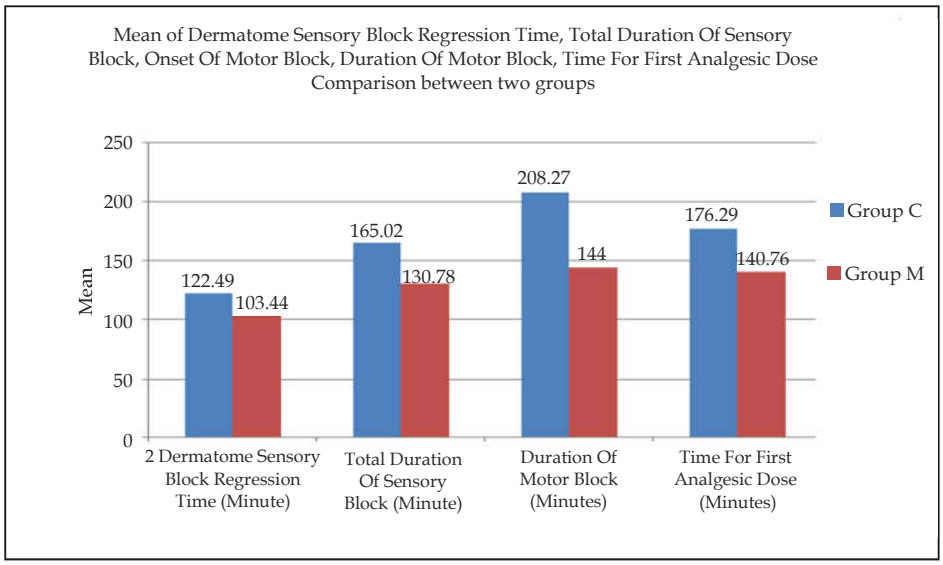

Fig. 2: Bar diagram showing mean of dermatome sensory block regression time, total duration Of sensory block, onset and duration of motor block, time for first analgesic dose comparison between two groups in study subjects.

Table 3: Heart Rate comparison between two groups

Pulse	Group				*p* Value
	Group M		Group C		
	Mean	SD	Mean	SD	
Baseline	83.18	8.28	83.58	9.02	0.827
2min	83.13	7.23	82.51	8.67	0.712
4min	79.69	7.08	80.56	7.87	0.584
6min	77.22	7.41	79.31	7.98	0.202
8min	75.04	7.25	78.82	8.69	0.028*
10min	72.24	7.20	77.38	8.20	0.002*
15min	70.04	7.47	76.27	8.80	0.001*
20min	68.04	8.05	75.87	9.58	< 0.001*
25min	65.89	8.41	75.98	9.27	< 0.001*
30min	64.51	8.12	76.78	9.16	< 0.001*
35min	63.68	8.47	76.14	9.40	< 0.001*
40min	62.53	8.68	75.02	7.51	< 0.001*
45min	62.26	8.44	75.42	7.46	< 0.001*
50min	62.45	9.20	73.76	8.38	< 0.001*
55min	61.70	7.46	76.10	9.18	< 0.001*
60min	61.31	6.28	76.18	8.18	< 0.001*
75min	61.55	6.12	74.50	8.02	< 0.001*
90min	61.47	6.38	75.92	4.80	< 0.001*
105min	64.50	8.47	76.57	3.64	0.004*
120min	62.40	7.70	63.00	1.41	0.921
Immediate Post Op	71.29	8.98	70.98	7.26	0.857
1hr	71.64	9.43	71.51	5.91	0.936

Pulse	Group				*p* Value
	Group M		Group C		
	Mean	SD	Mean	SD	
2hr	74.44	6.49	73.56	6.28	0.511
3hr	73.82	6.41	75.18	6.18	0.310
4hr	76.16	4.72	77.64	6.45	0.215
8hr	78.98	5.73	79.27	6.91	0.830
12hr	77.49	6.10	80.18	6.95	0.054
16hr	80.71	6.59	81.22	8.69	0.754
20hr	82.33	6.39	82.47	9.23	0.937
24hr	82.56	6.97	83.71	9.19	0.503

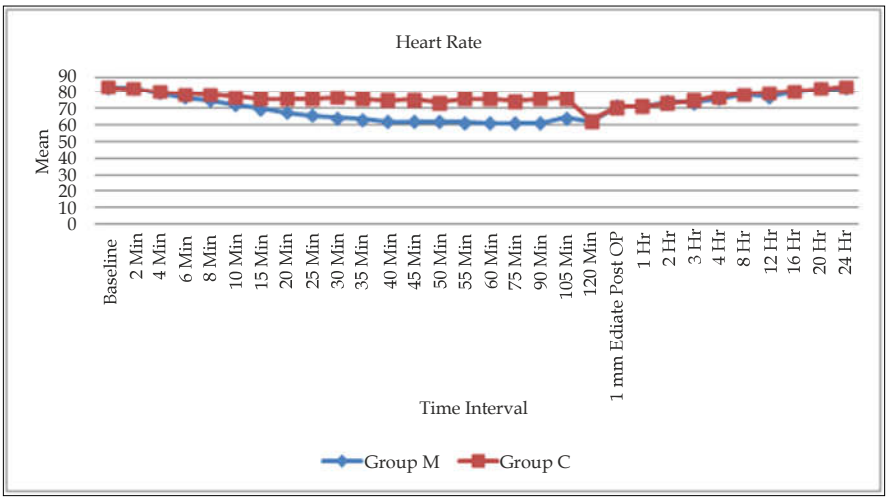

Fig. 3: Line diagram showing mean heart rate comparison between two groups at different time interval in study subjects

lower in Group M compared to Group C. At other intervals there was no significant difference in mean MAP between two groups (Fig. 4).

In the study there was significant difference in mean VAS score between two groups from immediate post op to 24 hr post op period. Mean VAS score was higher in Group M from Immediate post op to 6 hr from 12 hr to 24 hr Mean compared to group C (Table 4 and Fig. 5).

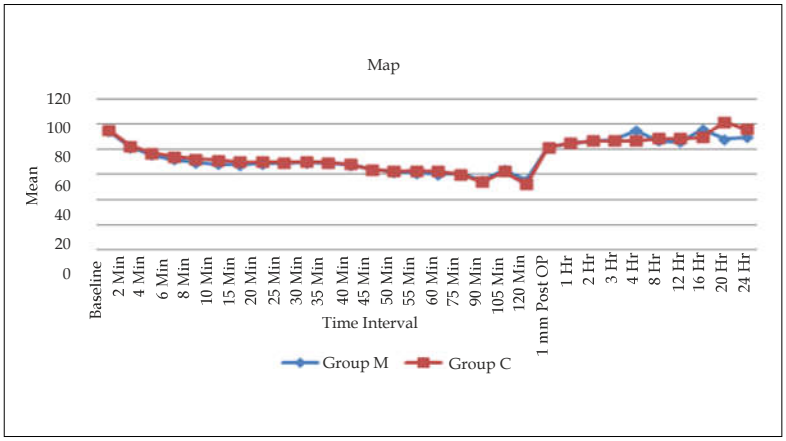

Fig. 4: Line diagram showing Mean MAP Comparison between two groups at different time interval.

Table 4: Visual Analogue Scale Score (Vas)

VAS Score	Group				P Value
	Group C		Group M		
	Mean	SD	Mean	SD	
Immediate Post Operative	.22	.42	.62	.75	0.002*
1hr	1.93	.65	2.71	.97	< 0.001*
2hr	3.02	.92	4.78	1.02	< 0.001*
6hr	6.20	.73	6.49	.51	0.031*
12hr	5.73	.84	5.40	.58	0.031*
24hr	5.64	.91	5.24	.53	0.012*

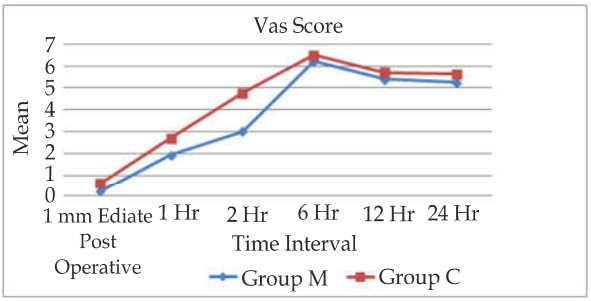

Fig. 5: Line Diagram Showing Mean Vas Score Comparison Between two Groups in Study Subjects

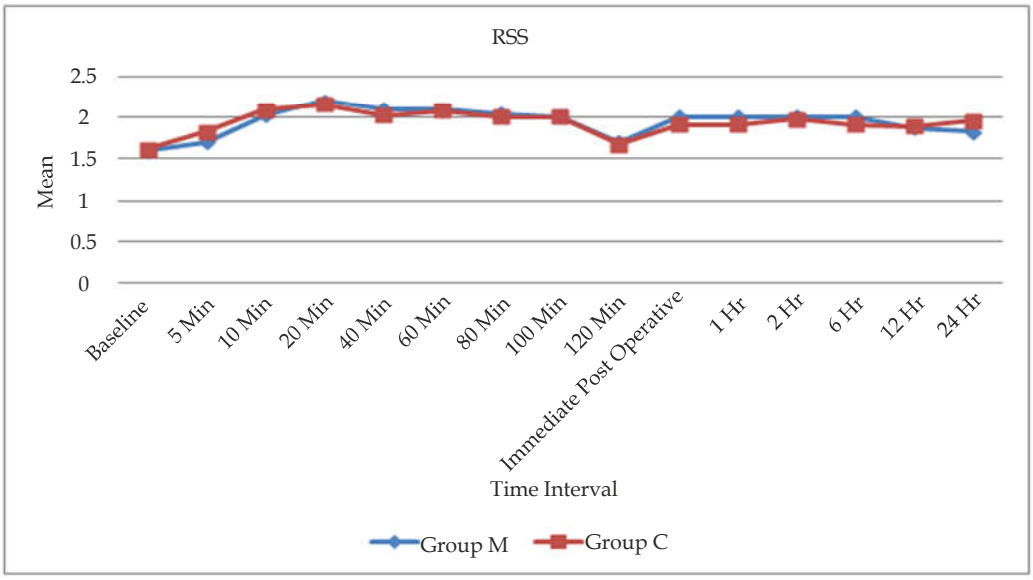

Fig. 6: Line diagram showing Mean Ramsey Sedation Score Comparison between two groups at different time interval

Discussion

Opioids are commonly used as intrathecal adjuvants to improve the quality of intraoperative analgesia and prolong it in post-operative period without significant motor or autonomic blockade.[5]

Fentanyl is a potent, short acting, highly lipophilic, synthetic opioid. It has been commonly used as an adjuvant for postoperative analgesia in neuraxial block.

Clonidine is a selective partial alpha2 adrenergic agonist. It inhibits the central transmission of nociceptive impulses probably by affecting descending noradrenergic tract in spinal cord that plays an important role in pain modulation by a non-opioid mechanism. The analgesic effect of clonidine is also believed to result from inhibition of release of substance P which inhibits the cGMP for its analgesic effect.[6] But Clonidine in higher doses can cause hypotension and bradycardia. A marked decrease in arterial blood pressure (BP) was observed with 75µg of intrathecal clonidine.[4] Addition of intrathecal clonidine 150mcg, decreased MAP significantly as compared with plain bupivacaine. However, in the dose range of 150–450µg, clonidine causes marked sedation.[7]

Because of this side effect associated with higher doses of clonidine there is a tendency toward the use of smaller doses. Such doses of clonidine producing only minimal side effects would be a true alternative to other technical or pharmacological procedures aimed at prolonging spinal anesthesia and analgesia. In our study we have used very low dose of clonidine and fentanyl as adjuvant, we didn't observe any side effects of any significant hemodynamic variations which requires treatment. Ahmed, et al. conducted study on combination of Clonidine (25µg)–fentanyl (25µg) combination with intrathecal bupivacaine for postoperative analgesia and concluded that duration of postoperative analgesia prolonged with

good haemodynamic stability and non-significant adverse effects.[2]

In our study also combination of Clonidine (15 µg)- Fentanyl (15 µg) with intrathecal bupivacaine was used and showed prolonged post-operative analgesia with good haemodynamic stability. Chopra P. at al. conducted study on low dose intrathecal clonidine and fentanyl added to hyperbaric bupivacaine for prolongation of analgesic effect in gynecological surgery. They found out that low dose (30µg) Clonidine and Fentanyl (25µg) mixture added to bupivacaine increases duration of analgesic effect compared to clonidine and bupivacaine group.[3] In our study, we had similar observations to above one and we have used Clonidine 15µg + Fentanyl 15µg in one group with Bupivacaine and Clonidine 30µg in other group with Bupivacaine. Combination of Clonidine and Fentanyl group showed slight prolongation of analgesic effect.

Benhamou D, et al. conducted study on intrathecal Clonidine and Fentanyl with hyperbaric Bupivacaine improves analgesia during caesarean section. They found improved intraoperative analgesia by adding clonidine to bupivacaine, combination of Clonidine and Fentanyl further improved analgesia with no increase in side effects.[8] Our study was similar to above study, combination of Clonidine-Fentanyl showed slight prolonged analgesia with very less side effects. The haemodynamic stability was observed in both the groups.

Conclusion

For spinal anaesthesia, a low dose combination of Clonidine (15mcg) + Fentanyl (15mcg) as an adjuvant to intrathecal 0.5% Bupivacaine (heavy) shown to have prolonged postoperative analgesia in patients undergoing infra-umbilical surgeries with stable haemodynamic parameters

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 798–803
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.22

Comparative Study of Ultrasound Guided PENG [Pericapsular Nerve Group] Block and FIB [Fascia Iliaca Block] for Positioning and Postoperative Analgesia Prior to Spinal Anaesthesia for Hip Surgeries: Prospective Randomized Comparative Clinical Study

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Abstract

Introduction: Extreme pain in hip fractures does not allow ideal positioning for spinal anesthesia. Adequate pain relief before spinal anesthesia will enhance patient's cooperation. We evaluated the analgesic efficacy of ultrasound guided PENG block and FIB for positioning and post operative pain relief in hip surgeries. *Methods:* This was a prospective, randomized, double blind study that included 60 patients aged 18-80 years of either sex belonging to ASA I to III undergoing hip surgeries. *Group P [n=30]* [USG guided Peng Block] **-** 25ml of 0.25% Ropivacaine *Group F [n=30]* [USG guided Fascia Iliaca Block} - 25ml of 0.25% Ropivacaine. Pain scores after the block, during positioning and post-operative period, opioid consumption and side effects if any were recorded. Statistical analysis done using student t test, chi-square test. Pvalue of < 0.05 was considered significant. *Results:* In Group P, mean VAS before block was 7.8 ± 0.47 which reduced to 0.6 ± 0.4 during positioning which is statistically significant (P<0.001), whereas in Group F, mean VAS before block was 7.6 ± 0.4 which reduced to 2.6 ±- 1.2 during positioning. Duration of postoperative analgesia was comparable between the two groups. (490.4 ± 40.8 minutes in group P and 470 ± 40.48 minutes in group F) *Conclusion:* In Hip fractures, PENG block produces more effective analgesia for positioning and postoperative pain than Fascia iliaca block without any significant side effects.

Key words: Ultrasound, Pericapsular nerve group block, Fascia iliaca block, Hip surgeries

How to cite this article:

K Shankar, Srinivasan Rangalakshmi, AB Ashwin, et al. Comparative Study of Ultrasound Guided PENG [Pericapsular Nerve Group] Block and FIB [Fascia Iliaca Block] for Positioning and Postoperative Analgesia Prior to Spinal Anaesthesia for Hip Surgeries: Prospective Randomized Comparative Clinical Study. Indian J Anesth Analg. 2020;7(3):798-803.

Introduction:

Hip fractures are common orthopaedic problem especially in elderly population which is associated with significant morbidity and mortality[1]. Early surgical reduction and fixation is the preferred treatment in most patients[2]. Spinal anaesthesia is the most common mode of anaesthesia used to fix these fractures[3]. Extreme pain due to fracture does not allow ideal positioning for these procedures[4] and hence a problem to access the subarachnoid space. Inadequate postoperative analgesia can restrict the limb mobility thereby delaying recovery along with increased consumption of opioids. Effective perioperative analgesia that reduces the requirement of opioids and its adverse effects is essential in this population[5]. Lower extremity

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Received on 31.01.2020**, Accepted on** 29.02.2020

peripheral nerve blocks like femoral nerve (FN) block, fascia iliaca block (FIB), and 3-in-1 FN block are popular analgesic techniques mainly due to their opioid-sparing effects and reduction in opioid-related adverse effects[6-8]. Analgesia from these blocks is only moderate[9], and literature suggests that the articular branches of these nerves are inconsistently blocked[10,11]. The anterior hip capsule is innervated by articular branches of femoral nerve, obturator nerve and accessory obturator nerve (AON) as reported by previous anatomic studies, suggesting that these nerves should be the main targets for hip analgesia, which can be blocked by Peri-capsular nerve group (PENG) block[12-17]. Using this information, we conducted this study to evaluate the efficacy of Ultrasound guided PENG block for positioning & post-operative analgesia for hip surgeries in comparison with Ultrasound guided Fascia iliaca block.

Material and Methods

After conducting a pilot study, effect size (d) of 1.5 in VAS was obtained. Considering standard deviation of 2, power as 80%, alpha error of 0.05, 27 patients per group was obtained. To avoid study errors, attrition, sample size of 60 with 30 patients in each group was considered. Prospective randomized double blind comparative study was conducted after obtaining institutional ethical committee approval and informed written consent of the patients. 60 patients of either sex aged between 18-80 years with American Society of Anaesthesiologists (ASA) physical status I-III posted for elective surgery for hip fracture under spinal anaesthesia but unable to sit due to pain were included in the study. Patients who could sit comfortably, refusing to participate in the study, local anaesthetic allergy, coagulopathy, infection at the site of block, neurological deficits, on other analgesics upto 8 hrs before performing nerve block, neuropsychiatric disorders were excluded. Emergency resuscitation equipment and drugs, preparation for general anaesthesia and ultrasound equipment for the nerve block were kept ready. On arrival to the operation theatre an intravenous line was secured. Pain assessment was done using visual analog scale (0 = no pain, 10 = maximum pain). VAS score before performing the block was noted both at rest and during dynamic hip movement (Elevating the affected limb 15^0 above the table). The anaesthetist performing the block was not blinded to the procedure, the patient and assessor of visual analog scale were blinded to group allocation. Patients were randomly divided into two groups of 30 each using sealed opaque envelope method. Regional block was performed with the patient in supine position. The site to be blocked was painted with 5% povidone iodine followed by 70% ethyl alcohol and draped. Linear high-frequency ultrasound probe (7 –15 mhz) was initially placed in a transverse plane over the anterior superior iliac spine (ASIS) and then aligned to identify the following landmarks:

Group P [Peng Block]- received Ropivacaine 0.25% 25ml. Landmarks included Anterior inferior iliac spine, ilio-pubic eminence, iliopsoas muscle and tendon, the femoral artery, and Pectineus muscle. Point of injection was musculofascial plane between the psoas tendon and ilio-pubic eminence.

Group F [Fascia Iliaca Block] – received Ropivacaine 0.25% 25ml. Landmarks included Internal oblique muscle, sartorius muscle, iliacus muscle and bone, fascia lata, fascia iliaca. Point of injection was between fascia iliaca and iliacus muscle.

VAS score before and 30 minutes after the block both at rest and during dynamic hip movement along with vital parameters-heart rate (HR), mean arterial pressure (MAP) by non-invasive blood pressure and oxygen saturation (SpO_2) were monitored. Because most patients with hip fracture are elderly, difficult spinal anaesthesia was anticipated, so after the block, all patients were positioned in sitting position for spinal anaesthesia and VAS score was noted at the time of positioning. If any patient of either group reported pain score of ≥ 4 during positioning, IV fentanyl 0.5microgram/kg was given every 5minute until the pain score is <4 or maximum dose of 3microgram/kg was given (whichever was earlier); patients who could not achieve pain score < 4 were excluded from the study. Quality of patient positioning was assessed by the anaesthetist giving spinal anaesthesia (0 = not satisfactory, 1 = satisfactory, 2 = good, 3 = optimal). Patient acceptance (yes/no) about positioning was noted. Spinal anaesthesia was given in sitting position in either midline/paramedian approach at the L3/4 or L4/5 level, with bupivacaine 0.5 % heavy 3ml (15mg) using 25G Quincke needle. Vital parameters was noted at regular intervals. Patient was shifted to post anaesthesia care unit (PACU) after the surgery. VAS scores were recorded at 0, 30min, 1hr, 4hr, 12 and 24 hrs along with vital parameters. Time of mobility was noted. Duration of analgesia was calculated from the time of giving the block till VAS score was ≥ 4. Tramadol 1mg/kg IV was given as rescue analgesic if VAS ≥ 4 in postoperative period. Total consumption of tramadol in first 24 hrs was noted. Complications if any were documented and appropriately treated.

Statistical Methods

Student T test was used to compare nominal data. Chisquare test was used to compare categorical data. *p* value of ≤0.05 was considered significant. All the statistical analysis was done using SSPS software V 22.0.

Results

60 patients were included in the current study. The demographic data of both the groups are presented in Table 1. There was no statistically significant difference in both groups with respect to demographic characteristics

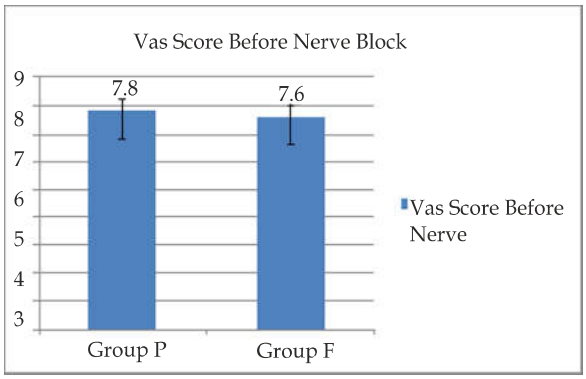
VAS score for pain before nerve block between Group P (7.8 ± 0.47) and Group F (7.6 ± 0.4) was comparable (*p* = 0.9356) (Table 2, Graph 1). VAS score 30minutes after performing the block at rest and during dynamic hip movement as well as during positioning before spinal anaesthesia was significantly less in Group P (0.6 ± 0.4) when compared to Group F (2.6 ± 1.2) (Table 2, Graph 2). Quality of patient positioning for spinal anaesthesia was higher in group P (2.348 ± 0.504) versus group F (1.754 ± 0.95) (*p* = 0.003) (Table 3). Patient acceptance was better in group P (27/3 versus 14/16) [Table 3]. No patient required additional doses of fentanyl in both the groups (Table 3).

Table 1: Demographic characteristics

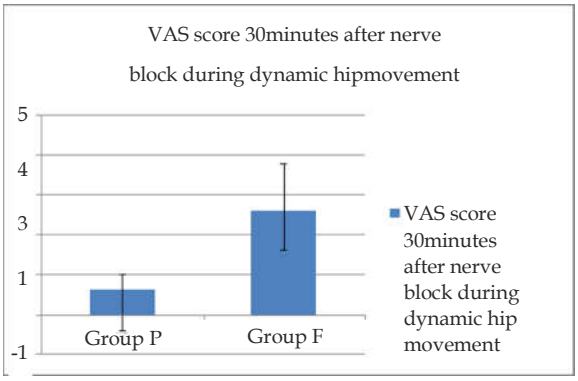
	Group P (n=30)	Group F (n=30)	*p* Value
Age(years)	53.58±19.95	49.54±21.61	0.4549
Weight(kg)	60.8±13.7	62.7±10.4	0.5475
Male	20	21	0.2344
Female	10	19	
ASA I	6	7	
II	19	20	0.7399
III	5	3	
Fracture neck of femur	11	7	0.4458
Inter trochanteric fracture	14	15	0.4458
Proximal femur fracture	5	8	0.4458

Table 2: VAS scores, mean reduction in pain

	Group P	Group F	*p* Value
VAS score before nerve block	7.8 ± 0.47	7.6 ± 0.4	0.9356
VAS score 30minutes after nerve block at rest	0.6 ± 0.4	2.6 ± 1.2	<0.001***
VAS score 30minutes after nerve block during dynamic hip movement	0.6 ± 0.4	2.6 ± 1.2	<0.001***
VAS score 30minutes after nerve block during positioning	0.6 ± 0.4	2.6 ± 1.2	<0.001***
Mean reduction in pain	7.2 ± 0.7	5 ± 0.8	<0.001***



Graph 1: VAS score before nerve block



Graph 2: VAS score 30minutes after block placement

Table 3: Quality of patient positioning, patient acceptance, additional fentanyl doses required

	Group P	Group F	*p* value
Quality of patient positioning	2.348 ± 0.504	1.754 ± 0.95	0.003***
Patient acceptance (yes/no)	27/3	14/16	
Additional fentanyl requirement	Nil	nil	

Haemodynamic variables i.e., heart rate, mean arterial pressure, SpO_2 were compared in both groups which is shown in Table 4.

Table 4: Vital parameters before nerve block and during positioning

Vital parameters	Group P	Group F	*p* value
Heart rate	76.88 ± 9.6	78.68 ± 9.5	0.4683
Baseline	76.08 ± 8.6	78.48 ± 8.4	0.2787
At positioning			
Mean arterial pressure	88.26 ± 5.5	85.8 ± 9.7	0.2318
Baseline	88.13 ± 5.9	84.5 ± 9.1	0.072
At positioning			
SpO2	97.21 ± 0.93	97.17 ± 1.17	0.892
Baseline	97.4 ± 0.4	97.1 ± 0.4	0.4750
At positioning			

Table 5: VAS score in postoperative period

Parameter	0min	30min	1hr	4hr	12hr	24hr
Group P	0.06 ± 0.24	1.45 ± 0.6	1.55 ± 0.69	2.46 ± 1.07	6.14 ± 0.95	6.3 ± 0.8
Group F	0.8 ± 0.27	1.7 ± 0.47	1.8 ± 0.41	2.16 ± 0.91	6.4 ± 1.01	6.5 ± 0.9
p value	0.4	0.52	0.572	0.23	0.18	0.25

Table 6: Duration of postoperative analgesia

Parameter	Group P	Group F	*p* value
Duration of postoperative analgesia	490 ± 40.8	470.8 ± 40.48	0.072

Table 7. Total analgesic in 1st 24 hrs, time to mobility, complications

Parameters	Group P	Group F	*p* value
Total analgesic required in 1st 24hrs	0.8 +/- 0.38	0.9 +/- 0.35	0.2935
Time of mobility	Within 6hrs	Within 6hrs	
Complications	Nil	Nil	

There was no significant difference in VAS scores in postoperative period (Table 5).

There was no significant difference in duration of postoperative analgesia (Table 6). Total analgesic consumption in 1st 24hrs between group P and group F (Table 7).

All patients were mobilised within 6hrs after the surgery and no complications were noted in both the groups.

Discussion

Hip fractures are common orthopaedic problem following trauma in elderly patients[1]. Early fixation of these fractures is essential to prevent fat embolism and other complications of hip fracture. Central neuraxial block such as spinal anaesthesia is commonly used for providing anaesthesia to repair these fractures[3]. This technique has many advantages over general anaesthesia like good pain relief, early mobility, decreased chances of deep vein thrombosis, reduced morbidity and mortality[18]. Ideal positioning is one of the prerequisite for successful spinal anaesthesia. Severe pain associated with hip fractures can interfere with positioning for spinal anaesthesia and reduce the chances of successful subarachnoid block. Extreme pain following surgery can interfere with patient mobility with subsequent increase in consumption of intravenous analgesics and its related side effects. Moreover, patients with hip fractures usually are elderly and have multiple comorbidities, which precludes the use of systemic analgesics. Regional analgesic techniques like femoral nerve (FN) block, fascia iliaca block (FIB), and 3-in-1 FN block, are commonly used to reduce pain, increase patient comfort and increase success rate for performing subarachnoid block[6-8]. However, analgesia from these blocks is only moderate[9], and literature suggests that the articular branches of these nerves are inconsistently blocked[13-15]. The anterior hip capsule is innervated by articular branches of femoral nerve, obturator nerve and

accessory obturator nerve (AON) as reported by previous anatomic studieswhich can be blocked by Peri-capsular nerve group (PENG) block.

Ropivacaine, a long acting local anaesthetichas reduced central nervous system and cardiac toxicity along with less propensity for motor blockade compared to bupivacaine, which enhances early mobilisation and prevents complications of immobility like atelectasis, pneumonia, deep vein thrombosis etc. This has made ropivacaine one of the commonly used local anaesthetic in peripheral nerve blockade[19].

In 2018, Girón-Arango L et al., performed PENG block on 5 patients having hip fracture. Study showed that there was reduced pain scores without quadriceps weakness in all patients[19]. In 2018, Ueshima et al., documented their successful clinical experience using the PENG technique in four patients for perioperative pain management in hip replacement surgery[20]. Our study aimed to compare PENG block with FIB using Ultrasound as this technique was unexplored and no prospective randomized trial was done before.

In our study, we observed that both the groups were haemodynamically stable without any significant difference in heart rate, blood pressure and oxygen saturation. Hence, PENG block and FIB does not alter the haemodynamic profile of the patients

We observed that PENG block provides superior analgesia than FIB during positioning (sitting) for spinal anaesthesia in cases of hip fracture.

We observed that both PENG block group and FIB group had prolonged duration of analgesia 490 ± 40.8 mins in group P and 470 ± 40.48 mins in group F. Mean doses of analgesic [tramadol 1mg/kg] required per patient in group P were 1.8 ± 0.68 in 1st 24 h in postoperative period compared to 1.9 ± 0.65 in group F. Thus, the overall opioid consumption in postoperative period was reduced without any inter-group differences. All patients were mobilised within 6hours after surgery with improved functional recovery. No complications were noted in any patient.

Based on our findings in this study of 30 patients of each group, we recommend more widespread use of USG guided PENG block for perioperative analgesia in patients with hip fractures as it provides satisfactory analgesia and patient comfort.

As this is a novel study and no previous randomized trials have been done, further studies are required to compare the efficacy of this new technique with that of already established techniques for hip analgesia.

One of the limitation of our study was assessment of VAS score which is subjective and can vary with the level of understanding between patient and anaesthesiologist. Duration of hospital stay was not recorded.

Conclusion

PENG block provides better analgesia for optimal positioning with better patient satisfaction than Fascia iliaca block for central neuraxial block in patients undergoing surgery for hip fractures. It also provides comparable duration of postoperative analgesia with FIB with a good safety profile.

Conflict of Interest: nil

Financial assistance: nil

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 804–807
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.23

Comparison of Vasopressor Effects of Phenylephrine and Mephenteramine during Spinal Anaesthesia for Ceasarian Section

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Abstract

Caesarian sections are mostly done under regional anaesthesia, especially spinal anaesthesia, in many places. Many of the patients develop hypotension after spinal anaesthesia. A fall in blood pressure of more than 20% from baseline value is hazardous to both mother and the baby. Various methods had been tried to alleviate this response. Preloading with crystalloid solution, maintaining a left lateral tilt, elevating the foot end, and pharmacological therapy using vasopressors are all tried. Common vasopressors used are Mephenteramine and Ephedrine. Now Phenyl ephrine is the vasopressor of choice. Here we are looking at the prophylactic effect of phenylephrine given intravenously along with spinal anaesthesia, and comparing the property with intravenous Mephenteramine given prophylactically along with spinal anaesthesia in full term pregnant subjects. All our subjects were aged between 18 to 40 years, weighing less than 70 kg, satisfying ASA1 criteria. Development of side effects like nausea, vomiting, retrosternal discomfort was also noted. Our subjects who received prophylactic vasopressors supported haemodynamic status of the subjects effectively till the delivery of the baby. Subjects who received intravenous phenyl ephrine developed a transient fall in heart rate which got corrected by itself. None of our subjects developed any hazardous side effects.

Keywords: Phenylephrine; Mephenteramine; Subarachnoid block; Cesarian section.

How to cite this article:
Mary Mammen, Marina Rajan Joseph. Comparison of Vasopressor Effects of Phenylephrine and Mephenteramine during Spinal Anaesthesia for Ceasarian Section. Indian J Anesth Analg. 2020;7(3):804–807.

Introduction

Choice of anaesthesia for delivering the baby by Caesarian section can be regional anaesthesia or general anaesthesia. More than 80% of pregnant patients coming for Caesarian section under subarachnoid block develop hypotension. More than 20% fall in blood pressure from baseline value is hazardous to mother and baby. A decrease in maternal blood pressure compromises foetal oxygenation leading to foetal acidosis and foetal asphyxia. A decrease in cardiac output precipitates symptoms such as nausea, vomiting, dizziness and decreased maternal consciousness. Supine hypotension syndrome and sympathectomy from subarachnoid block exaggerates hypotension.

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Received on 28.02.2020**, Accepted on** 16.03.2020

Endothelium dependent alteration of vascular smooth muscle function and increased presence of vasodilator prostaglandin and nitric oxide is counter balanced by intrinsic sympathetic vascular tone which is adversely affected by subarachnoid block.[9] Left uterine displacement by placing a wedge under the right buttocks, preloading with crystalloids[2] and use of vasopressors along with 100% oxygen are the standard protocol to support systolic blood pressure under subarachnoid block. Vasopressors commonly used were Mephenteramine or Ephedrine IM or IV. Uterine arterial pressure depends on maternal blood pressure and cardiac output.

Objectives

1. To evaluate the prophylactic effect of phenylephrine as a vasopressor during spinal anaesthesia for caesarian section.
2. To evaluate the prophylactic effect of mephenteramine as a vasopressor during spinal anaesthesia for caesarian section.
3. To compare the vasopressive property of phenylephrine with mephenteramine during spinal anaesthesia for caesarian section.
4. To assess the safety of using phenylephrine as a vasopressor during caesarian section under spinal anaesthesia.

Materials and Methods

Study Design

Randomized prospective study on full term pregnant subjects aged between 18 to 40 years weighing less than 70 kg, satisfying ASA 1 criteria. We have excluded subjects less than 18 years and above 40 years weighing more than 70 kg, subjects with associated systemic illness like diabetes, hypertension, bronchial asthma cardiovascular and respiratory diseases, foetal distress and drug allergies**.**

Sample Size

Sample size was calculated using the formula n= [SD] 2 [z alpha+ z beta] 2/ delta square with reference to similar other studies.[1] The sample size comes around 30 in each group.

Sampling Method

By block randomization and allocation concealed by sealed envelope.

Ethical Clearance

An ethical clearance was obtained from institution and an individual written and informed consent was obtained from each subject before enrolling them.

Procedure

Full term pregnant mothers aged between 18 to 40 years weighing less than 70 kg satisfying ASA 1 criteria were chosen for the study. The subjects were randomly grouped into 2 groups of 30 each. All elective subjects received oral Ranitidine 150mgm and oral Metaclopropamide 10 mg 2 hours before surgery. All emergency subjects received Inj. Ranitidine 50 mgm and inj. Metaclopropamide 10 mgm intravenously 30 mts before anaesthesia. All our subjects received 500 ml crystalloid solution through an 18g cannula on non dominant hand. Spinal anaesthesia was given using 23g spinal needle at L3-L4 space in lateral position. 1.6 ml of 0.5% Bupivacaine [H] was given to all our subjects. All our subjects received 100% O_2 by Bains circuit and a left lateral tilt was given using 15 degree wedge under right buttocks. Group 1 patients received 100 ugm phenylephrine and Group 2 received 6 mgm mephenteramine intravenously as prophylactic vasopressor along with spinal anaesthesia. Baseline heart rate, systolic blood pressure, diastolic blood pressure were noted and after prophylactic vasopressor every minute till baby was out. Standard monitors were used to monitor the parameters. Any incidence of nausea, vomiting, headache, chest discomfort were also noted. A fall in heart rate less than 50 /minute and a fall in systolic blood pressure below 90mm of Hg needed rescue drugs. Heart rate, systolic blood pressure, and diastolic blood pressure of both groups were collected and recorded in structured proforma. Mean heart rate, mean systolic blood pressure and mean diastolic blood pressure of both groups were calculated and statistically analyzed.

Analysis

Statistical package of social science was used to analyze data with computer. "T'' test was used to compare the 2 groups. Comparability was analyzed with analysis of ANOVA test, Student t tailed test and chi square test. A p value less than 0.05 was considered statistically significant.

Results

Table 1: Showing baseline characters of full term mothers in study group 1 and 2

	Group 1	Group 2
Mean Age	27	27
Mean Weight	52	51
Mean SBP	119	115
Mean DBP	79	77
Mean HR	88	85

Data collected from group 1 and group2 were comparable not only with respect to age, body weight, and gravid status of patients and also in terms of baseline heart rate, systolic blood pressure and diastolic blood pressure (Table 1).

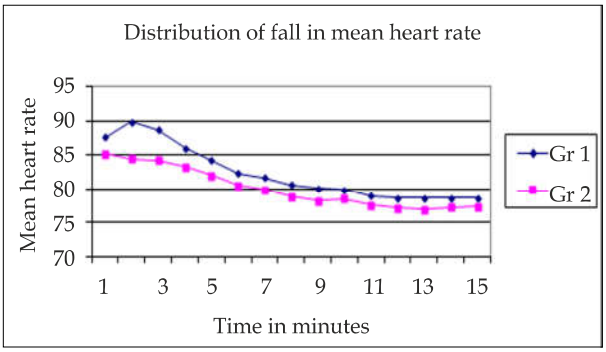

Fig. 1: Distribution of Heart Rate in Group 1 and Group 2

Group statistics of mean heart rate in group 1 and group 2 subjects were compared and presented above. There was a significant fall in mean heart from baseline to 15th minute of prophylactic drug in both groups [$p \leq 0.001$] (Fig. 1).

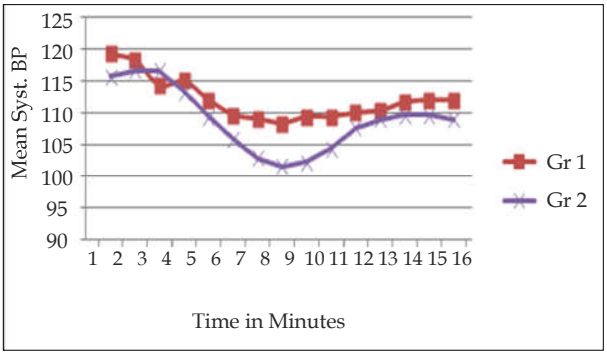

Fig. 2: Mean Systolic Blood Pressure in Group 1 and Group 2

Both vasopressors maintained mean systolic blood pressure at the time of delivery. The difference between the 2 groups was not significant [$p = 0.129$] (Fig. 2).

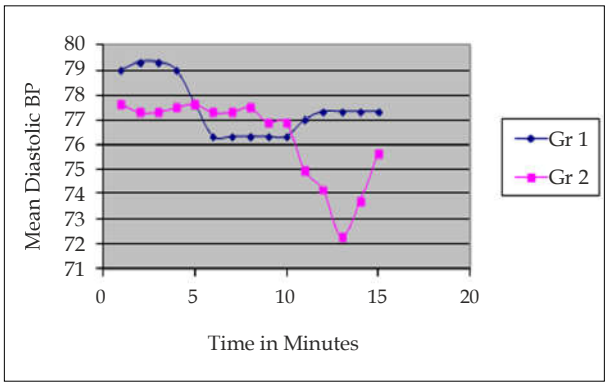

Fig. 3. Mean Diastolic Blood Pressure in Group 1 and Group 2

Mean diastolic blood pressure in group 1 and group 2 were compared and represented in the above figure. The mean diastolic blood pressure was significant in group 1 from12 th to 14 th minute in group 1. [$p = 0.008$] (Fig. 3).

Discussion

The groups were comparable with regards to distribution of age, weight, gravid status, mean systolic blood pressure, mean diastolic blood pressure and heart rate as shown in the table and figures given above. There was a significant fall in heart rate from baseline to 15th minute of prophylactic vasopressor in both groups [$p \leq 0.001$]. Sahoo[1] noted a rise in heart rate in the mephenteramine group, and a fall in heart rate in the phenylephrine group. Here vasopressors were given at the time of hypotension. We had given both vasopressors prohylactically in the study. Maternal bradycardia was more with phenylephrine.[4,5] In our study the heart rate did not fall below 50/mt in both groups. Sahoo et al had one patient who developed bradycardia.[1]

Both vasopressors effectively maintained systolic and diastolic blood pressure in our study. Sahoo had noted that 80% of patients in phenylephrine group required only single dose of the drug. All our subjects maintained a systolic blood pressure above 90 mm of Hg with single intravenous bolus dose of vasopressors in both groups. The diastolic blood pressure in group 1 was better maintained than in group 2,[3] and Cooper and others[5,7,8,9,10,11] state that phenylephrine is the most effective and safe vasopressor for caesarian section under spinal anaesthesia.

Sahoo[1] had noticed nausea and vomiting in 10% of subjects who received phenylephrine and 15% patients who received mephenteramine. None of our patients complained of nausea and vomiting.

Ngan kee found that 100 micrgm phenylephrine effectively supported maternal blood pressure during caesarian section under spinal anaesthesia.[5,7-19] David Cooper et al.[3], in their study state that phenylephrine is most effective vasopressor for caesarian section under spinal anaesthesia. Nausea and vomiting was also less with phenylephrine. Many other studies[5,7-11] state that phenylephrine is a better vasopressor in caesarian section. We also found phenylephrine is an effective vasopressor with minimum side effects.

Conclusion

Phenylephrine can be used safely to alleviate hypotension under spinal anaesthesia for caesarian section. Both Mephenteramine and phenylephrine supported the blood pressure during delivery of the baby. None of our subjects developed nausea and vomiting.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 808–815
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.24

Comparision of Dexmedetomidine Versus Clonidine as Anadjuvant to 0.5% Ropivacaine in Supraclavicular Brachial Plexus Block: A Randomized Double Blind Prospective Study

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Abstract

Introduction: Upper limb surgeries are mostly performed under anesthesia such as Supraclavicular brachial plexus block, peripheral nerve block not only provide Intraoperative anaesthesia but also ensure post operative analgesia. *Materials and methods:* This study was conducted on 100 patients of ASA physical status I to III in age group of 18-70 years of either sex posted for elective upper limb surgeries under Supraclavicular brachial plexus bock after taking informed consent at KVG Medical College, Sullia from January 2013 to June 2014. Patients was randomly allocated to 2 groups of 50 each by random number table prepared by another anesthetist not otherwise involved in the study outside the operating room, namely; *Group C:* 33 ml of 0.5% Ropivacaine plus 1 ug/kg Clonidine *Group D:* 33 ml of 0.5% Ropivacaine plus 1 ug/kg Dexmedetomidine *Results:* Onset of sensory block was faster in group D than in Group C, While onset of motor block was faster in group C than in Group D, but the difference was not statically significant ($p > 0.05$). Duration of sensory block and duration of motor block were significantly longer in Group D as compared to Group C ($p < 0.001$). There was significant increase in duration of analgesia in Group D as compared with group C. None of the patients in group D required sedation intraoperatively and they were comfortable throughout the surgery with arousable sedative effects. Significant lower heart rate was observed at 30, 45, 60, 75, 90, 105, 120 and 135 min, but not less than 60 beats/min, in Group D as compared with Group C ($p < 0.001$). Systolic and diastolic blood pressure were found to be significantly lower than baseline from 25 to 60 min in group D as compared with Group C ($p < 0.001$). *Conclusion:* addition of dexmedetomidine as an adjuvant to Ropivacaine produces a significantly faster onset of sensory block and a significantly longer sensory and motor block when compared to Clonidine. Dexmedetomidine significantly reduces the number of rescue analgesia dosage requirements in postoperative 24 hrs and prolongs the duration of analgesia when compared to Clonidine. The mean arterial pressure, heart rate, blood pressure did not require any therapeutic intervention in both study groups.

Keywords: Upper limb surgeries, Ropivacaine, Clonidine, Dexmedetomidine

How to cite this article:

Vinay Dandemmanavar, Pavan Kumar, Pratibha Omkar. Comparision of Dexmedetomidine Versus Clonidine as Anadjuvant to 0.5% Ropivacaine in Supraclavicular Brachial Plexus Block: A Randomized Double Blind Prospective Study. Indian J Anesth Analg. 2020;7(3):808–815.

Introduction

Upper limb surgeries are Mostly Performed Under peripheral Blocks such as the brachial Plexus block. Peripheral Nerve blocks not only provide intraoperative Anaesthesia but also extend Analgesia in the post-operative period without any systemic side-effects.[1,2] Alpha-2 adrenergic receptor agonists has been focus of the interest for their

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Received on 29.02.2020**, Accepted on** 29.02.2020

sedative, analgesic, perioperative sympatholytic and cardiovascular stabilizing effects with reduced anaesthetic requirements. Furthermore, various methods of administration, such as epidural, intrathecal and peripheral injections, have been tried either alone or in combination with another drug to prolong and intensify the anaesthesia.[5]

Dexmedetomidine, a potent α_2 adrenoceptor agonist, is approximately eight-times more selective towards the α_2 adrenoceptor than clonidine. In previous clinical studies, intravenous dexmedetomidine resulted in significant opioid sparing effects as well as a decrease in inhalational anaesthetic requirements.[6] In various animal studies, dexmedetomidine has been reported to enhance sensory and motor blockade along with increased duration of analgesia. In humans, dexmedetomidine has also shown to prolong the duration of block and post-operative analgesia when added to local anaesthetic in various regional blocks.[7] Till date, no studies have compared dexmedetomidine with clonidine with respect to duration of block and post-operative analgesia.[8,9] The present study was designed to test the hypothesis that dexmedetomidine when added as an adjuvant to local anaesthetic in supraclavicular brachial plexus block enhanced the duration of sensory and motor block, duration of analgesia and quality of block as compared with clonidine.[10,11]

Materials and Methods

Source of data collection: the study group will comprise of patients admitted in KVG Medical College and hospital, Sullia, for elective or emergency upper limb surgeries from January 2013 to June 2014.

Method of data collection: After the approval by the institutional Ethics Committee of the KVG Medical college and Hospital, Sullia, 100 patients aged between 18 to 70 years with ASA physical status I-III who were scheduled for elective or emergency, upper limb surgeries under brachial plexus block were enrolled in this prospective double blind randomized comparative study with written informed consent.

Patients who will be selected for the study will be randomly allocated to 2 groups of 50 each by random number table or slip in box method, prepared by another anesthetist not otherwise involved in the study, outside the operating room, namely:

(a.) Group C: 33 ml of 0.5% Ropivacaine plus 1 ug/kg Clonidine

(b.) Group D: 33 ml of 0.5% Ropivacaine plus 1 ug/kg Dexmedetomidine

Pre medication was given with tablet alprazolam 0.5 mg orally at 22:00 hrs on the night before surgery. No additional sedative medication was admitted in the first 60 min after injection of the study dose. The anesthetist performing the block was blinded to the treatment group. All observations will be carried out by a single investigator who will also be blinded to the treatment group.

Before being shifted to operation room, IV line with 18G IV cannula in the dorsum of hand of patients will be secured and the patient will be started with ringer lactate half an hour before surgery.

In the operation room, Patients will be monitored with standard anaesthetic monitoring techniques using non invasive blood pressure (NIBP), peripheral oxygen saturation (SpO_2) and electrocardiography evaluations. The baseline blood pressure, mean arterial pressure (MAP) and oxygen saturation was monitored and recorded after the block every 5 minutes for half an hour then every 15 minutes until the end of the surgery.

Hundred Patients scheduled for elective or emergency upper limb surgery were randomized and divided into two equal groups. Brachial plexus was approached by Supraclavicular route using a 50mm stimuplexinsulatedneedle connected to a peripheral nerve locator (Inmed). The location end point was a distal motor response with an output lower than 0.5 mA in the median nerve region. Patients were assigned randomly into one of the two groups. Ingroup C (n = 50) 33 ml of 0.5% Ropivacaine plus 1 ug/kg Clonidine and in group D (n = 50) 33 ml of 0.5% Ropivacaine plus 1 ug/kg Dexmedetomidine was given.

During injection, negative aspiration was performed every 5 ml to avoid intravascular injection.

Sensory block was assessed by the pin prick method. Assessment of sensory block was done at each minute after completion of drug injection In the dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve till complete sensory block, Sensory onset was considered when there was a dull sensation to pin prick along the distribution of any of the above mentioned nerves. Complete sensory block was considered when there was complete loss of sensation to pin prick.

Sensory block was graded as-

1. Grade 0: Sharp pain left

2. Grade 1: Analgesia, Dull sensation felt
3. Grade 3: Anaesthesia, no sensation felt.

Assessment of motor block was carried out by the same observer at each minute till complete motor blockade after drug injection. Onset of motor blockade was considered when there was Grade 1 motor blockade. Peak motor block was considered when there was Grade 2 motor blockade. Motor block will be determined according to a modified bromage scale for upper extremities on a 3 point scale.

1. Grade 0: Normal motor function with full flexion and extension of elbow, withstand fingers.
2. Grade 1: Decrease motor strength with ability to move the fingers only
3. Grade 2: Complete motor block with inability to move the finger

Postoperatively, this testing was done every 30 min until the sensory and motor variables become normal. Postoperatively quality of analgesia was evaluated with visual analogue scale from 0 to 10 where 0 defines no pain and 100 defines worst Pain ever suffered, every 30 min until VAS > 5, Supplementary analgesia was given at VAS > 5.

Visual Analogue Scale

Pain Intensity	Word Scale
0	No pain
1-2	Least pain
3-4	Mild pain
5-6	Moderate pain
7-8	Severe pain
9-10	Excruciating pain

Pain score > 5 - Supplememtary analgesia given

Sedation was assessed using Ramsay Sedation Scale (RSS) before the block and then every 15 min.

Ramsay Sedation Scale

1. Fully Awake
2. Drowsy
3. Dowsy but arousable to touch / call
4. Drowsy but arousable on deep stimuli

The rescue analgesia was given in the form of inj. Diclofenac SodiumAqueous 75 mg Iv Infusion in 500 ml RL or 100 mg IV paracetamol infusion.

Inadequate sensory and motor blockade beyond 30 mins following the infiltration will be considered as unsuccessful block.

Management of unsuccessful block: In the circumstances of inadequate or patchy action of the block, the block was supplemented with general anesthesia. If in case surgery was unduly prolonged and the effect of the block wore off, rescue analgesia was given in the form of intravenous fentanyl 1 mcg/kg and infusion of propofol 50-100 mcg/kg/min. The duration of sensory block was defined as the time interval between the end of local anesthetic administration and the complete resolution of anesthesia on all nerves. The duration of motor block was defined as the time interval between the end of local anesthetic administration and the recovery of complete motor function of the hand and forearm. Assessment of blood loss was done and fluid was administered as per the loss. Duration of surgery will be noted.

Inclusion criteria

1. Patient Aged between 18 to 70 years of Either sex.
2. ASA grade I-III.
3. Elective/Emergency upper limb surgeries.

Exclusion Criteria

1. Patient refusal for procedure.
2. Any bleeding disorder or patient on anticoagulants.
3. Neurological deficits involving brachial plexus.
4. Patients with allergy to local anesthetics.
5. Local infection at the injection site
6. Patients on any adrenoreceptor agonist or antagonist therapy.
7. Body mass index >35 kg/m2
8. Uncontrolled diabetes mellitus.
9. Pregnant women.

Study design: A prospective study will be conducted in patients with either sex requiring elective or emergency upper limb surgeries after obtaining an informed consent.

Sample size: A sample size of 100 was required. We planned to conduct study on 100 patients in the age group of 18-70 years of either sex, attending KVG hospital for upper limb surgeries.

Analysis of data: The data was analysed by SPSS version 17. Unpaired T-test was applied for demographic data, haemodynamic parameters, onset and duration of sensory and motor blockade

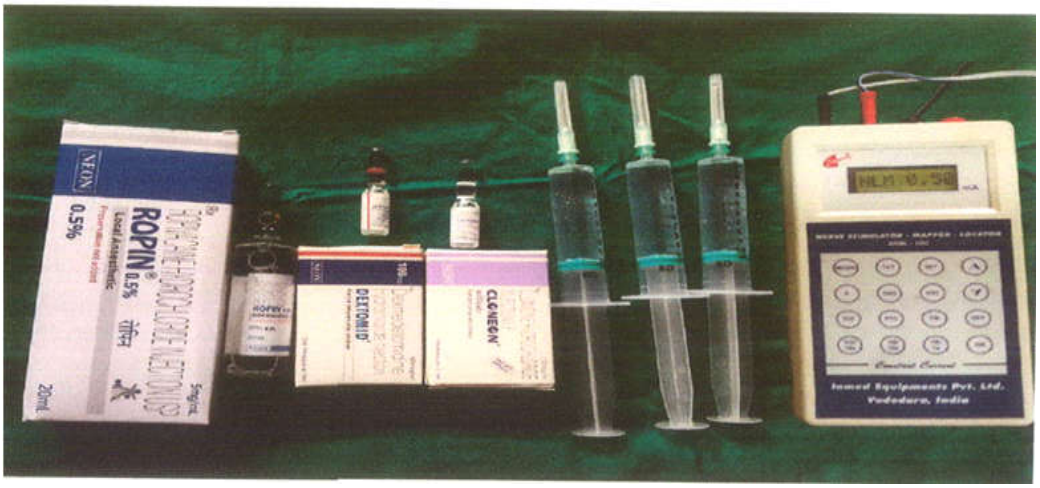

Fig. 1: Drugs Used

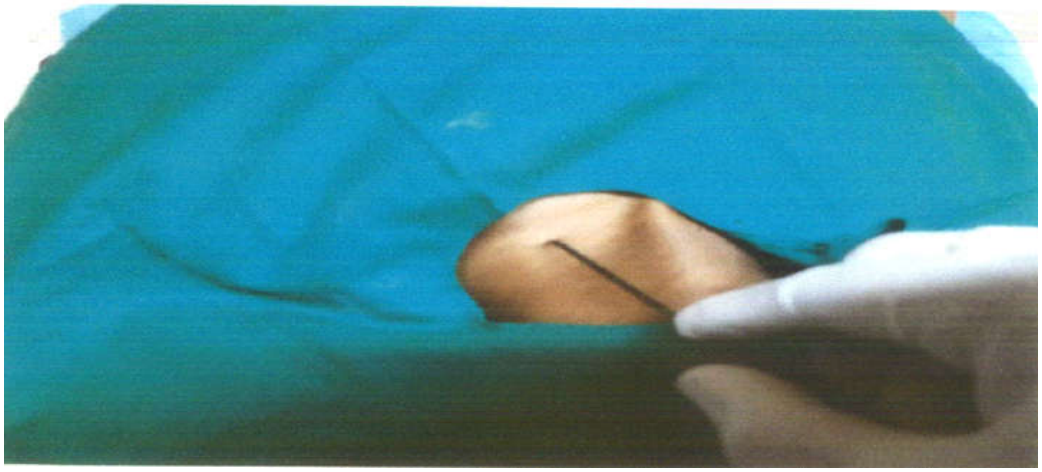

Fig. 2: Technique of supraclavicular brachil plexus block nerve mapper

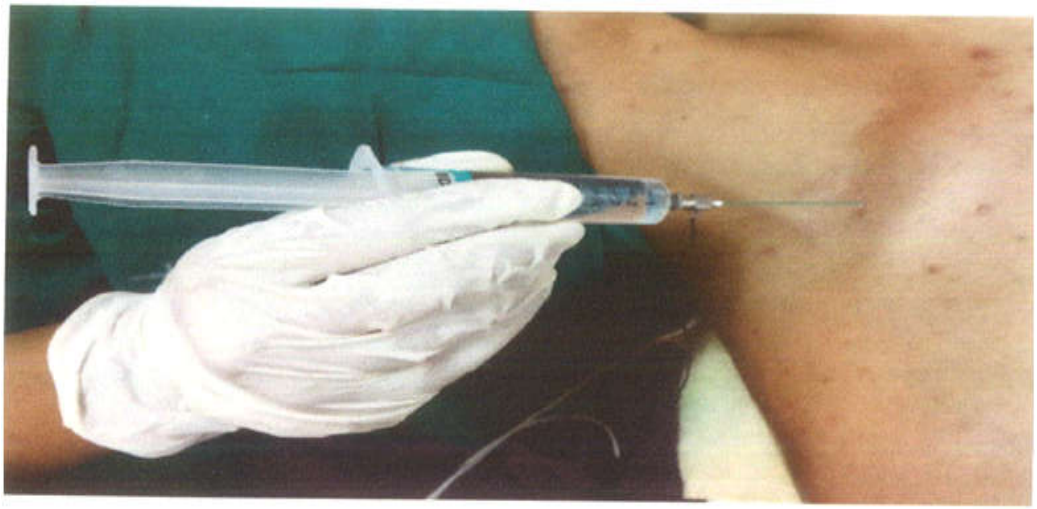

Fig. 3: Technique of supraclavicular brachil plexus block with nerve locator

Fig. 4: Peripheral nerve Stimulator

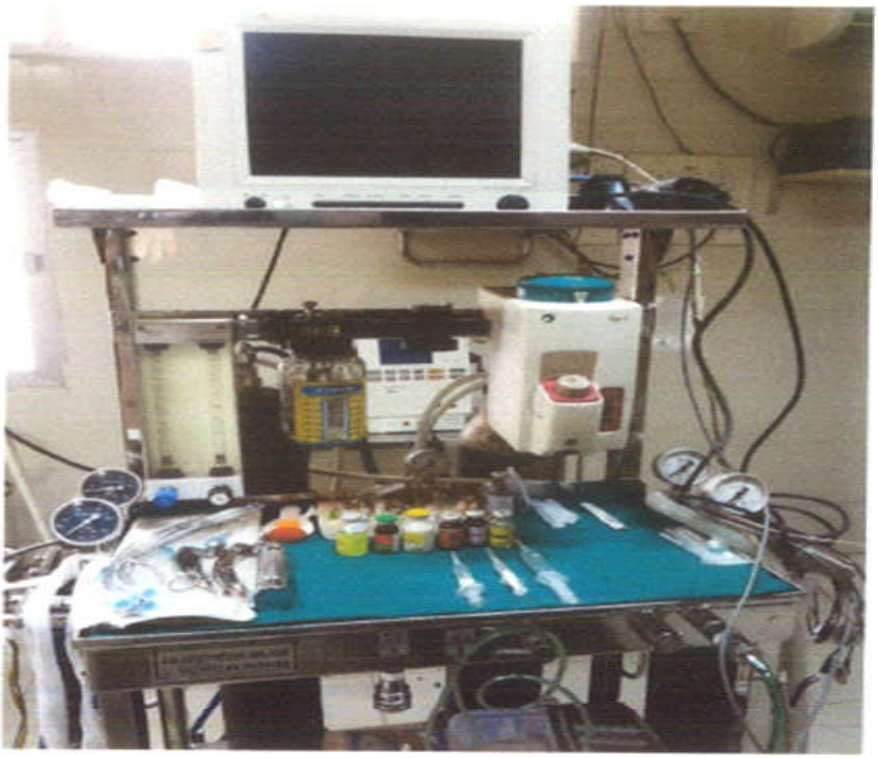

Fig. 5: Boyle's Machine

and duration of analgesia, proportions, percentages and chi-square test were used for the analysis of the data. P Value was considered significant if < 0.05 and highly significant if < 0.001.

Follow up: Yes

Follow Up period: 24 hours in postoperative ward.

Results

Hundred ASA I to III patients of either sex aged between 18 to 70 years, posted for upper limb surgeries under supraclavicular brachial plexus were selected for the study. The study was undertaken to evaluate the efficacy of Dexmedetomidine (1ug/Kg) as adjuvant to Ropivacaine 0.5% 33 ml of comparison with clonidine (1ug/Kg) as an adjuvant

Table 1: Frequencies

	Frequency	Percentage
Group C	50	50
Group D	50	50
Total	100	100

Table 2: Demographic data

	Group	Mean	SD	T value	*p* Value
Height	Group C	167.22	5.883	0.216	0.830
	Group D	168.00	7.045		
Weight	Group C	65.32	5.531	0.797	0.427
	Group D	66.28	6.478		
Age in years	Group C	40.62	12.844	0.458	0.648
	Group D	41.72	11.090		

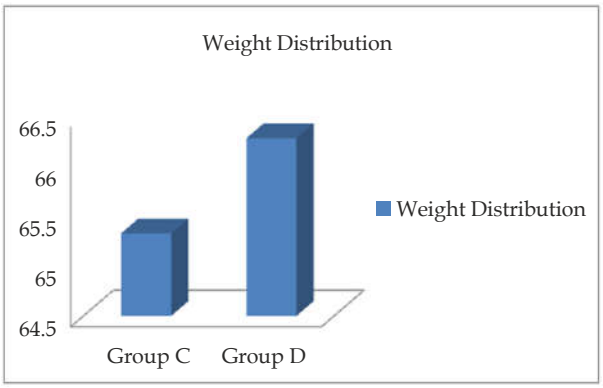

Fig. 6: Weight distribution

to Ropivacaine 0.5% 33 ml for brachial plexus block by supraclavicular approach.

Patients who were selected for the study were randomly allocated to 2 groups of 50 each by random number table or slip in box method, prepared by another anesthetist not otherwise involved in the study. Outside the operating room, namely:

Group C: 33 ml of 0.5% Ropivacaine plus 1 ug/ kg Clonidine

Group D: 33 ml of 0.5% Ropivacaine plus 1 ug/ kg Dexmedetomidine.

Hundred patients were divided in two equal groups of 50 each (Table 1).

Table 3: ASA Distribution

			Group		
			Group C	Group C	Total
ASA	I	Count	40	34	74
		%	80%	68%	74%
	II	Count	10	16	26
		%	20%	32%	26%
	Total	Count	50	50	100
		%	100%	100%	100%

Table 4: Types of Surgeries

Surgery		Group		Total
		Group C	Group D	
Buttress Plating	Count	2	3	5
	%	4%	6%	5%
Crif and K Wiring	Count	13	8	21
	%	26%	16%	21%
Implant removal	Count	3	1	4
	%	6%	2%	4%
Orif	Count	4	5	9
	%	8%	10%	9%
ORIF with DCP plate	Count	4	4	8
	%	8%	8%	8%
Orif with DCP plating	Count	21	23	44
	%	42%	46%	44%
Radial head excision	Count	1	3	4
	%	2%	6%	4%
TBW with K wiring	Count	2	3	5
	%	4%	6%	5%
Total	Count	50	50	100
	%	100%	100%	100%

Table 5: Comparison of duration of surgery in two groups studied

	Group	Mean	SD	T Value	P Value
DOS in mins	Group C	119.40	18.671	0.970	0.334
	Group D	123.00	18.434		

Table 6: Onset of sensory block between the study groups

	Group	Mean	SD	T Value	P Value
Onset of sensory blocking in mins	Group C	2.278	.7002	**6.377**	**0.000**
	Group D	1.562	.3741		

Table 7: Onset of motor block between the study groups

	Group	Mean	SD	T Value	P Value
Onset of Motor block in mins	Group C	4.21	1.085	1.812	0.073
	Group D	4.58	98.8		

The mean age of patients in Group C was 40.62 years and that in group D was 41.72 years. There was no statistically significant difference between the man ages of two groups. The mean height of patients in Group C was 167.72 cms and that in group D was 168.00 cms. There was no statistically significant differences between the mean height of two groups (Table 2 and Fig. 6).

Forty patients in group C came under ASA 1 category, where as 10 patients came under ASA II. In group D 34 patients belonged to ASA I category,

where as 16 patients belonged to ASA II category. The P value was found to be not significant (Table 3).

The mean time of onset block in this study in group C was 4.06 min and the mean onset of motor block group D was 4.46 min. there is no significant difference between the onsets of motor block in the two groups. Group C showed comparative earlier on set of motor block to Group D. However, P value suggests that there was no significant difference.

The mean duration of motor block in group C was 12.25 hours and the mean duration of motor block in Group D was 14 hours. This value showed that duration of motor block in Group D was that of group C. Statistically found to be highly significant.

The mean duration of sensory block in group C was 13.53 hours and the mean duration of sensory block in Group D was 15.95 hours. This value showed that duration of sensory block in Group D was longer than that of Group C. Statistically found to be highly significant (Table 6).

In group C, The mean duration of analgesia was 14.07 hours when compared to Group D having mean duration of 16.92 hours. Duration of analgesia was prolonged in Group D when compared with Group C. The *p* value was 0.000 which is statistically highly significant.

There was drop in heart rate in group D at interval of 20 mins and difference was found significant. P < 0.05 when compared to Group C. There was significant drop in the heart rate in group D at intervals of 25min, 30 min, 45 min, 60 min, 75 min, 90 min, 105 min, 120 min, 135min when compared to Group C. $p < 0.001$, these value suggest that there was significant drop in heart rate in Group D. However no patients developed bradycardia ie heart rate < 50 in either of the groups.

There was drop in systolic BP in Group D at interval of 30 min and 60 min differences was found highly significant $p < 0.001$ when compared to Group C. There was significant drop in the systolic BP in group D at intervals of 30 min, 60 min, 75 min, when compared to Group C ($p < 0.05$). These value suggest that there was significant drop in systolic BP in group D. however no patients developed i.e systolic BP < 90 mm of Hg in either of the groups (Tables 4-7).

Discussion

In our study we used 33 ml of 0.5% Ropivacaine for brachial plexus block because according to a study done by Hickeyet al.[13] It was found that 33 ml of a 0.5% ropivacaine solution used for performance of a subclavian perivascular block produced a rapid onset of sensory anesthesia with prolonged sensory and motor blockade.

In another study conducted by swami et al. who compared 1ug/kg Dexmedetomidine and 1 ug/kg clonidine as an adjuvant to bupivacaine 0.25% 35 ml in supraclavicular brachial plexus block. So we also choose same dose of dexmedetomidine and clonidine i.e 1ug/kg along with 0.5% ropivacaine 33 ml in supraclavicular brachial plexus block, to study block characteristics.[14]

In present study the mean time of onset of sensory block in Group C was 2.278 min and 1.562 min in Group D respectively. This difference in onset of sensory block was found to be statistically highly significant between the two groups.[15]

The mean duration of motor block in group C was 735 ± 74.4 mins and the mean duration of motor block in group D was 840 ± 49.80 mins. This value showed that duration of motor block in Group D was longer than that of Group C. Statistically found to be highly significant ($p < 0.001$).[16]

The mean sensory block in group C was 811.80 ± 75 mins and the mean duration of sensory block in group D was 957 ± 73.20 mins. This value showed that duration of sensory block in Group D was longer than that of group C. Statistically found to be highly significant ($p < 0.001$).[17]

In group C, the mean duration of analgesia was 844.20 ± 69.42 mins when compared to group D having mean duration of analgesia of 1015.20 mins. Duration of analgesia was prolonged in Group D when compared with group C. The *p* value was 0.000 which is statistically highly significant.[18]

Conclusion

In present study we found that dexmedetomidine 1ug/kg as adjuvant to 33 ml of 0.5% Ropivacaine produces a significantly faster onset of sensory block and a significantly longer sensory and motor block when compared to Clonidine 1 ug/kg Dexmedetomidine significantly reduces the number of rescue analgesic dosage requirements in postoperative 24 hrs and prolongs the duration of analgesia when compared to Clonidine. Onset of motor block was little faster with Clonidine but was statistically not significant.

To conclude, in our study we found that dexmedetomidine when added to Ropivacaine for Supraclavicular brachial plexus block shortens the onset time for sensory block and prolongs the duration of sensory and motor block. The

significantly prolonged duration of analgesia obviates the need for any additional analgesics. The added advantage of conscious sedation, hemodynamic stability and minimal side effects makes it a potential adjuvant for nerve blocks.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 816–823
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.25

Comparative Evaluation of Ropivacaine and Ropivacaine with Dexamethasone in Ultrasound Guided Brachial Plexus Block

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ABSTRACT

Introduction: The use of interscalene block as the primary anaesthetic technique avoids the complication associated with general anaesthesia. the present study is undertaken to study the effect of adding Dexamethasone as adjuvant to Ropivacaine. *Aims:* Aim is to study the comparison between ropivacaine and ropivacaine with dexamethasone in ultrasound guided brachial plexus block. *Materials and methods:* The present study was undertaken at Gandhi hospital, Secunderabad during the period of March 2019 to October 2019. The patients were randomised into 2 groups with 30 patients in each group. Group R – 30 ml of Ropivacaine 0.5% + 2ml Normal Saline and Group RD – 30 ml of Ropivacaine 0.5% + 2ml (8mg) dexamethasone. *Results:* Block was successful in 90% patients in Ropivacaine group and 93.3% in Ropivacaine + Dexamethasone. The difference was not statistically significant (p = 0.640)**.** There were no statistically significant differences in demographic profile of patients in either group in terms of age, body weight, or gender ratio (p >0.05). There were no statistically significant differences in patients posted for surgery in either group (P value – 0.726). There was no significant difference between 2 groups in terms of ASA grading (p = 1.000). Duration of sensory block, motor block in Ropivacaine group and Ropivacaine + Dexamethasone group is highly significant (p < 0.001). Duration of analgesia in Ropivacaine group was 628.88 ± 65.11 min whereas in Ropivacaine + Dexamethasone it is 1051 ± 61.36 min, which is statistically highly significant (p < 0.001). The hemodynamic parameters were statistically insignificant in both the groups since (p > 0.05). *Conclusion:* Addition of Dexamethasone to 0.5% Ropivacaine for interscalene brachial plexus block increases duration of sensory block, motor block as well as duration of analgesia.

Keywords: Dexamethasone; Ropivacaine; Interscalene brachial plexus block

How to cite this article:
Kota Raju, Priyanka Priyadarshini C. Comparative Evaluation of Ropivacaine and Ropivacaine with Dexamethasone in Ultrasound Guided Brachial Plexus Block. Indian J Anesth Analg. 2020;7(3):816–823.

Introduction

Pain is "an unpleasant sensory or emotional experience associated with actual or potential tissue damage, or described in terms of such damage". It is an unpleasant effect associated with significant psychological and physiological changes during surgery and post-operative period.[1] This can be overcome by the use of suitable drugs and techniques. Regional anaesthetic techniques have specific advantages for administration of analgesic supplements both intraoperatively and postopeatively. An ever increasing demand for

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Received on 05.02.2020**, Accepted on** 29.02.2020

regional anaesthesia from patients and surgeons matches the growing realization that regional anaesthesia can provide superior pain management and perhaps improve patient outcomes to meet evolving expectations for ambulatory, cost-effective surgery. Our aging population presents with an increasing range of co-morbidities, demanding a wider choice of surgical anaesthesia options including the use of a variety of regional techniques in conjugation with general anaesthesia to optimize clinical care, while at the same time reducing the risks of complications. Thus, the practice of regional anaesthesia remains an art for many practitioners and consistent success with these techniques often appears to be limited to anaesthesiologists who are regional anaesthesia enthusiasts. Regional Anaesthesia in the form of interscalene approach to the brachial plexus is often used for orthopaedic surgeries of the upper limb. It is often used either as an adjuvant to general anaesthesia or as the primary method of anaesthesia. With the introduction of newer and safer local anaesthetics with better advantages, regional anaesthesia has taken over asthe principle technique for upper limb surgeries. The use of interscalene block as the primary anaesthetic technique avoids the complication associated with general anaesthesia.[2]

There are many advantages of brachial plexus block for upper limb surgeries over general anaesthesia, namely effective analgesia with good motor blockade, awake patient, extended post-operative analgesia, early ambulation, early resumption of oral feeding, minimal number of drugs used so that polypharmacy is avoided, no airway manipulation and less incidence of post-operative nausea and vomiting Various approaches of brachial plexus block have been used for upper limb surgeries, namely[3] as Interscalene approach, Supraclavicular approach, Infraclavicular approach and Axillary approach. The principal indication for an interscalene block is surgery on the shoulder or manipulation of the shoulder. Blockade occurs at the level of the upper and middle trunks. Although this approach can also be used for forearm and hand surgery, blockade of the inferior trunk (C8 through T1) is often incomplete and requires supplementation at the ulnar nerve for adequate surgical anaesthesia in that distribution. Recent reports provide evidence that a low interscalene block (below c6, just superior to clavicle) may provide sufficient anaesthesia and analgesia for procedures of the lower arm.[4] Long acting local anaesthetic agent, Bupivacaine, is frequently used for brachial plexus anaesthesia. Its cardiac and central nervous system toxic effects in some patients prompted the researchers to develop new local anaesthetic agent with a profile similar to Bupivacaine without considerable toxic effects. One such possible replacement for Bupivacaine is Ropivacaine. This favorable clinical profile has prompted many clinicians to switch from Bupivacaine to Ropivacaine for all types of neural blockade. However, with clinical use, it was discovered that Ropivacaine's latency of sensory analgesia was approximately two thirds that of Bupivacaine, therefore it was not as effective in promoting prolonged post-operative analgesia. In an attempt to increase the duration of post-operative analgesia, various adjuvant drugs were used along with local anaesthetic agents. However, the glucocorticoid; Dexamethasone when used as adjuvant along with ropivacaine appears to be effective in prolonging the duration of analgesia and intensity of block obtained from interscalene approach using Ropivacaine, with the effect being stronger with Ropivacaine. Hence, the present study is undertaken to study the effect of adding Dexamethasone as adjuvant to Ropivacaine.

Materials and Methods

The Prospective randomised comparative study during the period of March 2019 to October 2019

Inclusion Criteria - Age 18 to 65 years, ASA grade I and II, Scheduled for upper limb orthopaedic procedures

Exclusion Criteria - Age group less than 18 years and more than 65 years, Patient belonging to ASA grade III, IV, hypersensitivity to local anaesthetics, Infection at the site of block, coagulopathy (abnormal BT, CT) or patient on anticoagulants therapy, severe systemic disorder (respiratory, cardiac, hepatic, renal diseases neurological, psychiatric, neurovascular disorders and contralateral diaphragmatic paralysis), morbid obesity and who are on corticosteroids for 2 weeks or longer within 6 months of surgery and chronic opioid use (>30mg oxycodone equivalent per day.

Based on previous studies it was anticipated that mean deviation of analgesic effect is 11 hours with standard deviation of 5 hours.For purpose of this study, a difference of atleast 4 hours in duration of analgesic effect between 2 groups is considered significant In order to detect this difference, required sample size is 26 at 5% (0.05) level of significance and 80% power of test. Approximately 60 patients will be enrolled in study to arrive at 52 evaluable cases. 26 in each group assuming a drop out of 15% either due to incomplete data or lower

enrollment.

Group R: - 30ml of 0.5% Ropivacaine + 2 ml of normal saline

Group RD: - 30ml of 0.5% Ropivacaine with 8mg of Dexamethasone-2ml

The study protocol was approved by institutional ethical committee and approval for study and written informed consent.

Pre-Anaesthetic evaluation

All the patients underwent thorough pre anesthetic evaluation on the day prior to surgery. All systems were examined including airway and the surface anatomy where the block was going to be given, and the procedure to be carried out was explained and informed written consent taken. They were informed about development of paresthesia. Patients were reassured to alleviate their anxieties. All the patients were kept nil per oral as per the fasting guidelines. All of them received drugs Tablet. Alprazolam 0.5mg on the night before surgery and Capsule Omeprazole 20mg on the day of surgery.

All basic investigations were done. Next day on arrival of patients in the operating room, an 18 gauge intravenous cannula was inserted under local anaesthetic infiltration on the non-operating hand and an infusion of Ringer lactate was started. The patients were connected to multiparameter monitor (Phillips Intellivue MX450) which records pulse rate (PR), noninvasive measurements of systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP), continuous electrocardiogram (ECG) monitoring using lead II and oxygen saturation (SpO2). The baseline blood pressure and heart rate and oxygen saturation were recorded.

The anaesthesia machine, emergency oxygen source, pipeline O2 supply, working laryngoscope, appropriate size endotracheal tubes along with connectors, functioning suction apparatus with suction catheter, Airways (oropharyngeal), Intravenous fluids Anesthetic agents– Thiopentone, ketamine, diazepam, succinylcholine Resuscitation drugs- Hydrocortisone, atropine, adrenaline, aminophylline, mephentermine, calcium gluconate and sodium bicarbonate.

Patient is placed in supine position, with the head facing away from the side to be blocked. A slight elevation of head end of bed is often more comfortable for the patient and it allows for better drainage and less prominence of neck veins.

Procedure

Parts are prepared with iodine solution. Transducer is placed in transverse plane to identify carotid artery. Once artery is identified transducer moved slightly laterally across the neck. The goal is to identify the scalene muscles and the brachial plexus sandwiched in between them. Needle is then inserted in-plane towards brachial plexus, in a lateral to medial direction. As needle passes through prevertebral fascia certain "give in" is often appreciated. After careful aspiration to rule out intravascular needle placement, 1 to 2ml of local anaesthetic is injected to document proper needle placement. Injection of several milliliters of local anaesthetic often displaces brachial plexus away from needle. An additional advancement of needle 1 to 2 mm toward brachial plexus may be beneficial to assure a proper spread of local anaesthetic. Whenever needle is further advanced or multiple injections used, assure that high resistance to injection is absent to decrease risk of intrafascicular injection. The spread of drug can be visualized. Throughout the procedure patient was observed for development of toxicity and immediate side effects like hypotension.

After the block was given patient was evaluated for onset of sensory and motor block, quality of sensory and motor block, overall quality of block, duration of sensory and motor block, duration of analgesia, side effects and complications. Assessment was done every 3 minute till development of sensory and motor block. At the end of 30 min if block was inadequate it was considered unsatisfactory or failure. The block was supplemented with general anaesthesia in case of failure. In the post-operative period patient pain was assessed by VRS score. If VRS >2 patient was administered rescue analgesia with tramadol 50mg IV and the study concludes at this point. At every assessment patient was observed for development of any adverse effects.

Statistical methods

Continuous variables (age, weight) were presented as Mean + SD. Fisher exact test was used wherever necessary. Statistical software OPEN EPI was used for data analysis.

p value of < 0.05 – Statistically significant

Results

There were no statistically significant differences in demographic profile of patients in either group in terms of age, body weight, or gender ratio ($p > 0.05$).

Table 1: Demographic characteristics of study population

Variable	Ropivacaine	Ropivacaine + Dexamethasone	*p* Value
Age(years)	40.33±12.82	41.73±12.69	0.672
Sex(M/F)	18(60%)/12(40%)	20(66.6%)/10(33.3%)	0.592
Weight(kg)	64.63±7.08	66.9±6.77	0.209
Duration (in mins)	78.66 ± 13.45	78.5 ± 11.68	P=0.960)

Table 2: Diagnosis of patients and ASA grade distribution in study

Diagnosis	Ropivacaine		Ropivacaine + Dexamethasone	
	NO	%	NO	%
Humerus proximal #	12	40%	10	33.3%
Humerus shaft #	8	26.6%	7	23.3%
Humerus with implant	10	33.3%	13	43.3%
ASA Grade				
1	23	76.6%	23	76.6%
2	7	23.3%	7	23.3%

Table 3: Onset and duration of Sensory and motor block in study

Onset	Ropivacaine (min)	Ropivacaine + Dexamethasone (min)	P value
Sensory block	12 ± 1.70	11.53 ± 1.66	0.310
Motor block	15.6 ± 1.66	14.78 ± 1.61	0.056
Duration of block(in minutes)			
Sensory	586.88 ± 63.64	1024.96 ± 58.27	0.000
Motor	534.25 ± 56.41	984.39 ± 57.89	
Duration of analgesia	628.88 ± 65.11	1051 ± 61.36	0.000

The average age was 40.33 ± 12.82 years in R group and 41.73 ± 12.69 years in RD group. Average body weight 64.63 ±7.08 kg in R group and 66.9 ± 6.77 kg in RD group. Both the groups had predominantly male patients. The duration surgery in both the groups was insignificant (p = 0.960) (Table 1)

There were no statistically significant differences in patients posted for surgery in either group (p value – 0.726). Implant removal was done for patients with implant insitu. Open reduction internal fixation with plating for fractures (Table 2).

There was no significant difference between 2 groups in terms of ASA grading (p = 1.000). Onset of sensory block in Ropivacaine group was 12 ± 1.70 min whereas in Ropivacaine + Dexamethasone group it was 11.53 ± 1.66 min, which was not statistically significant (p > 0.05) Onset of motor block in Ropivacaine group was 15.6 ± 1.66 min whereas in Ropivacaine + Dexamethasone it was 14.78 ± 1.61 min, which was not statistically significant (p > 0.05).

Duration of sensory block in Ropivacaine group was 586 ± 63.64 min whereas in Ropivacaine + Dexamethasone group it is 1024 ± 58.27 min, which is highly significant (p < 0.001). Duration of motor block in Ropivacaine group was 534.25 ± 56.41 min whereas in Ropivacaine + Dexamethasone group it is 984.39 ± 57.89 min, which is highly significant (p < 0.001).

Table 4. Overall quality of block in present study

Overall quality of block	Ropivacaine		Ropivacaine + Dexamethasone	
	NO	%	NO	%
Satisfactory block	27	90%	28	93.3%
Unsatisfactory block	3	10%	2	6.66%
Complete failure	0		0	

Table 5. Comparison of basal and post block values of hemodynamic parameters

Parameters	Ropivacaine	Ropivacaine+ Dexa	*p* value
Pulse/min(B)	77±6.16	78.3±5.48	0.391
MAP mmHg(B)	91.93±5.52	92.2±4.90	0.841
SpO2%(B)	99.26±0.94	99.3±0.83	0.861
Pulse/min(PB)	78.6±5.80	79.6±5.73	0.504
MAP mmHg(PB)	90.6±6.28	92.06±5.41	0.338
SpO2%(PB)	99.43±0.81	99.33±0.71	0.613

Duration of analgesia in Ropivacaine group was 628.88 ± 65.11 min whereas in Ropivacaine + Dexamethasone it is 1051 ± 61.36 min, which is statistically highly significant ($p < 0.001$) (Table 3).

Block was successful in 90% patients in Ropivacaine group and 93.3% in Ropivacaine + Dexamethasone. The difference was not statistically significant ($p = 0.640$) (Table 4).

The hemodynamic parameters were statistically insignificant in both the groups since ($p > 0.05$). (Table 5).

Discussion

In recent years, there has been a growing interest in the practice of regional techniques and, in particular, peripheral nerve blocks for surgical anaesthesia and postoperative analgesia. The development of local anaesthetic agents with lower toxicity and long duration of action had contributed to this change. Compared with general anaesthesia, regional anaesthesia is associated with multiple benefits including reduced morbidity and mortality. After going through the relevant literature regarding the use of Dexamethasone as an adjuvant to local anaesthetics, it was hypothesised that addition of Dexamethasone to Ropivacaine for interscalene brachial plexus block, will be effective in prolonging the duration of analgesia

In our study, the drugs selected for brachial plexus block were Ropivacaine and Dexamethasone. Bupivacaine and Ropivacaine are being regularly used for brachial plexus block for upper limb orthopaedic surgeries in our hospital. Ropivacaine has a higher toxic threshold, produces less cardiac and central nervous system effects compared to Bupivacaine and hence selected as the local anaesthetic for our study. In an attempt to increase the duration of post-operative analgesia, various adjuvant drugs are used along with local anaesthetic agents. Adjuvants include Epinephrine, Clonidine, Opioids, Ketamine and Midazolam. But all have met with limited success and the increase in the incidence of side effects were noted. Dexamethasone, as an adjuvant appears to be effective in prolonging the duration of analgesia of nterscalene block, with the effect being stronger with Ropivacaine. Despite concern surrounding 'off label' use of perineural adjuvants, the safety profile of dexamethasone is promising.[5] Additionally, orticosteroids have a long history of safe use in the epidural space for the treatment of radicular pain arising from nerve root irritation[6] and dexamethasone specifically has been studied as an adjuvant to epidural local anaesthetics.[7] In fact, the use of dexamethasone as an adjuvant to local anaesthesia for nerve blocks is discussed in prominent textbooks.[8,9] Hence in our study Dexamethasone was selected as an adjuvant to Ropivacaine for studying the effectiveness in prolongation of the duration of analgesia.

The prolonged sensory and motor block provided by Ropivacaine 0.5% or 0.75% for axillary, interscalene and subclavian perivascular brachial plexus block for upper limb surgery could be favourably compared with Bupivacaine 0.5% with similar quality of regional anaesthesia. Klein S M et al[11] conducted a study to compare 0.5% Bupivacaine and 0.5% and 0.75% Ropivacaine for interscalene brachial plexus block. In all three groups, the mean onset of motor and sensory block, Mean duration of analgesia was not statistically significant. Casati A et al[12] conducted a study with 20ml of 0.5%, 0.75%, 1% Ropivacaine or 2% mepivacaine. ostoperative analgesia was similar with the three Ropivacaine concentrations. Hence in our study we selected 0.5% as the concentration of Ropivacaine.

Various text books[13] have given 25-40ml as volume of local anaesthetics required for interscalene block. Radiographic studies suggest a volume to anaesthesia relationship, with 40ml solution associated with complete brachial plexus blockade. Volume used by various authors as K.C. Cummings et al. – 30ml, Dar F A et al. – 30ml, Kumar S et al. – 30ml, Klein S M et al.[11] – 30ml and Casati A et al.[12] – 20ml. In our study 30ml of 0.5% Ropivacaine was chosen, keeping in mind that it should not exceed the safe dose of 3ml/kg body weight. Dexamethasone 8mg was selected as all literature available used 8mg as dose in their study.

In our study onset of sensory block in Ropivacaine group was 12 ± 1.70 min and in Ropivacaine + Dexamethasone group it was 11.53 ± 1.66 which was stastically insignificant. Similar observations were found in the studies conducted by Ganvit K S et al.[14] and Kumar S et al.[15] where there was no statistically significant difference between the onset of sensory blockade among Ropivacaine group and Ropivacaine+Dexamethasone group which corelates with our study. Our study does not concur with the study conducted by Dar F A et al.[16] who have found a significant difference between the two groups regarding the onset of sensory block. In their study onset of sensory block has been defined as complete loss of sensation to touch in all the dermatomes. They have not separately studied the time taken for onset and maximum sensory blockade. In our study we have used loss of

sensation to pin prick as the end point unlike loss of touch sensation as the end point taken in their study. However in the study conducted by Cumming K C et al.[17] Kawanishi R et al.[18] Casati A et al., [12] onset of sensory blockade is not been documented. Hence we cannot compare our findings with that study.

In our study onset of motor block in Ropivacaine group was 15.6 ± 1.66 min and in Ropivacaine+ Dexamethasone group it was 14.78 ± 1.61 min which is statistically insignificant. Similar observations were found in the studies conducted by Ganvit K S et al.[14] and Kumar S et al.[15] where there was no statistically significant difference between the onset of Motor blockade among Ropivacaine group and Ropivacaine+Dexamethasone group which concurs with our study. Similar study conducted by Dar F A et al. who have found a significant difference between the two groups regarding the onset of Motor block. Onset of Motor block has been defined by Modified Bromage scale. In our study we have used Lovett Rating scale. Hence probably the difference and does not concurs with the study. However in the study conducted by Cumming KC et al.[17] Kawanishi R et al.[18] Casati A et al.[12] onset of Motor blockade is not been documented hence we could not compare our findings with that study.

In our study the duration of motor block was 534.25 ± 56.41 min in Ropivacaine group and 984.39 ± 57.89 min in Ropivacaine+Dexamethasone group which was statistically highly significant. Duration of sensory block in Ropivacaine group was 586.88 ± 63.64 min whereas in Ropivacaine+Dexamethasone it was 1024.96 ± 58.27 min which was statistically highly significant. The studies conducted by Ganvit K S et al.[14] Dar F A et al.[16] and Kumar S et al.[15] there were statistically highly significant difference in the duration of Motor and Sensory blockade between Ropivacaine and Ropivacaine+Dexamethasone group for brachial plexus block. Hence our study concurs with the above studies with respect to duration of motor and sensory blockade.

In our study the duration of analgesia was 628.88 ± 65.11 min in Ropivacaine group and 1051.07 ± 61.36 min in Ropivacaine+Dexamethasone group which was statistically highly significant. The studies conducted by Cummings KC et al.[17] Kawanishi R et al.[18] Ganvit KS et al[14] and Dar F A et al.[16] there was statistically highly significant difference in the duration of analgesia between Ropivacaine and Ropivacaine+Dexamethasone group for brachial plexus block. Hence our study concurs with the above mentioned studies in respect to duration of analgesia In Cummings KC et al.[17] Dexamethasone significantly prolonged the duration of analgesia of both Ropivacaine [median (inter-quartile range) 11.8 (9.7, 13.8) vs 22.2 (18.0, 28.6) h, log-rank p = 0.001] and Bupivacaine [14.8 (11.8, 18.1) and 22.4 (20.5, 29.3) h, log-rank p = 0.001]. Dexamethasone prolonged analgesia more with Ropivacaine than Bupivacaine (Cox's model interaction term $p¼$ = 0.0029). In Dar F A et al.[16] Demographic data and surgical characteristics were similar in both groups. The sensory and motor block onset time was earlier in group RD as compared to group R (Ropivacaine and Ropivacaine + Dexamethasone values are 17.5 ± 4.2 vs 14.6 ± 3.31, 20.67 ± 3.03 vs 18.01 ± 4.51 respectively) (p < 0.05). Sensory and motor blockade duration were longer in group RD than in group R (Ropivacaine and Ropivacaine+Dexamethasone values are 7.5 ± 0.55 vs 12.3 ± 0.40, 6.4 ± 0.30 vs 8.2 ± 0.50 respectively) (p < 0.001). Duration of analgesia was longer in group

RD than in group R (Ropivacaine and Ropivacaine+Dexamethasone values are 8.30 ± 0.40 vs 14.50 ± 0.30 respectively) (p < 0.001). The 24 hour Visual Analog Scale was more in group R as compared to group RD. The quality of anaesthesia was excellent in both the groups. The above study has used Visual Analog Scale, in our study Verbal Rating Scale was used for pain assessment. In Ganvit KS et al. The onset and peak of sensory blockade of RD vs R (4.3min vs 4.5 min, 9.3 min vs 9.07min) respectively and onset and peak motor blockade of RD vs R (6.6min vs 6.8min, 12.9min vs 13.1min) respectively were statistically insignificant, duration of sensory and motor blockade were significantly longer in the dexamethasone group (10.17 ± 1.13 vs. 6.5 ± 0.6 hrs and 8.35 ± 0.81 vs. 7.42 ± 0.78 hrs, respectively) than in the control group (p = 0.001). There were no side effects or complications observed in either group. Intraoperative and postoperative patient vital parameters such as heart rate, blood pressure and oxygen saturation were stable. Total mean duration of post-operative analgesia in group RD was 21.3 hrs and in group R was 10.24hrs which is statistically highly significant. In contrast to our study in the above study both onset and peak of motor and sensory block was assessed. In Kawanishi R et al[18] Perineural dexamethasone 4 mg significantly prolonged the duration of analgesia. The median duration of anaesthesia was longer in group Dperi (18.0 hours, interquartile range [IQR] 14.5–19.0 hours) than in group C (11.2 hours, IQR 8.0–15.0 hours). The median duration of anaesthesia was 14.0 hours (IQR 12.7–15.1 hours) in group Div. Significant differences were observed between group Dperi and C (p = 0.001). Kaplan– Meier curves for the first analgesic request with patients

not receiving any analgesics after 20 hours showed significant differences between groups Dperi and C (p = 0.005), and between groups Dperi and Div (p = 0.008), but not between groups C and Div (p = 0.411).

The block was satisfactory for 90% in Ropivacaine group and 93.33% in Ropivacaine +Dexamethasone group. The remaining patients who had unsatisfactory block, were administered general anaesthesia and were excluded from the study. There was no statistically significant differencebetween two groups in terms of overall quality of blockade.

The incidence of adverse events in either group was nil. As care was taken not to exceed safety margin of Ropivacaine which was 3mg/kg body weight Hemodynamic parameters like Pulse, Blood pressure and Spo2 were stable in study population without

Conclusion

There was no statistically significant difference in demographic data, duration of surgery, and hemodynamic parameters between the study groups. No statistically significant difference in onset of sensory and motor block and quality of overall block between 2 groups. There was statistically highly significant difference in between the groups in terms of duration of sensory and motor block and duration of analgesia. Hence it can be concluded that addition of Dexamethasone to 0.5% Ropivacaine increases the duration of sensory and motor block as well duration of analgesia in comparison to Ropivacaine alone in inter scalene brachial plexus block for upper limb surgeries.

From our study we conclude that addition of Dexamethasone to 0.5% Ropivacaine for interscalene brachial plexus block increases duration of sensory block, motor block as well as duration of analgesia. But there was no difference in onset of sensory and motor block, nor did it Improve the overall quality of block.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 824–828
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.26

Correlation between Interspinous Gap and the Ease of Spinal Anaesthesia: A Prospective Observational Study

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Abstract

Context: Spinal anaesthesia is a blind landmark based procedure, it can be challenging in some patients. The subarachnoid space should preferably be identified at the first attempt, as multiple punctures are associated with pain and patient discomfort, increase risk of postdural puncture headache, spinal hematoma formation, trauma to neural structures and permanent neurological sequalae. Predictors to assess the difficulty of spinal anaesthesia increases the chances of success with this blind technique prevent multiple attempts and add to patient comfort, thus increasing the quality of healthcare. *Aims:* We formulated this study to assess the ease/difficulty of spinal anaesthesia based on width of interspinous gap (ISG) and patient's characteristics. *Settings and Design:* A prospective observational study conducted in 77 ASA I and II patients of either sex and age between 18-65 years, posted for elective or emergency surgery under spinal anaesthesia. *Methods and Material:* The ISG was measured using vernier caliper at L4-L5 level in optimal flexed sitting position before spinal anaesthesia. The number of attempts, redirections and requirement of another spinal level were recorded. *Statistical analysis used:* Mean and Standard Deviation, Chi-square test, Independent t-test and p value. *Results:* The demographic data like age, gender, body mass index and type/gauge of spinal needle did not have any correlation with the ease of spinal anaesthesia while ISG was found to be significantly lower (p = 0.000) in patients who required more number of redirections, attempts and levels. *Conclusions:* ISG is a good predictor for the ease of spinal anaesthesia.

Keywords: Difficult Spinal Anaesthesia, Interspinous Gap, vernier caliper

How to cite this article:

Arjun, R Manickavasagan, Mamta Jain, et al. Correlation between Interspinous Gap and the Ease of Spinal Anaesthesia: Prospective Observational Study. Indian J Anesth Analg. 2020;7(3):824–828.

Introduction

Spinal anaesthesia (SA) is safe and effective alternative to general anaesthesia, and has multiple benefits like reduction in the rate of venous thromboembolism, myocardial infarction, requirement for postoperative analgesia, reduced sympathetic response to surgical stimulation, reduction in morbidity and mortality, thereby it is also economical.[1] SA is a first choice in below umbilical abdominal, lower extremity, urologic, gynecologic, and anorectal surgeries.[2]

But it is a landmark based blind technique and sometimes become technically challenging and very difficult. Traumatic placement of a needle

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Received on 12.12.2019**, Accepted on** 29.02.2020

requiring multiple attempts and change of level has been related to many complications. Some are transient, such as postdural puncture headache and transient neurological symptoms, however, some are severe like trauma to neural structures, spinal hematoma causing permanent neurologic deficits and long-term disability.[3] Multiple punctures are also associated with pain and patient discomfort due to which patients may be reluctant to undergo surgical procedure under spinal anaesthesia in future and opt for general anaesthesia.[4] So, efforts have been made in order to predict the difficult neuraxial blockade for the purpose of minimizing the risk caused by traumatic placement of the needle. Several factors thought to be associated with technically difficult neuraxial block like age, gender, body mass index (BMI), and spine deformities were demonstrated in earlier studies.

Based on the quality of anatomical landmarks assessed by palpatory method, various predictors were mentioned earlier for the ease of performing spinal anaesthesia but as all were qualitative methods so the chances of subjective bias were possible. Shankar et al conducted a study by measuring spinous process width (SPW) and interspinous gap (ISG) with caliper and it was found that SPW is not associated with ease of spinal anaesthesia and ISG is a better predictor for the ease of performance of spinal anaesthesia.[5] Atallah, et al have also attempted to devise difficulty scores for spinal anaesthesia based on radiological characteristics of lumbar spine.[6]

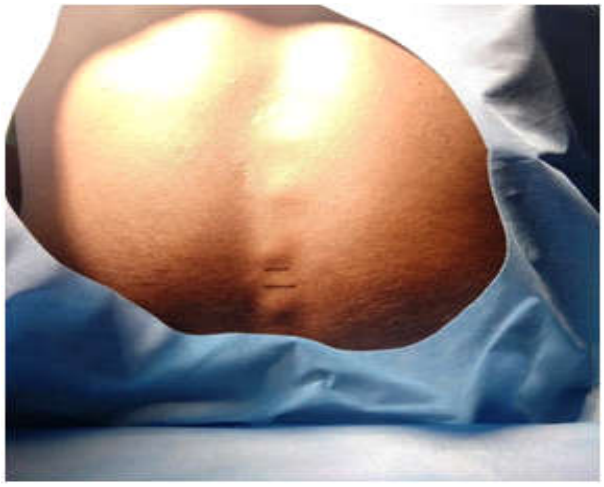
However, no absolute clinical predictors have been found so far. Hence, we formulated this study to assess the ease/difficulty of spinal anaesthesia based on width of ISG and patient's characteristics. This study can further add evidence and emphasis to the sparse literature on predictors for the ease of spinal anaesthesia.

Materials and Methods

The present study was a prospective observational study. 77 patients of either sex and age between 18-65 years of ASA I and II, posted for elective or emergency surgery under spinal anaesthesia were included in the study. Patients with spine deformities, previous history of spine surgery, any contraindication for spinal anaesthesia, not willing to give consent and pregnant patients were not included for the study. After obtaining the Informed consent, demographic details of patients including age, gender, height, weight, BMI were recorded. The lumbar puncture for spinal anaesthesia was performed by an experienced anaesthesiologist with more than 5 years of experience.

On the day of surgery, after the patient was brought to the operation theatre, intravenous access was established and intravenous fluid started. Standard monitors-SpO_2, NIBP, and ECG were connected. The patient was held by an assistant in optimal flexed sitting position. L4-L5 level was taken as the primary point of entry. These levels were estimated based on the Tuffier's line corresponding to L4-L5 level. The spinous process above and below the level were palpated and marked with a skin marker (Fig. 1).

The ISG between the adjacent spinous processes was then measured with a vernier caliper by the primary investigator. Vernier caliper is an instrument to measure very small distances even less than 1 mm with the help of main scale and vernier scale.[7-9] After measuring the ISG, type and gauge of spinal needle was decided by the



anaesthesiologist who was performing spinal anaesthesia and was blinded to the measurement of ISG. The number of attempts, redirections and requirement of another spinal level were recorded.

An Attempt was defined as a new skin puncture, using a different interspace for giving spinal anaesthesia or change of needle.[5]

A Redirection was defined as withdrawing the needle to skin and changing its direction before advancing again. The success or failure as determined by the need for additional anaesthesia was also noted. The outcome measures that were used to assess the difficulty in performing the lumbar puncture for spinal anaesthesia are ≥3 redirections, >1 attempt and >1 level. These cut-offs were the same as used in an earlier study correlating the spinous process dimensions with the ease of spinal anaesthesia.

Indian study by Shankar et al reported that 28% patients required more than 3 redirections.[5] The required sample size was calculated based on this prevalence, for 95% confidence interval and 10% precision and arrived as 77 patients. The value of $p < 0.05$ was considered statistically significant. Data was entered in Microsoft excel 2007 and SPSS version 19.0 (Statistical Packages for social sciences) was used for analysis. Chi-square test was done for comparing the categorical data like difficulty and ease in insertion, no of attempts, levels etc. Mean and SD were calculated for Age, Weight, BMI and ISG. Independent t-test was done to compare the difference in the mean ISG in one attempt & more than one attempt. The value of p is considered significant if $p \leq 0.05$.

Results

Table 1 summarizes the mean and standard deviation of the demographic characteristics and ISG. In our study, 70.1% patients were male and 29.9% patients were female. According to Table 2, it is clear that 3 or more than 3 redirections, more than 1 attempt and more than one level attempt was required in 27.3%, 28.6% & 9.1% patients respectively.

Table 1: Descriptive statistics

Variables	Mean ± SD
AGE (years)	43.82 ± 13.045
SEX(Male: Female)	54:23
BMI(Kg/m2)	26.0388 ± 4.18964
ISG(mm)	7.2306 ± 0.69245

Twenty-one patients who required ≥3 redirections has a mean ISG of 6.44 (±0.32)mm in contrast to 7.52 (±0.54) mm in those with <3 redirections ($p = 0.000$). 22 patients required >1 attempt with a mean ISG of 6.45(±0.31) mm in contrast to 7.54 (±0.53) mm in those with 1 attempt ($p = 0.000$) statistically significant. 7 patients with a mean ISG of 6.32 (±0.37)mm required more than one level in contrast to 70 patients with mean ISG of 7.32 (±0.65) mm who required single level ($p = 0.000$). Also the table shows that the number of redirections, attempts and levels required have no significance in relation to age, gender and BMI. Table3 suggests no correlation between ease of spinal anaesthesia and size/type of the spinal needle used ($p = 0.108$).

Table 3: Correlation Between Number of Attempts and Type/ Gauge of Spinal Needle

Type of needle	Size of needle	No. of patient	1 attempt	>1 attempt	*p*-value
Whitacre	27	31	18	13	0.108
	25	45	37	8	
Quincke	23	1	0	1	

Discussion

Spinal anaesthesia technique being an indispensable part of modern anaesthesia practice, every effort should be made for adequate preoperative prediction of difficult neural blockade to make the procedure less traumatic and more acceptable to patients. Ultrasound is useful in preoperative assessment of spine anatomy, especially if spine deformities are present but this requires expertise and not done routinely because of limited availability.[10-11]

In the present study, we are focusing on ISG, which is a bony landmark as the predictor of ease of spinal anaesthesia. Our study has shown that the ISG is one of the most important predictor for the ease of spinal anaesthesia. In our study we measured ISG of 77 patients undergoing spinal anaesthesia and found that ISG was significantly higher ($p = 0.000$) in patients who required only one intervertebral space, one attempt and <3 redirections. The results were similar to the study done by Shankar et al, there was a decreasing trend of difficulty with increased ISG.[5] Hence, by measuring ISG using a vernier caliper which is a cheaper and much easier technique, we can predict easy/difficult neuraxial block and can choose the best intervertebral space for successful central neuraxial block.

Table 2. Relationship between various factors & number of redirections, attempts and levels used (n=77)

Variable Number of patients	≥3 redirections 21 (27.3%) (mean ± SD)	<3 redirections 56 (72.7%) (mean ± SD)	*p* value	>1 attempt 22(28.6%) (mean ± SD)	1 attempt 55 (71.4%) (mean ± SD)	*p* value	>1 level 7 (9.1%) (mean ± SD)	1 level 70 (90.9%) (mean ± SD)	*p* value
Age(year)	42.43 ± 13.62	44.34 ± 12.91	0.45	41.45 ± 14.05	44.76 ± 12.62	0.25	44.00 ± 15.52	43.80 ± 12.90	0.96
Sex (%) Male:Female	24.07:34.78	75.92:65.21	0.33	25.92:34.78	74.07:65.21	0.43	7.40:13.04	92.59:86.95	0.43
BMI(Kg/m2)	25.64 ± 2.72	26.19 ± 4.64	0.96	25.49 ± 2.75	26.26 ± 4.65	0.71	24.87 ± 2.73	26.16 ± 4.31	0.52
ISG(mm)	6.44 ± 0.32	7.53 ± 0.55	0.00	6.45 ± 0.32	7.54 ± 0.54	0.00	6.33 ± 0.37	7.32 ± 0.65	0.00

Our study did not find any significance between the age of the subject and number of redirections, attempts or spaces used. Chien et al.[2], Shankar et al.[5] and Khoshrang et al.[12] reported that age was not associated with the first-level success or first attempt success, which was similar to our study. In a study done by Ruzman, et al., it was found that the block was easier to perform in younger patients (p = 0.007), which might be expected due to less incidence of spine deformities and probably better compliance during the procedure in younger patients.[13] However, no patient was older than 65years in our study, which could be the cause of no correlation seen between age and difficult spinal anaesthesia.

In our study relation with gender of the patient was also not significant which was similar to the study by Khoshrang et al.,[12] Sprung et al.,[14] where there was no significance between the gender and the ease of spinal anaesthesia.

Our study did not find BMI to be the predictor in assessing the ease of spinal anaesthesia which was similar to the study of Shankar et al.[5] and Sprung et al.[14] Contrary to this, Ruzman et al. showed difficulties in performing the block were often associated with higher BMI 28.79 ± 5.70 (p = 0.020) as compared to patients who had first attempt success of neuraxial block (BMI 27.23 ± 5.39).[13] In our study the mean BMI was 26.3 ± 4.19 lesser than at which the difficulty was found in their study.

The highest percentage of successful blocks in the study by Ruzman et al.[13] was found with finer gauze spinal needle (27 G) (p = 0.000). However, in our study there was no statistically significance correlation found between the successful block and gauge/type of needle used which was similar to the study by Sprung et al.[14] & Tarkkila et al.[15] This could be explained by the fact that 27G needle was mostly used in young patients with normal spine anatomy and normal BMI in Ruzman et al study.

Hence, lesser ISG is likely to be associated with more number of attempts for spinal anaesthesia and thus more complications like backache, postdural puncture headache (PDPH), intraspinal haematoma formation, arachnoiditis, meningitis, neural Injury like nerve root damage, spinal cord damage, cauda equina syndrome etc.[5] Among general population back injury is the most feared complication of the neuraxial anaesthesia.[16] According to United Kingdom NHS audit, the overall rate of permanent nerve injury is 0.1 per 10000 mostly associated with procedure related risk factors like paresthesia or radicular pain during the procedure.[17,18] Difficult or traumatic needle insertion, coagulopathy and female gender are important risk factor associated with spinal epidural hematoma formation.[19-20] Although it is very rare complication but it's devastating nature caused US Food and drug administration to issue a warning in 1997 for the concurrent use of low molecular weight heparin and spinal/epidural anaesthesia.[21-22] Traumatic and difficult neuraxial block also increases the chances of epidural abscess formation.[23]

The Quality of anatomical landmarks was considered to be the single most important predictor of difficulty for neuraxial access and our study showed that ISG is a good predictor of difficulty for neuraxial access and routine preoperative measurement of ISG could enable us to predict the difficulty of performing the neuraxial blockade and would forewarn us to be prepared in preventing the incidence of complications associated with spinal anaesthesia which could be crippling and life threatening.[2] As pregnant patients were not included, so the results could not be generalized. Also patient's movements could have altered ISG dimensions and affected the precision of the ISG measurements. And radiological measurement of ISG was not done which could possibly increase the accuracy of measurements. These are the limitations of this study. So to conclude, ISG is a good predictor for the ease of spinal anaesthesia and there is no statistical significance correlation between ease of spinal anaesthesia and age, BMI, gender or needle size/type. We also recommend that measurement of ISG should be done before performing neuraxial block in order to minimize the complications.

Key Messages: Preoperative measurement of interspinous gap using vernier caliper is a cheaper and easier technique, to predict easy/difficult neuraxial block and can help in choosing the best intervertebral space for successful central neuraxial block.

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 829–834
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.27

A Study of Haemodynamic and Pharmacodynamic Effects of Cis-Atracurium and Vecuronium in Patients Undergoing Laparoscopic Appendicectomy

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Abstract

Aim: To study the haemodynamic and pharmacodynamic effects of cis-atracurium and vecuronium. *Settings and Design:* Prospective, Randomized, Parallel group, Double blind study *Plan of Study:* After institutional review board approval and informed written consent from patients, eighty patients undergoing laparoscopic appendicectomy were randomized into two groups. Group-C n=40 received loading dose of inj. Cis-atracurium 0.15mg/kg and maintenance doses of 0.03mg/kg while Group-V, n=40 received loading dose of inj. Vecuronium 0.10mg/kg and maintenance doses of 0.02mg/kg. As premedication Inj. Ondansetron, Glycopyrolate, Midazolam were administered followed by Inj. Propofol + Inj. Fentanyl + loading dose of assigned drug for induction & intubation of the patient. Maintenance of general anaesthesia was done with O_2+N_2O (50:50), Sevoflurane inhalation, and intermittent doses of assigned muscle relaxant drug according to PNS. The observations as time of onset of action, intubation time, time interval between loading and first maintenance dose, time interval between maintenance doses, extubation time, total number of drug dosage requiredand haemodynamic parameters were noted. *Statistical analysis:* Data were analysed by using repeated measure ANOVA and by Manwitney U test. *Results:* Time of onset of action and intubation time in Group- V were significantly lower as compared to Group-C.Time interval between loading & first maintenance dose was comparatively higher in Group- C than Group- V. Time intervals between maintenance doses were comparable among both the groups. When compared with Group-V, extubation time was shorter in Group-C. *Conclusion:* Cis-atracurium had a longer time of onset of action, longer duration of action, hence less doses were required for maintenance of anaesthesia, faster recovery as compared to Vecuronium. Both drugs were haemodynamically stable.

Keywords: Cis-atracurium, Vecuronium, Train of Four, Onset of action, Duration of action & recovery

How to cite this article:
Nimisha A Tank, Shilpa M Doshi. A Study of Haemodynamic and Pharmacodynamic Effects of Cis-Atracurium and Vecuronium in Patients Undergoing Laparoscopic. Indian J Anesth Analg. 2020;7(3):829–834.

Introduction

The introduction of neuromuscular blocking drugs revolutionized the practice of anaesthesia. Before the advent of muscle relaxants, anaesthesia was induced and maintained by intravenous or inhalation agents. After the introduction of muscle relaxant, the anaesthesia underwent a conceptual change. Anaesthesia was redefined as a triad of narcosis, analgesia, and muscle relaxation. (1)

In 1975 Savarese and Kitz outlined the characteristics of an ideal anaesthetic agent; which are enumerated as follows:

- Non-depolarizing type of action ; Rapid onset of action ;Short duration of action

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Received on 12.02.2020, **Accepted on** 03.03.2020

- Rapid recovery; No cumulative pharmacokinetics; No histamine release
- Minimal cardiovascular effects; Pharmacological inactive metabolites
- Reversible by cholinesterase inhibitors

Depolarizing and nondepolarizing drugs are routinely used to facilitate tracheal intubation during the induction of anaesthesia and to maintain the muscle relaxation during surgery. Atracurium meets many characteristics for an ideal intermediate-acting drug. It also shows weak histamine-releasing properties, which limits the administration of large and rapid boluses.[2]

As a result of this, new molecule was developed named as Cis-atracurium. Cis-atracurium, a cis-cis isomer of Atracurium, constitutes 15% of the racemic mixture of the parent compound and it is three times more potent than Atracurium.[3] It does not causes histamine release,[4] possesses greater haemodynamic stability,[3] the favourable characteristics of Hoffman metabolism[5] so that the elimination of the drug is independent of hepatic and renal function.[6] Dosages may not need to be changed in the geriatric or younger population.

Atracurium has been demonstrated to exhibit shorter duration of action in elderly patients when compared with Vecuronium.[7] It appears reasonable to apply the same considerations to Cis-atracurium; but Cis-atracurium onset of action is slower[8] and its clinical duration of action slightly longer than that of Atracurium.[9] Cis-atracurium has been compared favourably as an alternative to Vecuronium in cardiac patients due to its inherent cardiovascular stability[10] and hence a better choice than Atracurium in this point of view.[11] The present study was planned to study the haemodynamic and pharmacodynamic effects of Cis-atracurium and its clinical comparison with widely used agent Vecuronium.

Materials and Methods

This prospective, randomized, parallel, double blind study was carried out in one of the tertiary care centre. Institutional Review Board permission was obtained from the institutional. The informed written consent was obtained from all the patients under study.

Eighty patients of either sex posted for laparoscopic appendicectomy under general anaesthesia were enrolled in this study according to following criteria. ***Age:*** 18–50yr and ***ASA class:*** I & II who were posted for elective laparoscopic appendicectomy under general anaesthesia.

Exclusion Criteria: Anticipated difficult airway, pre-existing liver or renal failure, ANC cases & lactating females, patient with neuromuscular disease& neurological disease.

Investigations: Preoperative investigations (Hb, TLC, platelet count, RBS, RFT,S.electrolytes, chest X-ray, ECG) were done. On the day of surgery, after shifting the patient to the preanaesthetic care room, standard monitoring for heart rate (ECG), systolic and diastolic blood pressure (NIBP), SpO_2 cables were connected to the patient & baseline vital parameters were recorded. IV access was secured using 20G intracath in right hand andinfusion 5% dextrose was started at the rate of 4ml/Kg/ hr.The patient was shifted to operation theatre. Inj. Ondansetron 0.08mg/kg, Inj. Glycopyrolate 0.004mg/kg, Inj. Midazolam 0.02mg/kg were administered intravenously.

The patients were randomized using computer generated random number sequence method into two groups with 40 patients in each group.

Group- C: Each patient received loading dose of inj. Cis-atracurium 0.15 mg/kg and maintenance doses of 0.03mg/kg.

Group- V: Each patient received loading dose of inj. Vecuronium 0.10 mg/kg and maintenance doses of 0.02mg/kg.

During the surgical procedure patient was monitored for ECG, SpO_2. Neuromuscular function was monitored, by assessing the contraction of adductor pollicis muscle by stimulating ulnar nerve at wrist using peripheral nerve stimulator (PNS). After cleansing the skin, ECG surface electrodes were placed over ulnar nerve at the wrist. Baseline TOF count was done before induction of anaesthesia. Ulnar nerve was stimulated with TOF supra-maximal stimulation (4 pulses, 0.2msec in duration at a frequency of 2Hz, 2 seconds in duration).

Induction of Anaesthesia: Preoxygenation with 100% oxygen for 3minutes; Induction of general anaesthesia was done with Inj. Fentanyl 1µg/kg followed by inj. Propofol 2mg/kg. Following check ventilation, muscle paralysis was achieved by loading dose of muscle relaxant drug according to the assigned group. When there is no response to Train of Four on peripheral nerve stimulation, trachea was intubated with sterile, polyvinylchloride, cuffed, appropriate sized endotracheal tube. Time of administration of study drug & time of onset of drug under study& intubation time were noted.

Maintenance of Anaesthesia: General anaesthesia was maintained with oxygen and nitrous oxide (50:50), Sevoflurane & intermittent doses of assigned neuromuscular blocking agent according to PNS. When the TOF count increases by more than two, the top-up dose of respective study drug was given. Time intervals between maintenance doses were noted. Tidal volume and ventilatory frequency will be adjusted so as to maintain normocapnia ($EtCO_2$: 40 ± 4 mm/Hg). Sevoflurane was titrated to maintain adequate depth of anaesthesia and to maintain haemodynamic parameters within 20% of their preoperative baseline values. Number of doses of the drug under study, total duration of surgery and intra-operative haemodynamic parameters were noted.

Reversal and Extubation: At the end of surgery, residual neuromuscular blockade was reversed with inj. Neostigmine 50µg/kg and inj. Glycopyrolate 10µg/kg intravenously after TOF count will be more than two.Extubation was done only after TOF count four was achieved and on recovering satisfactory consciousness and as per extubation criteria.

Monitoring: Haemodynamic parameters were monitored at baseline values; 5 minutes after inj Fentanyl; during laryngoscopy and intubation; every 10 minutes thereafter upto 30 minutes; and every 30 minutes upto the end of operation; at the end of operation; at extubation & at 2 minutes after extubation. PNS monitoring was done every 10sec till the onset of action and every minute till duration of action of drugs.

Statistical Analysis: All data were expressed as Mean ± SEM and compared by appropriate statistical tests. Hemodynamic data were compared by using Repeated measure ANOVA and other data by Manwitney U test. p value < 0.05 is consider as significant value.

Results

Patient characteristics in terms of age, gender, weight and height were comparable among both the groups (p > 0.05) (Table 1). Onset of action was [143.88 ± 15.62 secs] and intubation time was [191.6 ± 20.26 secs] in Group- V were significantly lower as compared to onset of action [187.13 ± 15.68 secs] and intubation time [244.50 ± 16.00 secs] in Group- C. The p-value < 0.0001 was found to be significant. Time interval between loading &first maintenance dose was comparatively higher in Group- C [49.50 ± 06.48 min] as compared to Group- V [29.85 ± 05.80 min] (p-value was <0.05). Time intervals between maintenance doses of Group- C & Group- V were21.25 ± 04.07 min & 23.07 ± 04.42 min respectively. Thetime intervals between maintenance doses of both groups were comparable & the p-value was >0.05.

Extubation time was comparatively shorter in Group- C (08.85 ± 02.62 min) than in Group– V. (14.47 ± 03.41 min) (p value < 0.05). Total number of doses were comparatively higher in Group- V (03.40 ± 00.63) compared to Group- C (01.47 ± 00.50) (p -value< 0.0001). Heart rate (HR) and mean arterial pressure (MAP) were comparable between both the groups. After intubation, it was decreased significantly after intubation in both the groups.

Discussion

While selecting neuromuscular agent for tracheal intubation or skeletal muscle relaxation, main aim of an anaesthesiologist is to select an agent with rapid onset, longer clinical duration of action, better haemodynamic stability and good spontaneous reversal.[12] Cis-atracurium, a nondepolarizing, intermediate acting, neuromuscular agent, decomposes into laudanosine and a tetravalent alcohol metabolite by Hoffman elimination. So, recovery of muscle relaxation is little affected by liver or kidney diseases.

In present study, patient's characteristics in terms of age, gender, weight and height were comparable among both the groups (Table 1) (p-value > 0.05). In present study while comparing the variables

Table 1. Demography data

Data	Group- C (n-40) Mean ± SD	Group- V (n -40) Mean ± SD	p- Value
Age(years)	28.80 ± 09.35	27.92 ± 09.57	0.6805
Gender(M/F)	21 /19	19 /21	0.8233
Height(cm)	157.90 ± 04.36	159.50 ± 02.99	0.0597
Weight(kg)	57.57 ± 05.54	55.40 ± 05.89	0.0931

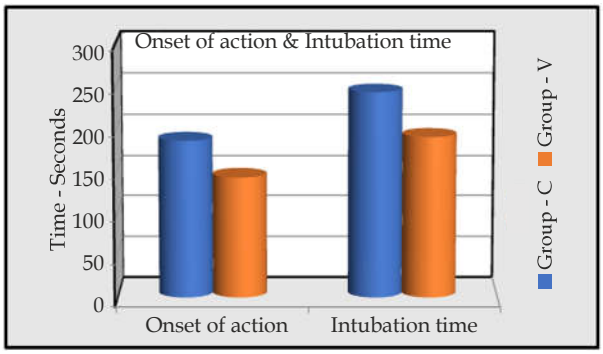

Fig. 1: Onset of action & Intubation time

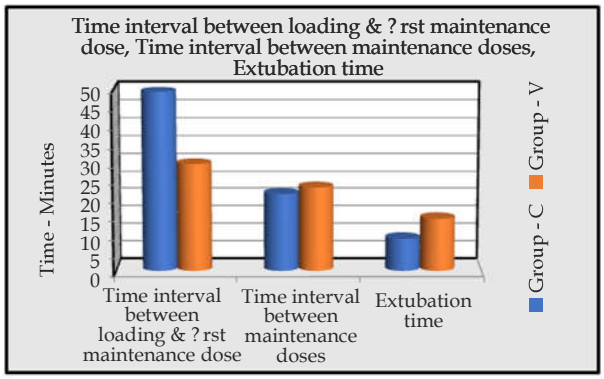

Fig. 2: Time interval between loading & first maintenance dose, Time interval between maintenance doses, Extubation time

Fig. 3: Total no. of doses required

like, onset of action (143.88 ± 15.62 seconds) and intubationtime (191.6 ± 20.26 seconds) in Group- V those were significantly loweras compared to onset of action (187.13 ±15.68 seconds) and Intubationtime (244.50 ± 16.00 seconds) in Group- C. (p-value <0.05) (Fig. 1).

Keles et al.[13] suggested that, the onset time was significantly shorter with Vecuronium than that with Cis-atracurium. Eppich L et al.[3] suggested that Cis-atracurium demonstrated a slightly longer onset and duration of action compared with Vecuronium and also the onset of maximum block was dose related in the Cis-atracurium group. Increasing the Cis-atracurium dose from 0.1 - 0.2 mg/kg shortened by 2minutes the onset of maximum dose block. However this delay did not influence the overall quality of intubating conditions.

The present study shows that,

- Time interval between loading &first maintenance dose was comparatively higher in Group- C (49.50 ± 06.48 minutes) than Group- V. (29.85 ± 05.80 minutes) (p-value < 0.05) (Fig. 2).
- Time intervals between maintenance doses were comparable among both the groups. Group- C (21.25 ± 04.07 minutes) & Group- V (23.07 ± 04.42 minutes) (p-value <0.05) (Fig. 2)

C Melloni et al.[14] suggested that Cis-atracurium duration of action was slightly longer than that of Vecuronium which was similar to our study. Vecuronium owes its relatively short duration of action to rapid distribution kinetics such that recovery occurs largely during the distribution phase. In contrast, Atracurium and Cis-atracurium are rapidly degraded by a pathway which is independent of hepatic and renal function, so that the pharmacological recovery occurs during the elimination phase. Amini Shahram et al.[15] studied effects of different doses of Cisatracurium on appropriate time for endotracheal intubation and haemodynamic changes during anaesthesia and found that the clinical duration of action with 0.15 mg/kg was 44.93 ± 05.40 minutes; comparable to our study, while with 0.20 mg/kg it was 57.03 ± 04.21 minutes.

In present study, extubation time was comparatively shorter in Group- C (08.85 ± 02.62 minutes) than in Group- V. (14.47 ± 03.41 minutes) (p-value <0.05) (Fig. 2). C Melloni et al.[14] found that spontaneous complete recovery time (SCRT) were similarly short with a trend toward a faster recovery with Cis-atracurium. Sarooshian SS et al.[16] found that young patients have more rapid onset of block than elderly patients because of slow bio-phase equilibration in elderly patients but clinical duration of action and recovery profile was found to be similar between two groups. Similar finding were observed by Ornstein et al.[17]

In present study, total number of doses were comparatively higher in Group- V (03.40 ± 00.63) as compared to Group- C (01.47 ± 00.50) (p value <0.05) (Fig. 3). There were no differences in baseline

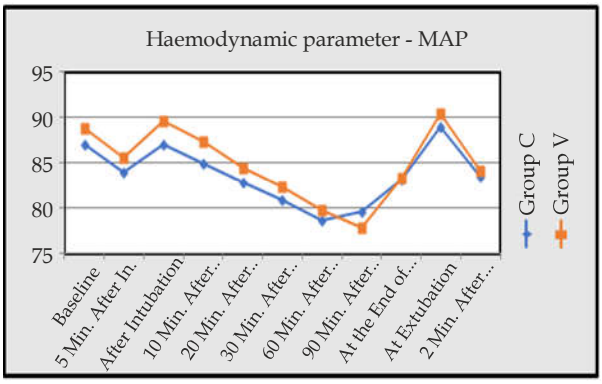

Fig. 4: Haemodynamic parameter - MAP

haemodynamic values among both the groups. After the induction of anaesthesia, both the groups showed significant but similar decrease in mean arterial pressure (MAP) and heart rate (HR) (Fig. 4). Hear rate (HR) was comparable between both the groups. It Was decreases significantly after intubation, but in the both groups (Fig. 5).

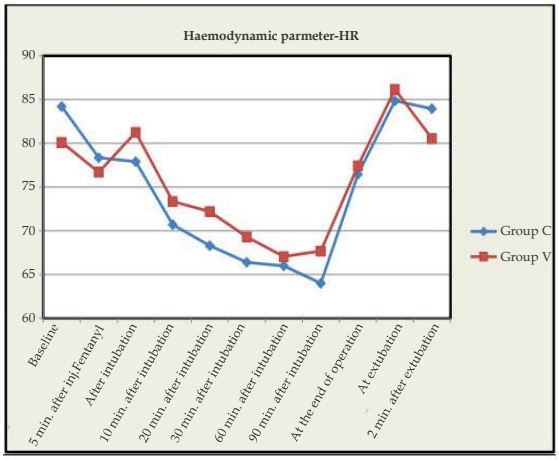

Fig. 5: Haemodynamic parmeter-HR.

EL Kasaby A M et al.[18] observed that small changes occurred in MAP and HR post induction and post intubation but these changes were not significant statistically and clinically at higher doses of Cis-atracurium. So, haemodynamic stability was evident among higher doses of Cis-atracurium.

In our study, no complications were observed in any of the patients. Complications like cumulative effect (defined as a progressive increase in the duration of action of repeat doses) did not appear; however elderly patients demonstrated a prolongation of NMB action with Vecuronium in comparison with Cis-atracurium, supporting differences in cumulation between muscle relaxants especially during recovery.[19,20] From this point of view Cis-atracurium seems a superior drug because it does not exhibit even the slightest minimal cumulation as evident with Atracurium.[19]

Limitations of the study: We used TOF count for assessment of intubation time, time required for maintenance doses, recovery times. However there are more sensitive test in neuromuscular monitoring such as single twitch and double burst stimulations for neuromuscular monitoring and also clinical tests for extubation.

Conclusion

- Though the Cis-atracurium and Vecuronium are intermediate acting agents, Cis-atracurium has a longer onset of action as compared to Vecuronium.
- Cis-atracurium has a longer duration of action, so minimal no. of doses required for maintenance of anaesthesia.
- Cis-atracurium has a faster recovery as compared to Vecuronium.
- No much changes in haemodynamic parameters in both the groups.

Conflict of Interest: Nil

Funding/ Sponsorship: Nil

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 835–841
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.28

Effect of intrathecal Clonidine on subarachnoid Block Characteristics in Patients Undergoing TURP and TURBT

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Abstract

Introduction: Transurethral resection of prostrate (Turp) and transurethral resection bladder tumour (Turbt) are major operations, subarachnoid block is a well accepted and popular technique for Turp and Turbt. *Materials and method:* This randomized prospective double blind study conducted at MIOT hospitals, Chennai, from October 2014 – December 2015, evaluated the effective dose of clonidine with 10mg of 0.5% heavy bupivacaine in 80 patients posted for these surgeries and also to find the effect of various doses of clonidine on various subarachnoid block characteristics. *Results:* The level of peak sensory block (mean ± SD) was thoracic vertebral level T9.4 ± 0.68 in group BN T8.95 ± 0.94 In group BC 15, T8.3 ± 1.41 in group BC 25 and T7.5 ± 1.19 in group BC 35. There were significant differences in the peak sensory level between the groups. The 2 segment regression time (mean ± SD) defined as the time taken for the peak sensory level to regress 2 segments was compared between the 4 groups. It was 53.65 ± 5.81 min in group BN compared to 56.15 ± 7.23 min in groupBC15, 63.60 ± 8.66 min in group BC 25 and min 65.25 ± 6.87 in group BC 35. The difference in 2 segment regression was significant between the groups. The time to first requirement of analgesia was compared the 4 groups. It was 85.95 ± 6.21 min in group BN, 89.25 ± 6.37 min in group BC 15, 95.90 ± 8.59 min in group BC 25, 99.50 ± 5.72 min in group BC 35 . The difference was significant between the groups. *Conclusion:* Addition of 35mcg of clonidine to bupivacaine when compared to 25mcg/15mcg clonidine significantly prolongs the duration of analgesia without affecting the onset and maximum level achieved of sensory block.

Keywords: Intrathecal clonidine; TURP; TURBT

How to cite this article:
Putta Vinod Kumar, Krishna Diddi, TVL Tanuja. Effect of intrathecal Clonidine on subarachnoid Block Characteristics in Patients Undergoing TURP and TURBT. Indian J Anesth Analg. 2020;7(3):835–841.

Introduction

Transurethral resection of prostrate (Turp) and transurethral resection bladder tumour (Turbt) are major operations, subarachnoid block is a well accepted and popular technique for Turp and TURBT, that can be performed under general anaesthesia and epidural anaesthesia also.[1,2]

Intrathecal bupivacaine is commonly used for subarachnoid block, however doses more than 10 mg are associatedwith prolonged sensory and motor blockade so we are restricting bupivacainedose in this study to 10mg.[3] Various agents such as Opioids, Clonidine, Ketamine, Midazolam, Neostigmine were used as adjuvants to Bupivacaine in subarachnoid block.

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Received on 07.02.2020, **Accepted on** 16.03.2020

Clonidine is an alpha 2(α-2) adrenoreceptor agonist. Alpha 2 adrenoreceptors are located on primary afferent terminals on neurons in the superficial lamina of the spinal cord and within several brainstem nuclei. They may be responsible for analgesicaction at peripheral spinal and brainstem sites[4]. Clonidine produces a minor degree of nerve conduction blockade at high concentrations with some preference to C fibers.[4] This conduction blockade may result in the enhancement of peripheral nerve block when this agent is added to local anaesthetics.[5] Clonidine not only prolongs the duration of action of bupivacaine but also has potent antinociceptive properties.

Materials and methods

This randomized prospective double blind study conducted at MIOT hospitals, Chennai, from October 2014 – December 2015, evaluated the effective dose of clonidine with 10mg of 0.5% heavy bupivacaine in 80 patients posted for these surgeries and also to find the effect of various doses of clonidine on various subarachnoid block characteristics. Patients of either physical status ASA 1 or ASA 2 admitted for elective Turp and Turbt.

Formula used for the sample size n:

$n = (Z_{\alpha/2} \pm Z_{\beta})^2 * 2 * \sigma^2 / d^2$

where $Z_{\alpha/2}$ is the critical value of the Normal distribution at α/2 (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), Z_{β} is the critical value of the Normal distribution at β (e.g. for a power of 80%, β is 0.2 and the critical value is 0.84), σ_2 is the population variance, and d is the difference you would like to detect

Patients of ASA physical status 1 and 2, were included in the study. while the patients of ASA physical status 3 and above, allergic to any of the study drugs, undergoing treatment with α2 agonists, patients refusing for the trial, coming with emergency bladder outlet obstruction, Patients with Absolute contraindication for spinal anesthesia-Raised ICT, Bleeding disorders, and Infection at the site, Neurological deficit were excluded from the study.

After institutional ethics committee approval and informed consent 80 patients were included in the study. Patients were randomized to one of the four groups according to a computer generated randomization list

- Group BN: 10mg (2ml) 0.5% hyperbaric bupivacaine ± normal saline(0.24ml)
- Group BC15: 10mg (2ml) 0.5% hyperbaric bupivacaine ± 15μg clonidine (diluted with normal saline to 0.24ml).
- Group BC25: 10mg (2ml) 0.5% hyperbaric bupivacaine ± 25μg clonidine (diluted with normal saline to 0.24ml).
- Group BC35 : 10mg(2ml) 0.5% hyperbaric bupivacaine ± 35μg clonidine

Each patient was advised to fast after 10pm and diazepam [5-10mg] given orally night before surgery and 2 hrs before surgery. All patients [ie; patients in group BN, BC15, BC25, BC35] received 2ml bupivacaine ± additive(normal saline/ clonidine) intrathecally over 1 minute after ensuring free flow of cerebro spinal fluid (CSF) .The patient was then positioned supine and the level of sensory and motor blockade were assessed. The cephalad spread of anaesthesia and the degree of motor block was assessed every 5 min. The level of sensory block was assessed by pin prick using 25 G needle. The onset of motor blockade noted as the time taken for loss of knee reflex. [Modified bromage score 3]. The maximum height of the blockade was determined by the sensory level achieved at 20 min. All patients were monitored in PACU after the Surgery for a period of 24hrs. postoperative pain, Duration of pain relief, Any symptom of TURP SYNDROME, Time for catheter sensation and Adverse effects were noted finally.

Results

The mean age of patients(± SD) in group BN was 44.95 ± 15.34 years compared to 47.15 ± 15.15 years in group BC15, 45.10 ±14.46 years in groupBC25 and 43.20 ± 16.67 years in group BC35. The difference in age between the groups was not significant. The gender distribution was comparable between the groups.

The distribution of patients according to ASA physical status between the groups was also comparable. 7 patients in group BN,7 patients in group BC15 , 11 patients in group BC25 and 8 patients in group BC35 belonged to ASA physical status 2 and mainly had controlled essential hypertension.

The mean weight in kilograms of patients in group BN was 77.50 ± 15as compared to 72.50 ± 8 in group BC15, 75.85 ± 11.47 in group BC25 and 72.05 ± 9.19 in groupBC35. The difference in weight between the groups was not significant.

The Duration of Surgery Between the 4 Groups was of mean Duration of 42.60 ± 5.67 min in Group BN, 46 ± 6.58mins in group BC15, 46.85 ± 7 ins in group BC25 and 52 ± 7.17 mins in Group BC35 (Table 1 and Fig. 1).

Table 1. Demographic data

Parameters	Group BN	Group BC15	Group BC25	Group BC35	*p* Value
Age	44.95 ± 15.34	47.15 ± 15.15	45.10 ± 14.46	43.20 ± 16.67	NS
Gender (M/F)	2/10	2/10	2/10	2/10	NS
ASA (1/2)	13/7	13/7	9/11	12/8	NS
Weight	77.50 ± 15	72.50 ± 8	75.85 ± 11.47	72.05 ± 9.19	NS
Surgical duration (min)	42.60 ± 5.67	46 ± 6.58	46.85 ± 7	52 ± 7.17	0.000

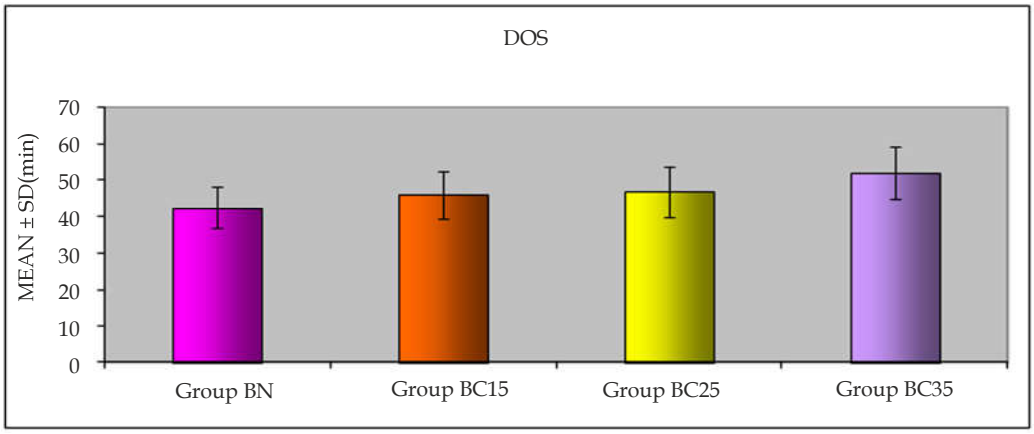

Fig.1: Demographic data

Table 2. Sensory Level

SL	Group BN	Group BC15	Group BC25	Group 35	P
5	11.3 ± 0.5	11.2 ± 0.6	10.1 ± 0.7	9.7 ± 0.5	0.000
10	10.8 ± 0.6	10.4 ± 0.6	9.6 ± 0.8	9 ± 0.6	0.000
15	10.1 ± 0.6	9.7 ± 0.7	8.7 ± 1	8.1 ± 0.8	0.003
20	9.4 ± 0.6	8.9 ± 0.9	8.3 ± 1.4	7.5 ± 1.1	0.000
25	8.8 ± 0.5	8.2 ± 0.6	7.4 ± 1	6.8 ± 1.1	0.001
30	8.4 ± 0.6	7.8 ± 0.7	7 ± 1.3	6.4 ± 1	0.000
35	7.8 ± 0.6	7.5 ± 0.6	6.2 ± 1.3	5.8 ± 0.7	0.000
40	7.7 ± 0.6	8 ± 0.9	6 ± 1.1	5.4 ± 0.8	0.000
45	8.1 ± 0.5	8.5 ± 0.8	6.4 ± 0.9	5.6 ± 1	0.000
50	8.3 ± 0.5	9.3 ± 0.8	7 ± 0.7	6.1 ± 0.8	0.000
55	9 ± 1.4	9.7 ± 0.9	6.8 ± 0.4	6.5 ± 0.7	0.032
60			7.8 ± 0.4	7.1 ± 0.6	0.146

p value <0.05 significant SL = sensory level.

Sensory block characteristics: The level of peak sensory block(mean ± SD) was thoracic vertebral level T9.4 ± 0.68 in group BN T8.95 ± 0.94 In group BC15, T8.3 ± 1.41 in groupBC25 and T7.5 ± 1.19 in group BC35. There were significant differences in the peak sensory level between the groups. The minimum level of sensory block achieved at 20 minutes was T10 in all 4 groups. The maximum level of sensory block achieved was T8 in group BN T6 in group BC15, T4 in group BC25 and Group BC35 at 20 minutes. The sensory level was checked with pin prick method every 5 min thereafter. The sensory block level achieved in all 4 groups was comparable up to 50-60 minutes. Sub group analysis showed significant differences in sensory block level between the groups BN and BC35 from 05 minutes onwards. There were no significant differences between groups BNand BC15, B15 and BC25, B25 and BC35. The mean sensory level (mean ± SD) is shown in table 2 and displayed graphically in Figure 2.

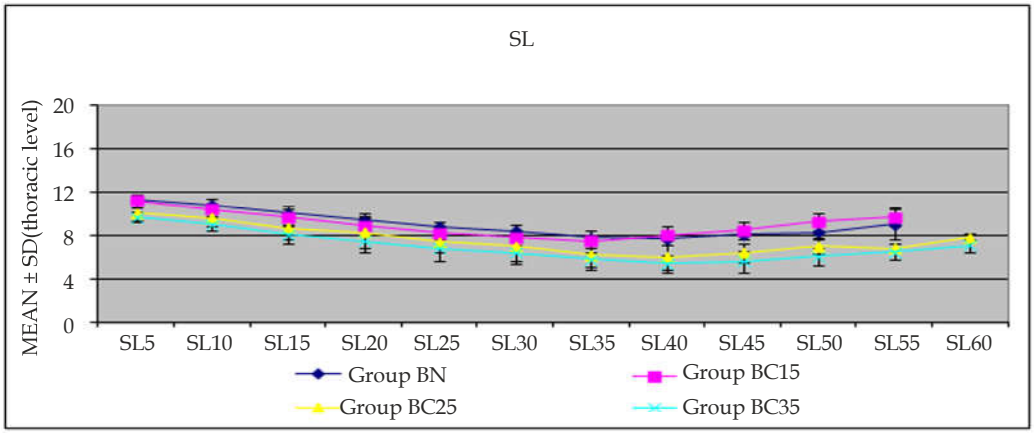

Fig. 2: Sensory Level

Table 3: Two Segment Regression Time

Parameter	MEAN ± SD				*p* Value
	BN	BC15	BC25	BC35	
Duration (Mins)	53.65 + 5.81	56.15 + 7.23	63.60 + 8.66	65.25+6.87	0.000

p Value <0.05 is significant.

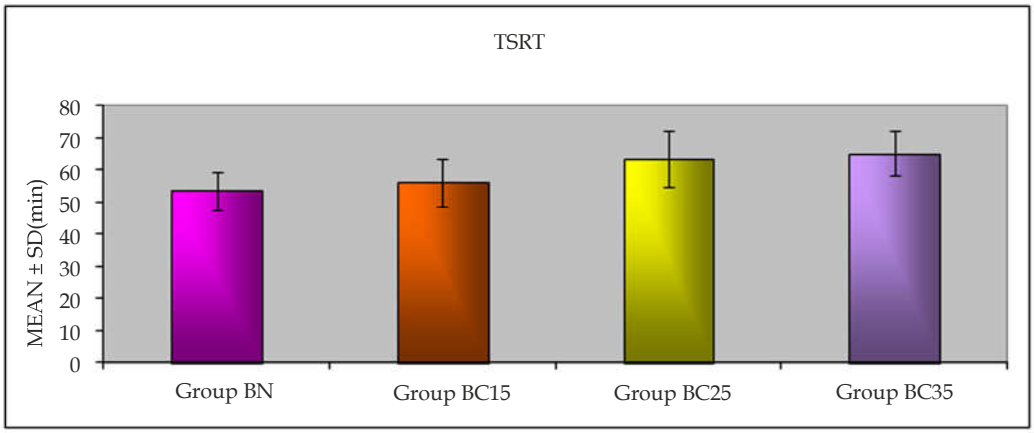

Fig. 3: Two Segment Regression Time

Two segment regression time: The 2 segment regression time (mean ± SD) defined as the time taken for the peak sensory level to regress 2 segments was compared between the 4 groups. It was 53.65 ± 5.81 min in group BN compared to 56.15 ± 7.23 min in Group BC15, 63.60 ± 8.66 min in Group BC25 and min 65.25 ± 6.87 in group BC35. The difference in 2 segment regression was significant between the groups. Subgroup analysis showed a significant difference in 2 segment regression times between groups BN and BC25 and BN and BC35. It was not statistically significant between groups BN, BC15 and BC25, BC35. The 2 segment regression time (mean ± SD) is tabulated in Table 3, and displayed in Fig. 3.

Time to first requirement of analgesia: The time to First requirement of analgesia was compared the 4 groups. It was 85.95 ± 6.21 min in group BN, 89.25 ± 6.37 min in group BC15, 95.90 ± 8.59 min in group BC25, 99.50 ± 5.72 min in group BC35. The difference Was significant between the groups. Subgroup analysis was done and there was a significant difference in the time to first requirement of analgesia between the Groups BN & BC25 and BN & BC35. It was not significant between the groups BN & BC15 and BC15 & BC25. The time to first requirement of analgesia (Mean ± SD) is tabulated in Table 4, and is displayed graphically in Figure 4.

Table 4: Time to first requirement of analgesia

Parameter	MEAN ± SD				*p* Value
	BN	BC15	BC25	BC35	
Duration(Mins)	85.95+6.21	89.25+6.37	95.90+8.59	99.50+5.72	0.000

p Value <0.05 Significant

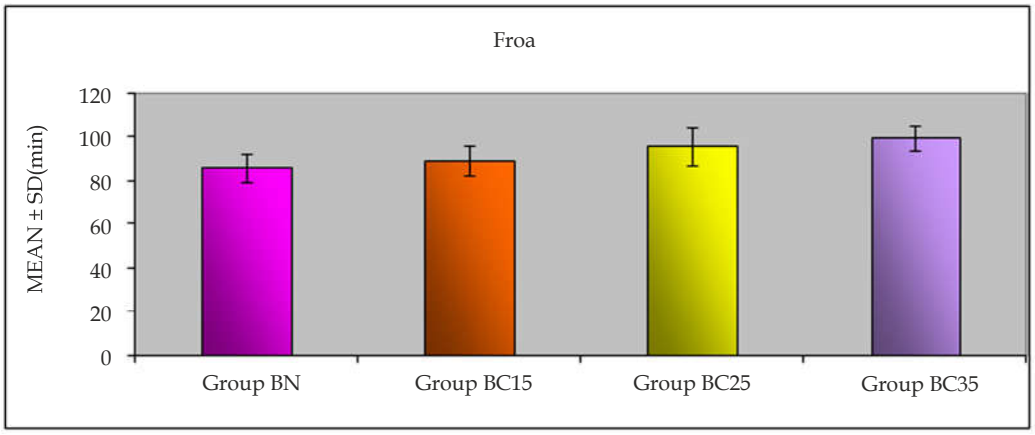

Fig. 4: Time to first requirement of analgesia

Table 5: Duration of Motor Block

Parameter	**MEAN ± SD**				***p* Value**
	BN	**BC15**	**BC25**	**BC35**	
Duration(Mins)	89.90 + 6.19	98.5 + 7.09	120 + 10.40	133.75 + 17.32	0.000

p Value <0.05 Significant

Significant difference was observed with BC35 from others. NO significant difference is seen between BN and BC15 groups.

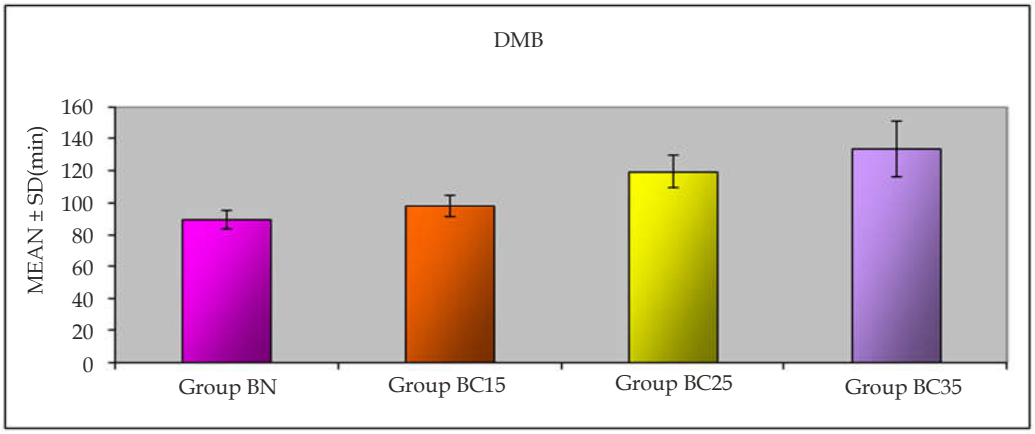

Fig. 5: Duration of Motor Block

Motor block charecteristics: In group BN it was 89.90 ± 6.19 mins, 98.5 ± 7.09 mins in group BC15, 120 ± 10.40 mins in group BC25 and 133.75 ±17.32mins in groupBC35. The motor block characteristics (mean ± SD) is tabulated in table 5, and displayed graphically in Figure 5.

Discussion

The addition of clonidine to intrathecal bupivacaine prolongs the duration of motor block by 30-50%[6]. The mechanism is due to the alpha 2 adrenoreceptor induced hyperpolarisation of motor neurons in the ventral horn of spinal cord.[7] However these studies have used higher doses of local anesthetics (15mg) along with higher doses of clonidine (75mcg) for patients undergoing lower limb and lower abdominal surgeries[6].

There are a limited number of studies in literature

in which lower doses of intrathecal clonidine has been used as an adjuvant with hyperbaric bupivacaine for transurethral resection of prostrate (TURP) and transurethral resection of bladder tumor (TURBT). Our study compared the effects of addition of various doses of clonidine 15mcg, 25mcg and 35mcg to hyperbaric bupivacaine 0.5% 10mg on subarachnoid block characteristics in patients undergoing TURP and TURBT. Eighty patients were randomly selected and assigned into four groups (BN, BC15, BC25 and BC35). We found that patients in group BC35 had a longer two segment regression time, longer duration of motorblockade and longer time for first analgesic requirement when compared to other groups.

Sensory blockade is produced by local anesthetics is potentiated by clonidine intrathecally. Mechanism is not known but it is presumed to involve inhibition of afferent neurons at the dorsal horn level resulting in the activation of descending noradrenergic pathways with release of acetylcholine producing analgesia.[8]

In this study the sensory block achieved at 20 mins in all the four groups was comparable. The level of peak sensory block (mean ± SD) was thoracic vertebral level T9.4 ± 0.68 in group NS T8.95 ± 0.94 In group BC15, T8.3 ± 1.41 in groupBC25 and T7.5 ± 1.19 in group BC35.

The minimum level of sensory block achieved at 20 min was T10 in all 4 groups. The maximum level of block achieved was T8 in group NS, T6 in group BC15, T4 in group BC25 and group BC35 at 20 mins. The sensory block level achieved in all 4 groups was comparable upto 55mins. There was a significant difference in sensory level between the groups NS and BC35 starting from 05 min onwards.

The effect of intrathecal clonidine in increasing the duration of sensory blockade is more marked with doses > 75 mcg. Lower doses have shown heterogeneous results in terms of prolongation of sensory block.[9]

Braz and coworkers[9] found that addition of 45 mcg or 75 mcg of clonidine to 17.5 mg of hyperbaric bupivacaine resulted in almost similar increase in the two segment regression times as compared to bupivacaine alone in patients undergoing cesarean section.

Ajay kumarchowdary and coworkers[10] did a study in patients under going elective anorectal surgery and found that the time to two segment S2 regression, was significant prolonged in patients receiving 30 mcg of intrathecal clonidine with 0.75% ropivacaine than in patients receiving 0.75% ropivacaine alone.

The time to first requirement of analgesia was compared the 4 groups. It was85.95 ± 6.21 min in group BN, 89.25 ± 6.37 min in group BC15, 95.90 ± 8.59 min in group BC25, 99.50 ± 5.72 min in group BC35 . The difference was significant between the groups.

Subgroup analysis was done and there was a significant difference in the time to first requirement of analgesia between the groups BN & BC25 and BN & BC35. It was not significant between the groups BN & BC15 and BC15 & BC25.

Manishasapate and coworkers[11] did a study and found that the time to first requirement of analgesiawas considerably prolonged in Group receiving clonidine (450.33 ± 95.10 min) as compared with Group receiving plain hyperbaric bupivacaine (220 ± 36.36 min), which was also highly significant. The total duration of analgesia was prolonged in this study in all the three groups who were given clonidine.

Conclusion

Addition of 35mcg of clonidine to bupivacaine when compared to 25mcg/15mcg clonidine significantly prolongs the duration of analgesia without affecting the onset and maximum level achieved of sensory block. Postoperative analgesia was also prolonged with 35mcg clonidine with an increase in motor block duration (as evidenced by longer time for first analgesic requirement) in patients undergoing transurethral resection of prostrate (TURP) and transurethral resection of bladder tumour (TURBT).

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Original Research Article

Indian Journal of Anesthesia and Analgesia
May – June 2020; 7(3): 842–847
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7320.29

An Observational Study to Compare the Effects of Cisatracurium Verses Atracurium During General Anaesthesia in Patients Posted for PCNL (Percutaneous Nephrolithotomy)

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Abstract

Background: Cisatracurium is 3 to 4 times more potent than Atracurium and is devoid of histamine release. However $2ED_{95}$ dose of Cistracurium does not provide satisfactory intubation conditions as compared to $2ED_{95}$ dose of Atracurium. *Aims:* To compare the neuromuscular blocking characteristics of $3ED_{95}$ dose of Cisatracurium and $2ED_{95}$ dose of Atracurium. *Material and Methods:* 60 patients were divided into two groups: Group A received 0.5 mg/kg iv of Atracurium ($2ED_{95}$) and Group B received 0.15 mg/kg iv of Cisatracurium ($3ED_{95}$) as intubating dose. Onset time, duration of action, condition of intubation, haemodynamic effects and signs of histamine release were monitored. *Results:* $3ED_{95}$ dose of Cisatracurium had a faster onset time (2.96 ± 0.61 minutes) as compared to $2ED_{95}$ dose of Atracurium (3.55 ± 0.51 minutes ; *p*-value 0.0134). Group B also had longer duration of action than Group A (67.16 ± 9.39 minutes vs 44.87 ± 4.94 minutes respectively; Pvalue 0.0013). Excellent intubating conditions were seen in 53.33% of patients in Group B and 46.67% of patients in Group A. 4 patients had signs of histamine release in Atracurium group and none in Cisatracurium Group. *Conclusion:* $3ED_{95}$ dose of Cisatracurium is a more effective neuromuscular blocking agent than $2ED_{95}$ dose of Atracurium in terms of providing faster onset time, longer duration of action, excellent intubating condition and better hemodynamic stability with no histamine release.

Keywords: Cisatracurium; Atracurium; Neuromuscular blocking agent.

How to cite this article:
Chudasama Ankita, Sara Mary Thomas, Dinesh K Chauhan. An Observational Study to Compare the Effects of Cisatracurium Verses Atracurium During General Anaesthesia in Patients Posted for PCNL (Percutaneous Nephrolithotomy). Indian J Anesth Analg. 2020;7(3):842–847.

Introduction

The practice of giving anesthesia was revolutionized with the introduction of neuromuscular blocking agent (NMBA).[1] An ideal NMBA should have fast onset of action, ensures haemodynamic stability with no residual paralysis effect and provides good conditions for intubation.[2]

Succinylcholine, the gold standard of muscle relaxant has some side effects which include muscle fasciculations leading to muscular pain, increase in intraocular and intracranial pressure. This led to the search of newer muscle relaxants.[3] Atracurium and Cisatracurium are non depolarising NMBA with intermediate duration of action. [4] Atracurium is a mixture of 10 optical isomers[2] and Cisatracurium is a purified form of one of the 10 stereoisomers of atracurium and has a potency of approximately 3 to 4 times more than Atracurium. Unlike the parent compound, Cisatracurium is not associated

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Received on 07.03.2020, **Accepted on** 19.03.2020

with histamine release.[5-7] It may not yield satisfactory intubating conditions such as those seen with equipotent doses of atracurium; so the recommended intubating dose of Cisatracirium is $3ED_{95}$.[8] Both the drugs are eliminated by Hoffmann elimination which is an organ independent process; hence end stage renal or hepatic disease does not affect the pharmacokinetics and pharmacodynamics of these molecules.[4]

The aim of this study was to compare the efficacy of $2ED_{95}$ dose of Atracurium and $3ED_{95}$ dose of Cisatracurium with respect to onset of action, intubating conditions, haemodynamic effects, duration of action and signs of histamine release in patients posted for Percutaneous Nephro Lithotomy (PCNL) under General Anaesthesia.

Material and Methods

This prospective observational study was conducted in a tertiary hospital after approval from the institutional ethics committee and written informed consent

All patients between 18–65 years of age posted for PCNL under general anaesthesia, belonging to American Society of Anaesthesiologists (ASA) Grade I and II were included in this study. Patients having history of Bronchial Asthma, drug allergy or having Mallampatti Grade III or IV on examination were excluded from the study.

Preanaesthetic evaluation was done and 60 patients fulfilling the criteria were included in the study. They were equally divided into two groups. Group A received Injection (Inj) Atracurium 0.5 mg/kg ($2ED_{95}$) intravenous (iv) as intubating dose and 0.1mg/kg iv as maintenance dose. Group B received Inj Cisatracurium 0.15 mg/kg ($3ED_{95}$) as intubating dose and 0.03 mg/kg as maintenance dose.

On the day of surgery, patients were kept nil by mouth for 6 hours for solids and 4 hours for clear fluids. On arrival to the operation theatre multichannel monitors were attached and baseline parameters were noted. 18G intravenous (IV) line were secured and infusion of crystalloid solution was started. Neuromuscular monitor was also attached. Inj Glycopyrrolate 0.004 mg/kg iv, Inj Midazolam 0.02 mg/kg iv and Inj Tramadol 1–1.5 mg/kg iv were given as premedication. General anaesthesia was induced with Inj. Propofol 2 mg/kg iv. Patients were given muscle relaxant according to the Group assigned. Time interval between the intubating dose and loss of T_1 (1^{st} response) of Train of Four (TOF) stimuli was noted and was considered as "onset time of intubation". After loss of T_1 of TOF stimuli, laryngoscopy was done in sniffing position and endotracheal intubation done using proper sized tube. Intubation score were assessed by Intubating Conditions Scoring System[9] (Table 1). Intubating conditions[9] were graded based on intubating scores (Table 2).

Haemodynamic parameters namely Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Mean Arterial Pressure (MAP) were noted immediately after intubation and 5, 10, 15 and 20 minutes (min) after intubation. Anaesthesia was maintained with N_2O:O_2 (50:50) mixture and Isoflurane. After intubation, at every 5 min TOF stimulation was recorded and accordingly maintenance dose of muscle relaxant ($1/5^{th}$ of intubating dose) was given with 25% recovery of

Table 1: Intubating Conditions Scoring System

Score	Jaw Relaxation	Vocal Cord Movement	Resonse to Intubation
0	Poor	Closed	Severe coughing or bucking
1	Minimal	Closing	Mild coughing
2	Moderate	Moving	Slight movement of diaphragm
3	Good	Open	None

Table 2: Classification of Intubating Conditions

Intubating Conditions	Score
Excellent	8–9
Good	6–7
Fair	3–5
Poor	0–2

T_1%. The duration of muscle relaxant (time interval from injection of intubating dose of muscle relaxant to 25% recovery of T_1%) was recorded. Patients were monitored for histamine release by monitoring skin changes (flush, erythema or wheals), haemodynamic instability or bronchospasm. At the end of surgery, Inj. Neostigmine 0.05 mg/kg iv and Inj. Glycopyrrolate 0.008 mg/kg iv were given for reversal and extubation was performed when TOF ratio >0.9 was achieved.

Statistical Analysis

Data was processed using SPSS Version 18. Quantitative data was expressed as Means ± SD while qualitative data were expressed as numbers and percentages (%) Paired *t*-test were used to test significance of difference of quantitative variables that follow normal distribution and chi-square test was used to test significance of difference of qualitative variables. A *p*-value <0.05 was considered statistically significant.

Results

Demographic profile were comparable in both the study groups.

Group B patients had faster onset time of intubation as compared to Group A (2.96 ± 0.61 min vs 3.55 ± 0.51 min respectively; *p*-value 0.0134). Also the duration of muscle relaxant action was significantly longer in Group B (67.16 ± 9.39 min) as compared to Group A (44.87 ± 4.94 min; P value 0.0013).

Haemodynamic parameters showed significant increase in HR and MAP from baseline immediately after attempt of intubation in Group A as compared to Group B. (Table 3 and 4)

Table 3: Mean Heart Rate (beats per minute) at different time intervals in both the Groups.

	Group A				Group B			
Time Points	**Mean**	**SD**	***p*-Value**	**Inference**	**Mean**	**SD**	***p*-Value**	**Inference**
Baseline	69.60	6.39	>0.05	NS	70.93	6.11	>0.05	NS
After Injection of Muscle Relaxant	74.17	6.31	>0.05	NS	71.57	5.72	>0.05	NS
After Attempt of Intubation	83.37	6.30	0.0001	55	75.23	5.37	>0.05	NS
5 min	74.57	5.90	>0.05	NS	74.80	5.40	>0.05	NS
10 min	73.57	5.73	>0.05	NS	76.90	5.28	>0.05	NS
15 min	75.13	6.23	>0.05	NS	73.60	4.63	>0.05	NS
20 min	74.27	6.21	>0.05	NS	72.53	4.70	>0.05	NS

MIN – minutes, NS- Not significant, SS- Statistically Significant.

Table 4: Mean Arterial Pressure (MAP) in mmHg at different time intervals in both the Groups

Time Points	Group A				Group B			
	MAP	**SD**	***p*-Value**	**Inference**	**Mean**	**SD**	***p*-Value**	**Inference**
Baseline	81.42	4.37	>0.05	NS	82.72	5.09	>0.05	NS
After Injection of Muscle Relaxant	79.38	4.35	>0.05	NS	82.07	5.26	>0.05	NS
After Attempt of Intubation	91.18	4.98	0.0018	SS	84.27	4.84	>0.05	NS
5 min	86.45	4.30	>0.05	NS	83.47	3.89	>0.05	NS
10 min	82.45	4.27	>0.05	NS	85.53	3.86	>0.05	NS
15 min	81.02	4.24	>0.05	NS	84.52	7.12	>0.05	NS
20 min	80.13	4.18	>0.05	NS	86.13	6.85	>0.05	NS

MIN – minutes, NS- Not significant, SS- Statistically Significant

On evaluating the Intubation Scores and Intubating Conditions it was seen that higher proportion of patients in Group B had greater score (score 3) for jaw relaxation, vocal cord movement and response to intubation and had higher percentage of excellent intubating conditions (53.33%) as compared to Group A (46.67%) (Figs. 1, 2).

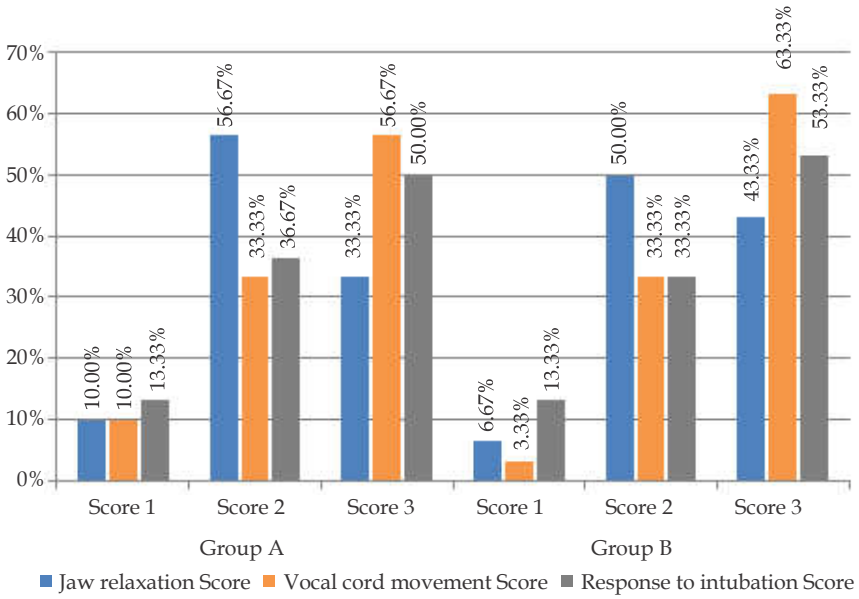

Fig. 1: Graph comparing Intubation Scores between the Groups.

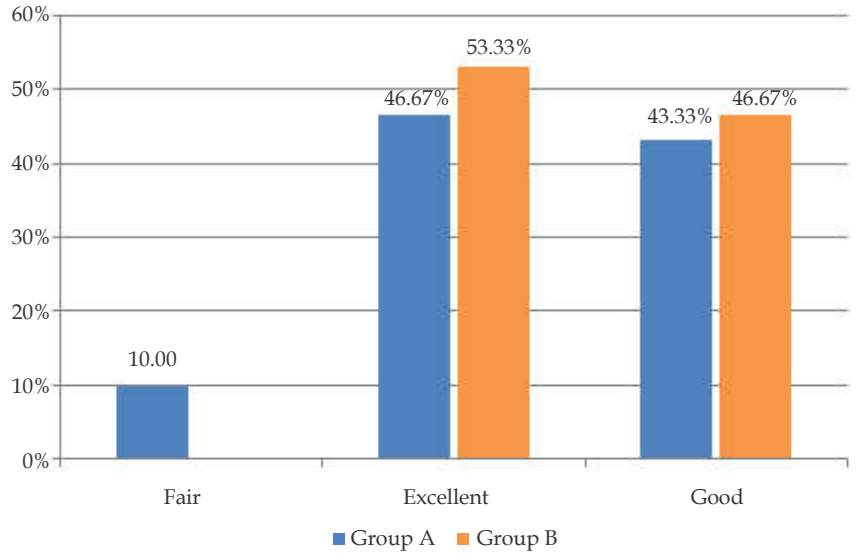

Fig. 2: Graph comparing Intubation Conditions between the Groups.

It was observed that 4 out of 30 patients in Atracurium Group had signs of histamine release while none of the patients in Cisatracurium had similar findings (Table 5).

Table 5: Signs of Histamine release between the Groups.

Histamine Release	Group A		Group B	
	N	%	*N*	%
Flush	2	6.67	0	0.00
Erythema	1	3.33	0	0.00
Wheal	1	3.33	0	0.00
Total	4	13.33	0	0.00

N- number

Discussion

Muscle relaxant is used to facilitate endotracheal intubation and to provide surgical relaxation.[10] In selecting a neuromuscular blocking agent the three goals that need to be achieved are rapid adequate muscle relaxation, haemodynamic stability and predictable complete return of skeletal muscle function.[11] Hence through this study we wanted to compare the potency and neuromuscular blocking properties of 3 × ED_{95} dose of Cisatracurium and 2 × ED_{95} dose of Atracurium.

Mohanty et al.[12] did a prospective randomised study of 60 patients who were allocated to 3 groups. Group A received 0.5 mg/kg of Atracurium (2 × ED_{95}), Group C_1 received 0.1 mg/kg of Cisatracurium (2 × ED_{95}) and Group C_2 received 0.15 mg/kg of Cisatracurium (3 × ED_{95}). Onset time of intubation was significantly faster with Group C_2 (2.65 ± 0.17 min) as compared to Group C_1 and Group A (4.04 ± 0.19 min and 2.80 ± 0.19 min respectively; *P*-value 0.001). Group C_2 also had a longer duration of action (64.6 ± 4.83 min) than Group C_1 and Group A (43.2 ± 2.72 min and 43 ± 2.27 min respectively). Higher proportion of patients in Group C_2 had excellent intubating conditions as compared to Group C_1 and Atracurium Group.(70% vs 65% and 60%).[12]

Likewise another study done by Kasaby et al.,[13] evaluated the neuromuscular blocking characteristics of Atracurium (2 × ED_{95}) and different doses of Cisatracurium (2 × ED_{95}, 4 × ED_{95} and 6 × ED_{95}). They concluded that higher doses of Cisatracurium (6 × ED_{95} and 4 × ED_{95}) showed significant faster onset time of intubation (2 ± 1.2 min and 2.9 ± 1.4 min respectively) as compared to 2 × ED_{95} dose of Atracurium and Cisatracurium (3.24 ± 0.55 and 4.37 ± 0.46 min respectively; P value < 0.05). 6 × ED_{95} and 4 × ED_{95} dose of Cisatracurium had a longer duration of action (78.4 ± 8.6 min and 65.5±10.5 min respectively) than 2 × ED_{95} dose of Atracurium and Cisatracurium (44.4 ± 4.13 and 43.6 ± 4.15 min respectively; *P*-value <0.05). On evaluating the conditions of intubation, regarding the assessment of vocal cords, 2 × ED_{95} dose of Atracurium and Cisatracurium were similar while 4 × ED_{95} and 6 × ED_{95} doses of Cisatracurium were significantly better than 2 × ED_{95} dose of Atracurium and Cisatracurium.[13]

The observations of our study were in concordance with these results. In our study, Cisatracurium group (3 × ED_{95}) had faster onset time of intubation and longer duration of action than Atracurium group (2 × ED_{95}). Intubating conditions in Cisatracurium group were Excellent in 53.33% and Good in 46.67% of patients which was better than the intubating conditions seen in Atracurium group, in which, only 46.67% were Excellent and 43.33% were Good.

Regarding haemodynamics, Kasaby et al.[13] observed an increased stress response to intubation in patients who received 2 × ED_{95} dose of Atracurium and Cisatracurium but not in patients who received 4 × ED_{95} and 6 × ED_{95} dose of Cisatracurium. The analysis done in our study was consistent with this conclusion. Our results also showed a statistically significant increase in HR and MAP from baseline post intubation in Atracurium Group (Group A). This may be because that the patients were not fully relaxed which lead to an increased stress response to intubation.

Lien CA et al.[14] concluded from their study that in patients who received 2 × ED_{95} dose of Atracurium, there was a greater increase in median plasma Histamine concenteration as compared to patients who received 2 × ED_{95}, 4 × ED_{95} and 8 × ED_{95} dose of Cisatracurium. The findings in our study were similar to this observation. In our study we found that 4 patients in Atracurium group had signs of histamine release and none of the patients in Cisatracurium had similar findings.

Conclusion

We conclude that 3 × ED_{95} dose of Cisatracurium is a more potent neuromuscular blocking agent than 2 × ED_{95} dose of Atracurium in terms of faster onset of action and longer duration of action. It also ensures better haemodynamic stability with no stress response during intubation. 3 × ED_{95} dose of Cisatracurium provides excellent conditions for intubation and is not associated with any signs of histamine release as compared to 2 × ED_{95} dose of Atracurium.

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