Indian Journal of Anesthesia and Analgesia

Aims and Scope

The Indian Journal of Anesthesia and Analgesia (IJAA) is official peer-reviewed scientific journal addresses all aspects of anesthesia practice, including anesthetic administration, pharmacokinetics, preoperative and postoperative considerations, coexisting disease and other complicating factors, cost issues, and similar concerns anesthesiologists contend with daily. The Journal seeks a balance between outstanding basic scientific reports and definitive clinical and management investigations. The Journal welcomes manuscripts reflecting rigorous analysis, even if unusual in style and focus.

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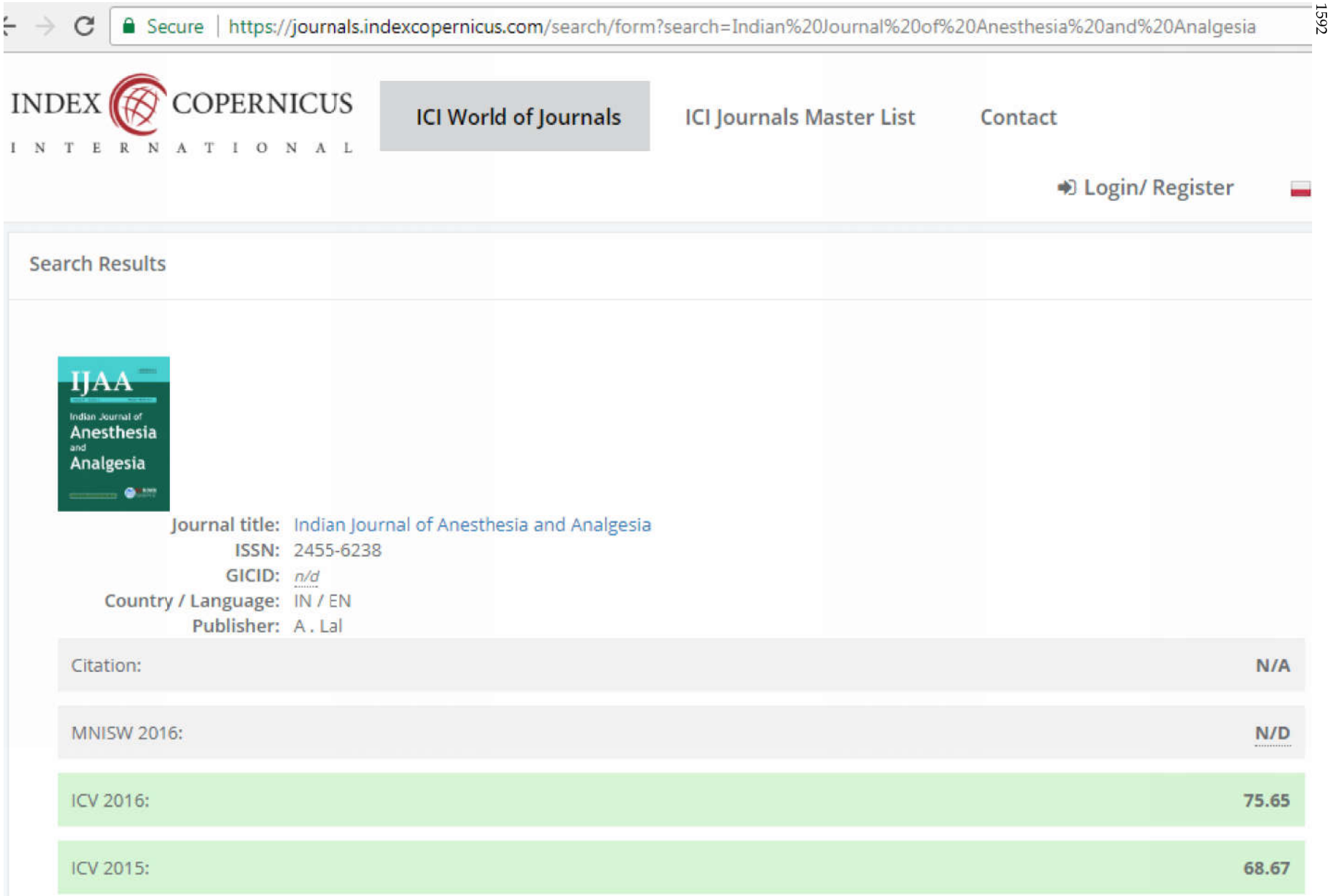
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Comparative Study of Thoracic Epidural and General Anesthesia in Modified Radical Mastectomy

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Abstract

Background: Surgery is the treatment of choice in breast cancer and the current moto is towards less extension of removal of tissue with axillary dissection for removal of lymph nodes to guide further treatment. *Aim:* The present study compare *thoracic epidural* with general anesthesia in cancer surgeries of the breasts. *Materials and Methods:* It is a comparative study in 60 patients divided into two groups, epidural group (n = 30) underwent epidural thoracic block and other group(n = 30) underwent conventional general anesthesia. Following variables were noted as duration of the surgery, the need of anesthesia or sedation, and intraoperative hemodynamic parameters. In the postoperative period, length of time until discharge from the recovery room and from the hospital, severity of pain, adverse effects, and satisfaction with the anesthetic techniques were noted. *Results:* Both groups have no significance in the duration of the surgery was observed. The rate of hypertension was more in the group of patients who underwent general anesthesia, while hypotension was more in the epidural group. Postoperatively, pruritis (40%) has more incidences in the epidural block group. Nausea (20%) and vomiting (33%) was more in general anesthesia group. The length of stay in the recovery room and hospitalization were lower in the epidural group; Satisfaction with the anesthesia is more with epidural block. *Conclusions:* Epidural block is advantages when compared with general anesthesia and can be used as anesthesia option in oncologic mastectomies with axillary lymph node dissection.

Keywords: Thoracic Epidural; Radical Mastectomy.

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Introduction

Breast cancer is most common amongindian females is 25.8 per 100,000 women and mortality 12.7 per 100,000 women [1]. Persently incidence of breast cancer has been increasing. Surgery is the choice of treatmentand the current tendency is towards less extensive procedure with axillary dissection for removal of lymph nodes to guide further treatment. In present scenario anesthetic technique should provide good intraoperative anesthesia and adequate postoperative analgesia without collateral effects and with minimized hospital stay.

General anesthesia combining intravenous and inhalational agents, is the technique normally followed for this procedure. The consideration for general anesthesia includes ineffective pain control due to a lack of residual analgesia, and a increased incidence of nausea and vomiting, increase hospital stay [2]. Other unwanted effects of general anesthesia in these cancer patients are relate to depression of the immune system [3].

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Thoracic epidural block is more used in collaboration plastic surgeries of the breasts [4] and postoperative analgesia of thoracotomies, and there are also few studies on its use in cancer surgeries of breast [5]. The present study is done to compare thoracic epidural block and general anaesthesiain female patients who are undergoing cancer surgeries of the breast with axillary exploration, with intraoperative hemodynamic parameters, postoperative analgesia, and side effects.

Materials and Methods

This is a prospective case study conducted in 60 patients scheduled for elective cancer breast surgery done in collaboration with anaesthesia department.

Inclusion Criteria

ASA one or two, females aged 25-65 years with breast carcinoma proven by FNAC or biopsy and mammogram.

Exclusion Criteria

Difficult airway, contraindications to epidural block, Infection of the puncture area for epidural block.

Sixty patients with carcinoma breast are divided into two groups- Thoracic Epidural (T) and General Anaesthesia (G) of 30 patients each. All the intraoperative parameters heart rate, blood pressure, bleeding and postoperative outcomes, seroma formation, drains, wound infection rates, flap necrosis and hospital stay are recorded.

During the surgery, the surgeon evaluation of the quality of anesthesia, the need of residual sedation, hemodynamic changes as tachycardia, represented by a heart rate greater than 100 bpm; bradycardia, heart rate below 60 bpm; hypotension, defined as a 20% drop in baseline blood pressure; and hypertension, a 20% increase in baseline blood pressure, and other intercurrences, such as pruritus, nausea, and vomiting were recorded as well as the length of the surgery.

Postoperatively, the length of stay in the recovery room and the hospital stay were recorded. Quality of analgesia was evaluated using a verbal scale that included very strong pain, strong pain, mild pain, absence of pain, and the consumption of other analgesics were recorded. The incidence of nausea and vomiting was also recorded and at the time of discharge patients were questioned about their degree of satisfaction with the anesthetic technique. Analgesia consisted of 20 mg of IVtenoxicam every 12 hours, and 1 g of dypirone and 50 mg of tramadol were administered intravenously whenever tenoxicam was not enough. For the statistical analysis SPSS Version16 using a $p < 0.05$ as significant.

Results

There is no significance in between both groups. (Table 1).

The duration of surgery was similar in both groups. Hypotension more frequent in patients who underwent epidural block, while hypertension more in those who underwent general anesthesia (Table 2).

Table 1: Demographic details

Details	Group-T	Group-G	P- Value
Age(in years)	56 ± 8	61 ± 9	>0.05
weight(Kgs)	70± 10	72± 13	>0.05
Height(cms)	159± 11	161± 12	>0.05
Surgery			
segmental mastectomy	26	25	>0.05
Total mastectomy	4	5	>0.05
Physical status			
ASA-1	4	7	>0.05
ASA-11	26	23	>0.05

Table 2: Intraoperative findings

Introperative Data	Group-T	Group-G	P- Value
Duration of surgery (min)*	100 ±35	105±38	>0.05
Hypertension(in number)	1(3%)	6(20%)	<0.05
Hypotension	16(53%)	3(10%)	<0.05
Tachycardia	0	0	<0.05
Bradycardia	5(17%)	4(13%)	<0.05

Table 3: Post operative data

Post operative data	Group-T	Group-G
Nausea	0	6(20%)
Vomiting	3(10%)	10(33%)
Pruritis	12(40%)	0
Discharge (in minutes)	54+19	116+14
Hospital discharge(in hours)	40+13	65+25
Satisified	30(100%)	21(70%)
Dissatisified	0	9(30%)

Postoperatively, the incidence of pruritus (40%) was greater in the epidural block group and that of nausea (20%) and vomiting (33%) was observed in general anesthesia group. The length of stay in the recovery room and hospitalization were lower in the epidural group; Satisfaction with the anesthesia is more with epidural block. (Table 3).

Discussion

Mastectomy is traditionally performed under general anaesthesia. The anesthetic technique should provide good intra-operative anesthesia and post-operative analgesia without collateral effects and with reduced hospital stay. Regional anesthesia has protective effect against the peri operative stress response and beneficial effects have been attributed to the changes in physiology used by neuraxialanesthesia and better pain management. Patients did not complaint of pain and request for additional analgesic was lower.

The hypotensionincidence was more ie of 53%; however, the fall in blood pressure was easily controlled with low doses of vasopressor. Reason for Hypotension could be due to inhibiting sympathetic cardiac fibersin thoracic block . since other studies have similar results it is correlating with our study [5,6].

Postoperative analgesia using local anesthetic with spinal opioid and intravenous anti-inflammatory had better results; patients did not complain of strong pain and the request for supplementary analgesic was lower. Tramadol was not used in patients in the epidural block group. Complete control on pain is important since it provide goodpostoperative period and early hospital discharge, and can have a long-term effect, decreasing complications such as chronic pain [7]. Prior administration of tenoxicam can be advantageous, as suggested by another study [8].

Regional block has decreased nausea and vomiting rate, in comparision to general anesthesia, which is in agreement with several procedures and studies [9]. In the present study, the incidence of this complication in the general anesthesia group is comparable to that reported literature which is done previously in those comparing general anesthesia and regional block. The only study [6] that made a comparable evaluation showed an incidence of 10% of nausea and vomiting among patients undergoing epidural block, which is considerably lower than the incidence seen in general anesthesia, but it still suggests that there are other factors involved in the development of this problem. It is speculated that it could be due to the spinal administration of opioid (fentanyl) for sedation It would be interesting to study whether the association with anti-emetics can reduce the incidence.

Reason for Pruritus in study may be due to the administration of fentanyl through spine, it is most frequent adverse effect. Since pruritus was not severe, specific treatment of this occurrence was not necessary.

The recovery room length of stay and in the hospital stay was lesser in the epidural block group. As the stay is less it is cost effective and also that decrease hospital sickness in patients.

Belzarena, Sérgio D [10] compared thoracic epidural blockandgeneral anesthesia in female patients undergoing cancer surgeries of the breast with axillary exploration same as our study. He concluded Epidural block is more advantage when compared with general anesthesia and can be considered an anesthesia option in oncologic mastectomies with axillary lymph node dissection.Groeben H. et al. [11] studied the effect of high thoracic epidural and local anesthetic on bronchial hyper reactivity and concluded that thoracic epidural is safer than general anesthesia in respiratory compromised patients. It can provide adequate anesthesia with minimal effect and without patient discomfort because surgery of breast does not require motor blockade. Hypotensionincidence was more (60%) however it was easily controlled by lower dose of vasopressor. Similarly Doss NW, Ipe J, Crimi T et al. [6] studied continuous thoracic epidural anesthesia with 0.2% Ropivacaine versus general anesthesia for perioperative management of modified radical mastectomy and had similar results. Respiration was also not significantly effected demonstrating that thoracic epidural can be safely used in respiratory compromised patients.

Similarly, Groeben H, Schuafer B et al. [12] studied lung functions under high thoracic segmental epidural anesthesia with Ropivacaine or Bupivacaine in patients with severe obstructive

pulmonary disease undergoing breast surgery and had similar results. The patients undergoing regional anesthesia were discharged earlier than general anesthesia and is more cost effective.

Conclusion

To conclude, single-dose thoracic epidural block associated with local anesthetic and opioid was sufficient for mastectomy. Also quality of postoperative analgesia , shorter recovery timeand lower incidence of nausea and vomiting, early hospital discharge, can be considered as advantages.

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Original Research Article

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Proseal LMA vs. Endotracheal Intubation in General Anaesthesia for Abdominal Surgeries

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Abstract

Varients of supraglottic airway devices are generally used in difficult airways or in day-care surgeries to bypass the consequences of endotracheal intubation or to replace tracheal intubation. In this study, the aim was to evaluate the advantages of proseal LMA over endotracheal tubes in the prospects of ease of insertion and efficacy for positive pressure ventilation without the risk of regurgitation and aspiration and without any detrimental variations in hemodynamics. A randomized clinical study was carried out on 80 patients of either sex belonging to ASA Grade I and II, proposed for abdominal surgeries under general anaesthesia and were randomly allocated in two groups (Group I- Proseal LMA and Group II- Endotracheal intubation). Parameters observed were ease of insertion (number of attempts), insertion or intubation time of device and nasogastric tube and effects on hemodynamics. 40 patients were included in each group. Success rate for insertion of device in first attempt was 93% in group I and 99% in group II. Mean insertion time in group I was 15.57 seconds and 22.24 seconds in group II, which was statistically insignificant ($p<0.1$). Mean nasogastric tube (Ryle's tube) insertion time in group I was 9.96 seconds in compare to group II, where the mean time was 12.55 seconds, which was statistically significant. The conditions for proper and adequate ventilation to maintain 100% oxygen saturation in both groups were satisfactory without any air leak. According to this study, it can be concluded that Proseal LMA is a safer and effective alternative for endotracheal tubes in general anaesthesia.

Keywords: Proseal LMA; Endotracheal Tubes; General Anaesthesia; Aspiration Pneumonitis; Positive Pressure Ventilation.

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Ajai Vikram Singh. Proseal LMA vs. Endotracheal Intubation in General Anaesthesia for Abdominal Surgeries. Indian J Anesth Analg. 2018;5(10):1597-1601.

Introduction

Laryngeal mask airway was invented by British anaesthesiologist Archibald Brain in 1983 as an alternative to tracheal intubation in patients when conventional endotracheal intubation is either difficult or impossible. They can be used instead of face mask or endotracheal tube during sponataneous or controlled ventilation. Many modifications in LMA's were carried out according to the ease and requirement. Proseal LMA is the modified and most complex version of the specialized laryngeal mask devices. It was designed by Archie Brain in 1990s and released in 2000 [1]. The aim was to construct a laryngeal mask with improved adequate ventilation characteristics by sealing glottic opening with no leak and protection against regurgitation. The new

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features incorporated in this device are a modified cuff and a drain tube. The proseal LMA has a larger ventral cuff, attached to a second cuff placed on the dorsal surface of bowl. Mask design is also unique. The bowl is deeper and has no apertures and the inflatable portion extends around the back. When the cuff is inflated, the mask is pushed anteriorly and the glottis becomes enveloped in the bowl which provides better leakproof seal around the glottic aperture [1]. It has an integrated gastric/venting port and a tube which traverses through the mask. When this airway is placed properly, the distal orifice of the drain tube lies in the upper eosophagus [1]. It is a safer and effective device to use as an alternative to face mask in spontaneously breathing patients [2]. In comparison to endotracheal intubation, proseal LMA produces less or no incidence of sore throat, hoarseness, minimum pressor response and better tolerance in spontaneously breathing patients. It can be inserted easily without direct laryngoscopy and without the use of muscle relaxants.

Aims of Study

The aim of this study was to compare proseal LMA and endotracheal intubation by assessing the ease of insertion, insertion time and its effects on hemodynamics.

Material and Method

A randomized, prospective study was done on 80 patients of 18-60 yrs of age, either gender of ASA Grade I and II admitted for planned abdominal surgery under general anaesthesia and randomly allocated in two groups.

Group I- Proseal LMA

Group II- Endotracheal tube

Written and informed consent was obtained after explaining the study protocol. Proper pre-anaesthetic check-up was done including airway assessment and all routine investigations were checked. Patients with body mass index >25 kg/M^2, age below 18 yrs, mouth opening <2cm (Mallampati Grade III and IV), patients with history of gastro-eosophageal reflux disease, pregnant females and anticipated difficult airway due to any physiological or musculo-skeletal abnormalities were excluded from this study [3]. All patients were advised nil orally for 6-8 hrs and tablet alprazolam 0.5mg was given night before surgery. In operation theatre, monitor was attached to record basal heart rate, blood pressure, oxygen saturation, $EtCO_2$ and ECG. Patent intravenous line was secured and drip of crystalloid fluid was started. Patients were premedicated with Inj glycopyrrolate 0.2mg, ranitidine 50 mg, metoclopromide 10mg, ondensetron 4mg, pentazocine 30mg and midazolam 2mg intravenously 5mins before induction of anaesthesia. Pre-oxygenation was done with 100% oxygen for 3 mins. Induction was done with inj propofol (2-2.5mg/kg), intubated with inj succinylcoline (1-1.5mg/kg). Bag-mask ventilation was continued till the disappearance of fasciculations. Patients head was placed and stabilized in intubating position. Appropriate size selection of proseal LMA and endotrachial tube was done on the basis of weight as recommended by the manufacturer's guidelines [4]. Proseal LMA or endotracheal tube was inserted according to the respective group. Proseal LMA was inserted by digital method [1]. Cuff was inflated with the recommended volume of air [4]. Correct placement of Proseal LMA was confirmed by uniform chest expension, capnograph and by gel displacement test [1]. Insertion time of device and nasogastric tube, attempts of insertion and associated hemodynamic changes were recorded. Once the patient was properly intubated, auscultated for adequate ventilation, they were maintained on N_2O+O_2, Vecuronium 0.8mg/kg and Isoflurane (1-1.5%). Heart rate, blood pressure and oxygen saturation were monitored at frequent interval throughout the intra-operative period and immediately after extubation. $EtCO_2$ was maintained below 36 mmHg. At the end of surgery, patients were reversed with inj 2.5mg neostigmine and 0.4mg glycopyrroate. Patients were observed for any airway trauma, sore throat or hoarseness of voice.

Observations

This table 1 shows that mean age in group I was 42.2±11.32 yr and 40.8±12.01 yr in group II. There were 28 males and 12 females in group I and 25 males and 15 females in group II. The difference in mean age, sex distribution and mean body mass index were statistically insignificant ($p>0.05$).

Ease of insertion of the device, according to attempts classified into easy, moderate, difficult and impossible. More than 3 attempts for insertion of PLMA was considered as impossible and it was substituted by endotracheal intubation. According to this table, 37 patients were intubated with PLMA in the first attempt and 3 patients in second attempt in group I, whereas only 1 patient was intubated in second attempt in group II (Table 2).

Mean insertion time in group I with PLMA was 15.57±3.18 seconds and 22.24±2.61 seconds in group II with ETT. The difference was statistically insignificant ($p>0.05$).

This Table 3 shows that insertion of nasogastric tube was moderately difficult in 2 patient in group I and in 5 patients in group II.

Table 4 shows it was easy to insert nasogastric tube in group I in comparison of group II. Findings were found statistically significant.

Table 5 shows statistically significant changes in heart rate and mean arterial pressure during laryngoscopy and intubation/extubation and perstisted after 3 min in group II, whereas statistically significant changes were observed during insertion of proseal LMA in group II which persisted for 15 seconds.

Table 1: Demographic data

Parameters	Group I	Group II	P value
Age in yrs (mean ±S.D.)	42.2±11.32	40.8±12.01	P=0.465
Sex, number			
Males	28	25	p>0.05
Females	12	15	p>0.05
BMI	22.7±2.05kg/m^2	23.1±1.81kg/m^2	p>0.05

Table 2: Device insertion characteristics

Ease of insertion	Group I	Group II	P value
Easy	37	39	p>0.05
Moderate	3	1	
Difficult	-	-	
Impossible	-	-	
Insertion time(in mins)	15.57±3.18 sec	22.24±2.61 sec	p>0.05

Table 3: Nasogastric tube insertion characteristics

Ease of insertion	Group I (PLMA)	Group II (ETT)
Easy	38	35
Moderate	2	5
Difficult	-	-
Impossible	-	-

Table 4: Insertion time

	Group I (PLMA)	Group II (ETT)	P value
Mean ± S.D.	9.96±1.29 sec	12.55±1.25 sec	P<0.05

Table 5: Insertion time

Parameters	Group I	Group II
Heart rate± S.D.		
Basal	81.3±3.14	80.91±3.88
During insertion	83.12±3.77	88.7±6.1
After 15 seconds	83.19±3.59	90.0±5.83
After 1 min	82.59±2.64	89.83±5.37
After 3 min	81.76±3.1	86.29±3.13
After 5 min	80.03±4.01	81.41±2.92
During extubation	80.59±2.96	87.27±4.49
After 1 min	80.97±3.02	86.81±3.69
After 3 min	78.49±3.69	82.5±2.19
Mean arterial pressure		
Basal	84.62±2.37	83.49±2.82
During insertion	86.48±3.34	94.53±4.41
After 15 seconds	87.17±3.67	97.38±4.85
After 1 min	85.34±2.99	94.13±3.71
After 3 min	85.09±2.17	89.1±3.19
After 5 min	83.21±3.28	86.52±2.94
During extubation	83.48±3.63	99.21±5.15
After 1 min	83.16±3.0	98.63±4.47
After 3 min	81.37±2.36	89.55±3.18

Discussion

Endotracheal intubation with endotracheal tubes in patients under general anaesthesia is the standardized technique to achieve secured airway for proper ventilation along with minimum risk of regurgitation and aspiration since long time [5]. Problems related to rigid laryngoscopy and intubation such as sympathetic stimulation, trauma to the airway, sore throat and postoperative hoarseness of voice, inability to intubate in difficult airway patients and inability in conducting day care surgeries without endotracheal intubation leads to invent a device which can fulfill the advantages of endotracheal tubes without intubation [6,7]. A new era of anaesthesia has started since the invention and modification in classic LMA [8]. Before the invention of proseal LMA, classic LMA was used in place of endotracheal tubes to bypass its related consequences.

This study was conducted to compare the efficacy of proceal LMA over endotracheal tubes to overcome the associated problems of endotracheal intubation.

Insertion of device was found easy in 93% of patients in group I and 99% in group II. These findings correlated with the findings of Evans et al[7]. Mean insertion time for successful and secured placement of PLMA in group I was 15.57±3.18 seconds and 22.24±2.61 seconds in group II with ETT which was insignificant. These findings corresponds with earlier studies [9,10,11,12,13,14].

Hemodynamic response during insertion and extubation in both groups corresponds with the findings with other studies [8,9,13].

Mean insertion time for introducing nasogastric tube in group I was 9.96±1.29 seconds with PLMA and 12.55±1.25 seconds in group II with ETT. These values were found statistically significant ($p<0.01$). The difference in mean time was due to as it was inserted with ease in group I through drain tube in PLMA. Findings correlated with the findings of Saraswat et al. [9], where the mean insertion time was 9.77 seconds with PLMA and 11.5 seconds with ETT.

Conclusion

In this study, it was observed that proceal LMA is easy to insert without producing any trauma to oropharyngeal structures, provides adequate spontaneous and controlled ventilation [15].

Achieving adequate ventilation along with normocapnic state is the paramount goal of an anaesthesiologist, which was achieved by PLMA.

According to the findings of this study, it can be concluded that both PLMA and endotracheal tubes showed similar efficiency during intubation and maintenance of anaesthesia without any air leak and without any risk of regurgitation. Hence, it can be concluded that PLMA can replace and can be a better and effective alternative to endotracheal intubation as it also not produces any detrimental hemodynamic changes.

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Comparison of Butorphanol and Buprenorphine as an Adjunct to Local Anaesthetic Solution in Supraclavicular Brachial Plexus Block

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Abstract

Introduction: Opioids are well studied adjuncts although the evidence regarding the analgesic benefit of opioid adjuncts remain equivocal. The effectiveness of buprenorphine and butorphanol administered as adjuncts to local anaesthetic solution into brachial plexus sheath was evaluated. *Aim:* The objectives of this study are to compare between Butorphanol and Buprenorphine as an adjunct to local anaesthetic solution in supraclavicular brachial plexus block with respect to – Duration of sensory and motor block, duration of analgesia and untoward side effects. *Materials and Methods:* The study was a randomized prospective double blind and comparative study carried in 60 ASA grade I and II patients undergoing elective upper limb surgeries, aged between 18-60 years were randomly allocated into 2 groups of 30 each. All patients received 1% lignocaine plain 2mg/kg and 0.5% bupivacaine at 2mg/kg body weight. In addition, 30 patients in group A received butorphanol tartarate (30mcg/kg) while the 30 patients of group B received buprenorphine hydrochloride (3mcg/kg). Using VAS score the analgesia was evaluated every hourly for six hours, every two hours for next twelve hours and then every six hours till 48 hours. *Result:* heart rate pattern of both groups shows statistical significance at 10^{th} to 13^{th} hour of the study period. systolic blood pressure changes between two groups shows statistical significance between 9^{th} to 11^{th} and 14^{th}, 15^{th}, 16^{th}, 18^{th}, 20^{th} and 24 hrs. diastolic blood pressure between two groups show statistical significance between 8^{th}-12^{th} hr and 18^{th}, 20^{th} and 24^{th} hr. Statistical significance with respect to respiratory rate at 2^{nd} to 5^{th} hr, 14^{th} hr, 16^{th} hr to 20^{th} hr, 28^{th} hr and 48^{th} hr.postoperative pain using visual analogue scale (VAS) between the two groups with statistical significance at 3^{rd}, 9^{th}, 11^{th}-13^{th}, 17^{th} and 18^{th} hrno statistical significance in terms of onset, duration of surgery, sensory and motor blockade between the two groups. Average duration of analgesia were 14.13±8.41hr and 22.18±12.13hr in groups A and B respectively, showed statistical significance. The group B showed prolonged analgesia produced by addition of buprenorphine to local anaesthetic. Side effects like nausea, vomiting and numbness were comparable in both groups without any significance. *Conclusion:* We conclude that buprenorphine as an adjunct administered with local anaesthetics into brachial plexus sheath is an efficient way to overcome the perioperative pain in upper limb surgery.

Keywords: Buprenorphine; Butorphanol; Local Anaesthetic Adjuncts; Brachial Plexus Block; Perioperative Analgesia.

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Introduction

The alleviation of pain is the main concern of anaesthesiologist and has received tremendous focus in this evolving field of medicine. Many methods, many drugs and many routes have been tried for this purpose. Fundamental to modern neural blockade is the concept that pain is a sensory warning conveyed by specific nerve fibre, amenable in principle, to modulation or interruption anywhere inthe nerve's pathway.

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Pain relief after upper limb surgery can be achieved by various regional anaesthetic techniques. The supraclavicular brachial plexus is one among the most popular regional nerve blocks performed. The ease and predictable landmarks makes it a popular approach. The advantages are – It provides long lasting post operative analgesia, thereby reducing the systemic analgesic requirement; it aids in early ambulation, overcoming the disadvantages of general anaesthesia.

The limitations of local anaesthetics are – slower onset of action, shorter duration of action and prolonged motor and sensory blockade. Different adjuncts have been tried to fill the lacunae created by the local anaesthetics. The novel approaches are – alkalinisation of local anaesthetics, carbonation, addition of opiates, calcium channel blockers (verapamil), clonidine. The existence of opioid receptors in peripheral nerve tissue has led to investigation of incorporating small doses of opioids in peripheral nerve blocks, hoping to achieve analgesia with minimal side effects. Hence pain relief using opioids admixed with local anaesthetics for peripheral nerve blocks have been tried.

Buprenorphine, a semi-synthetic thebaine congener is thirty to thirty five times more potent than morphine. It has a longer duration of action due to high affinity to μ receptor. Butorphanol, a synthetic opioid analgesic is five to eight times more potent than morphine. It has comparatively lesser incidence of systemic side effects. Therefore, a comparative study with buprenorphine and butorphanol as adjuncts to local anaesthetics in brachial plexus block through supraclavicular approach for upper limb surgery is desired to improve the onset, quality and duration of analgesia.

Materials and Methods

A prospective, randomised, comparative study consisting of 60 patients undergoing upper limb surgery lasting more than thirty minutes were included in the study. The elective surgical interventions were internal fixation of bones with plates and screws, excision of bone cysts, reconstructive and other surgeries involving upper limb.30 patients in group A (Butorphanol) and 30 patients in group B (Buprenorphine) is undertaken to study the change in pattern of haemodynamics, pain score by VAS, duration of analgesia, duration of sensory and motor blockade and side effects.

Inclusion Criteria

Patients with ASA I and II physical status, within the age group of 18-60 years, of both sexes undergoing elective surgeries were included in the study.

Exclusion Criteria

Patients with age <16 and >60 years; patients with coagulopathy or on anti-coagulants, peripheral neuropathy; patients who had received opioid in the past twelve hours; patients with history of substance abuse; local cutaneous infections; pregnant patients; patients with allergy to local anaesthetics, butorphanol and buprenorphine; ASA class III and IV patients; patients undergoing emergency surgical procedures were excluded from the study.

Preoperative Preparation

The study protocol was approved by the hospital ethical committee. All the patients underwent thorough preanaesthetic 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. The anaesthetic procedure to be carried out was explained. They were informed about development of paraesthesia. Patients were reassured to alleviate their anxieties. A written informed consent was taken. They were educated regarding the visual analogue scale. All the patients were fasted overnight. All of them received oral diazepam 10mg and tablet ranitidine 150mg night before surgery.

Basic laboratory investigations were conducted including haemogram, urine analysis and whenever needed chest x-ray, electrocardiogram, blood sugar.

Method of collection of data – Supraclavicular brachial plexus block was carried out as an elective procedure on the patients undergoing upper limb surgery. Sixty patients were randomly allocated into 2 groups (group A, n=30 and group B, n=30) in double blind fashion. All drug solutions were prepared by an anaesthesiologist not involved in administration of anaesthesia, patient care and data collection.

Group A (n=30): Received brachial plexus block with 1% lignocaine plain at the dose of 2mg/kg body weight and 0.5% bupivacaine 2mg/kg along with inj. Butorphanol 0.03mg/kg to the solution.

Group B (n=30): Received brachial plexus block with 1% lignocaine plain at the dose of 2mg/kg body weight and 0.5% bupivacaine 2mg/kg along with inj. Buprenorphine 3mcg/kg to the solution.

All the necessary equipments and drugs needed for administration of general anaesthesia and for resuscitation were kept ready in order to manage in case of failed block or toxic reactions occurring during the procedure. Block was performed using a standard protocol.

The effect of anaesthetics on the following parameters were observed –

1. The time of onset for sensory blockade: defined as time between injection and total abolition of pinprick response, was evaluated in four nerve areas (radial, ulnar, median and musculocutaneous) at every 3 minutes until 45 minutes after the injection. The block was judged to be failed if anaesthesia was not present in 2 or more peripheral nerve distribution and such patients were excluded from the study.
2. The duration of sensory blockade: defined as the time between onset of action and return of pinprick response, was assessed every 30 minutes in at least 3 major nerve territory.
3. The duration of analgesia: defined as the time between the onset of action and the onset of pain, was the time when the patients received the first dose of analgesic. Supplemental analgesia was given in the form of intramuscular inj. Diclofenac sodium 50mg to 75mg, when visual analogue scale was more than 4.
4. The duration of motor blockade: was assessed every 30 minutes till the return of complete muscle power in at least 2 major nerve distribution.

During surgery, pulse rate, non-invasive blood pressure and peripheraloxygen saturation through pulse oximetry were monitored.

Post-operative assessment: Patients would be evaluated postoperatively, every hourly for first six hours, second hourly for next twelve hours, for the following parameters – intensity of pain, motor and sensory recovery. Patients were also monitored for the side effects of opioids including nausea, vomiting, drowsiness, pruritis and urinary retention. The intensity of pain was assessed using visual analogue scale (VAS) score. This scale consists of a 100mm line on which the patients represented the degree of pain he/she was experiencing by placing a point somewhere between "no pain" ("0") and the worst pain ever experienced ("100"). The supplemental analgesia was given in the form of inj.Diclofenac 50-75mg IM, when VAS score was more than four.

Statistical methods – Chi-square test and Fisher Exact test has been used to find the homogeneity of sex distribution between the two groups and Student t test has been used to find the homogeneity of age and weight distribution between the two groups. Student t test (Two tailed) has been used to find significant difference of haemodynamics between the two groups and the study parameters namely – time of onset, duration of surgery, duration of motor and sensory blockade, and duration of analgesia between the two groups. Mann Whitney U test has been used to assess the significant difference of VAS score between the two groups. Chi-square and Fisher Exact test has been used to find significant difference of incidence of side effects between the two groups. The statistical software used was SPSS.12.0.1 for windows and statistica.

Results

The table 1 shows that the average age was 33.47±10.97 yrs in group A and 35.07±10.98 yrs in group B. The average weight of the patients were 60.40±8.62 kg in group A and 63.33±9.48 kg in group B respectively. Both groups had predominantly male patients, accounting to nearly 2/3 of the total study population in each group. There was no significant difference in age, weight and sex distribution.

This line chartcomparing the heart rate pattern of both groups shows statistical significance at 10^{th} to 13^{th} hour of the study period although they are within an acceptable clinical range (Figure 1).

In this line chart the compared systolic blood pressure changes between two groups shows statistical significance between 9^{th} to 11^{th} and 14^{th}, 15^{th}, 16^{th}, 18^{th}, 20^{th} and 24 hrs. (Figure 2).

Table 1: Comparison of demographic parameters

Demographic parameters	Group A (n=30)	Group B (n=30)	P value
Age in years (Mean±SD)	33.47±10.97	35.07±10.98	0.575
Weight in Kg (Mean±SD)	60.40±8.62	63.33±9.48	0.215
Sex	M:F – 20:10	M:F – 23:7	0.781
Inference	Samples are age, sex and weight matched with p>0.05		

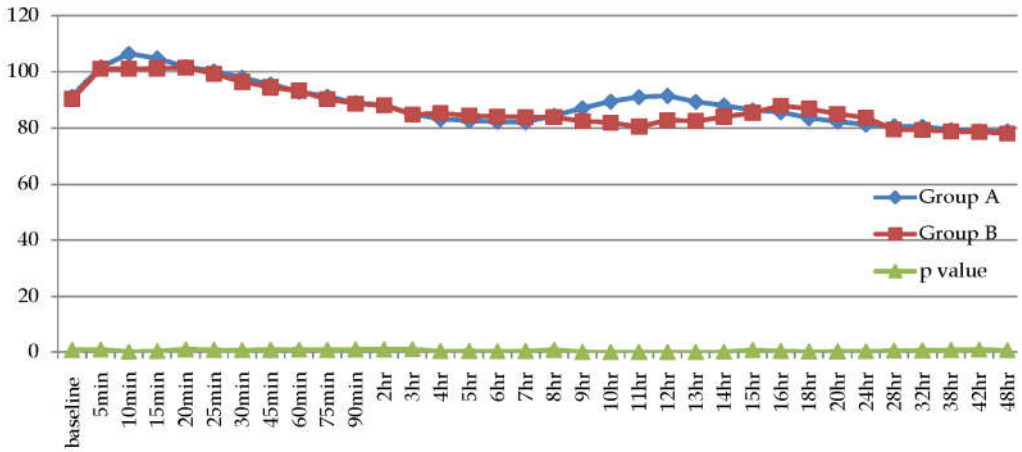

Fig. 1: Comparison of heart rate between the two groups

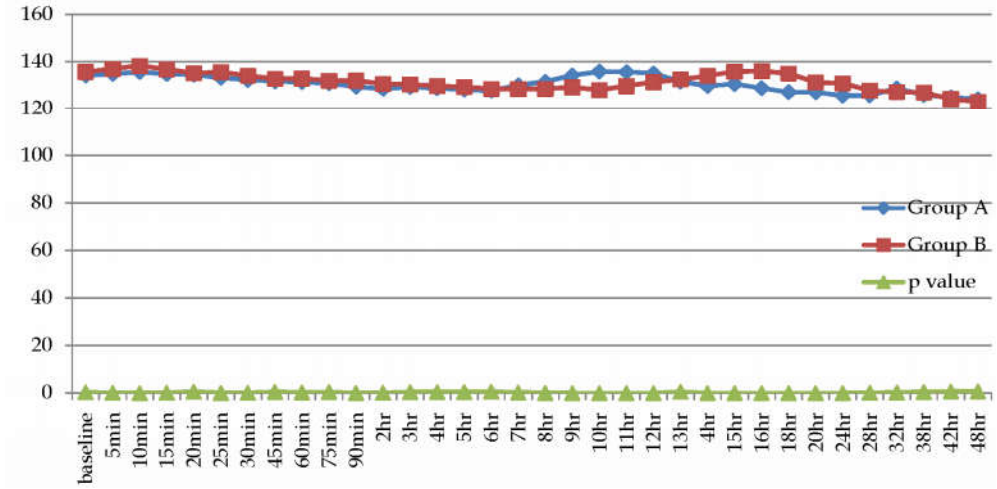

Fig. 2: Comparison of systolic BP between the two groups

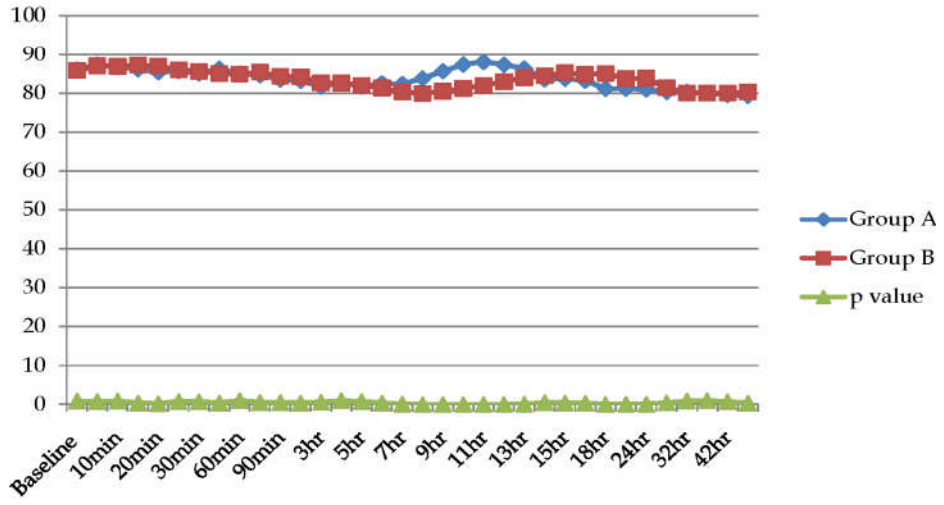

Fig. 3: Comparison of diastolic BP between the two groups

The compared diastolic blood pressure between two groups show statistical significance between 8th-12th hr and 18th, 20th and 24th hr. (Figure 3).

In Figure 4 there is statistical significance with respect to respiratory rate at 2nd to 5th hr, 14th hr, 16th hr to 20th hr, 28th hr and 48th hr. (Figure 4).

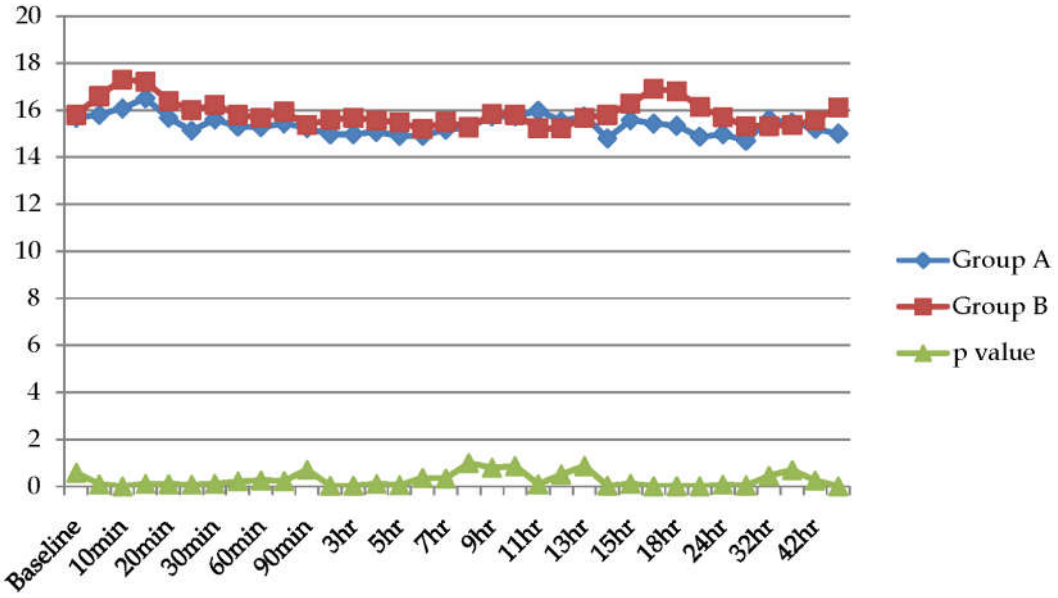

Fig. 4: Comparison of respiratory rate between the two groups

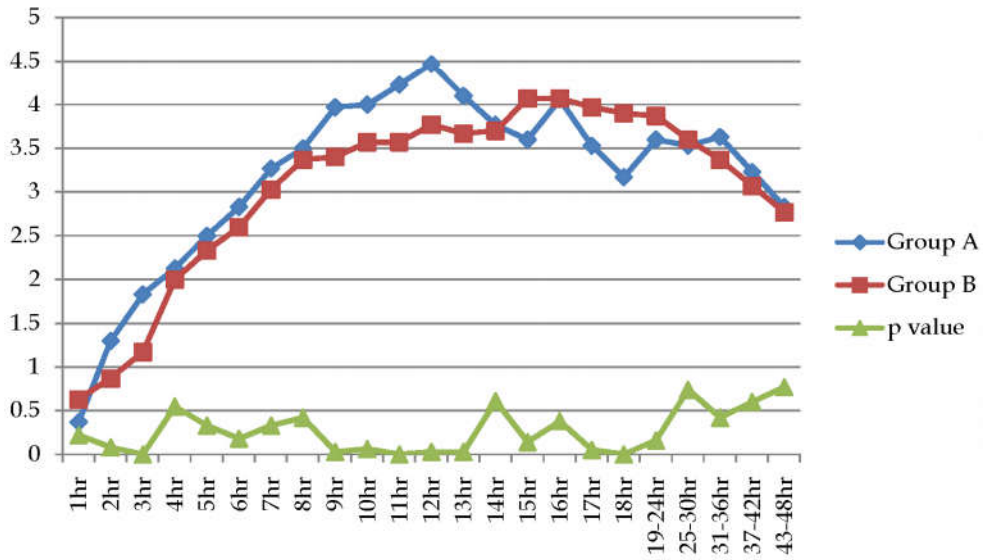

Fig. 5: Comparison of VAS score between the two groups

Table 2: Comparison of study parameters between the two groups

Study parameter	Group A (n=30)		Group B (n=30)		P value
	Mean	SD	Mean	SD	
Time of onset (min)	20.47	3.64	19.47	4.90	0.37
Duration of surgery (min)	79.50	26.27	84.33	37.20	0.56
Duration of sensory blockade (min)	385.67	66.67	380.50	80.15	0.79
Duration of motor blockade (min)	367.40	71.43	360.00	77.87	0.70
Duration of analgesia (hrs)	14.13	8.41	22.18	12.13	0.00

The patients were assessed for postoperative pain using visual analogue scale (VAS). The above graph compares the VAS scores between the two groups with statistical significance at 3rd, 9th, 11th-13th, 17th and 18th hr of the study period. (Figure 5).

In the Table 2, there was no statistical significance in terms of onset, duration of surgery, sensory and motor blockade between the two groups. However, the average duration of analgesia were 14.13±8.41hr and 22.18±12.13hr in groups A and B respectively, showed statistical significance.

Table 3: Comparison of side effects between the two groups

Side effects	Group A (n=30)	Group B (n=30)
Nausea	3 (10.0%)	3 (10.0%)
Vomiting	2 (6.7%)	1 (3.3%)
Numbness	1 (3.3%)	1 (3.3%)
No side effects	24 (80.0%)	25 (83.3%)
Inference	Side effects are statistically similar between the two groups with p=0.739.	

The group B showed prolonged analgesia produced by addition of buprenorphine to local anaesthetic.

The observed parameters like nausea, vomiting and numbness were comparable in both groups without any significance (Table 3).

Discussion

Varieties of receptors mediate nociception in peripheral sensory nerve fibres. The knowledge of these receptors has been used in the form of various adjuncts administered along with local anaesthetics. These adjuncts may not only prolong the analgesic duration but also thought to reduce the systemic analgesic consumption as well as their side effects. To prolong perioperative analgesia various adjuncts such as opioids, clonidine, verapamil, neostigmine and tramadol have been tried. Although the role of opioid as an adjunct has been debated over a long period, it is still in regular use.

The objective of the study was to compare the analgesic efficacy between butorphanol and buprenorphine as an adjuncts to local anaesthetics in brachial plexus block.

The study was a prospective, randomized, double blind study carried out at our hospital. 60 patients belonging to ASA I and II physical status patients undergoing upper limb surgeries were included in the study. Patients were divided into 2 groups –

Group A (n=30): Received brachial plexus block with 1% lignocaine plain at the dose of 2mg/kg body weight and 0.5% bupivacaine 2mg/kg along with inj. Butorphanol 0.03mg/kg to the solution.

Group B (n=30): Received brachial plexus block with 1% lignocaine plain at the dose of 2mg/kg body weight and 0.5% bupivacaine 2mg/kg along with inj. Buprenorphine 3mcg/kg to the solution.

In our study, we observed that there was no change in the time of onset of sensory blockade between two groups. This was similar to the observation done by Eric J. Veil [1], who found no change in the onset time when morphine and buprenorphine were added to 0.5% bupivacaine into brachial plexus sheath.

However, Flecher et al. [2] had an early onset of block with fentanyl. The pH of the injected solution around the nerve would certainly influence the onset of action.

The other block characteristics like duration of sensory and motor blockade were similar in both groups.

We observed that addition of buprenorphine to local anaesthetic solution much longer acting analgesia (22.18±12.13) than produced by addition of butorphanol (14.13±8.14hrs).

Bazin et al. [3], had observed a similar duration of analgesia (median 20hrs). On buprenorphine administration, in a similar way, Candido et al. [4] has observed duration of analgesia produced with buprenorphine wasthree times longer than that produced by local anaesthetics alone.

Wajina et al. [5] has also found satisfactory and prolonged analgesia with butorphanol administered as continuous intrabrachial infusion. The prolonged analgesic duration [6] observed with buprenorphine may be attributed to its high affinity for μ opioid receptor and high lipid solubility, which favours easy penetration through the axonal myelin and nerve membrane.

The other factor that might have influenced the protracted analgesia of buprenorphine, was its potency. Buprenorphine in 33-35 times more potent than morphine when compared with butorphanol which is only 3.5 times more potent.

The other proposedmechanisms [7] for the opioid mediated analgesia are: It has more of a central action than peripheral action. The transport of the administered drug into extradural or subarachnoid space either by diffusion or by the centripetal axonal transport results in central action. The presence of the bidirectional axonal transport of opioid binding receptors has been already confirmed.

This thought has been questioned by Dahl et al. [8]. He compared the effects of morphine injected extradurally with that injected perifemorally. He

concluded that, if centripetal axonal transport exists it was clinically not significant. Christen et al. later confirmed that morphine concentration in CSF were similar after perifemoral or IM injection.

The expression of opioid receptors during the time of inflammation has been proposed mechanism of action. Mays et al. [9] obtained long lasting pain relief up to 24 hours , when 6mg of morphine was given in 30ml of saline into brachial plexus sheath, for chronic pain relief. But most of the studies, conducted for the postoperative pain relief, during minimal inflammation, have come with better analgesic durations. The electrophysiological study results with morphine, pethidine, fentanyl have suggested that opioids may exert non- specific action on nerves by impairing sodium and potassium conduction.

The presence of variety of receptors and the difference in the affinity of administered drug to the receptor can be alternative explanation to the longer duration of analgesia produced by buprenorphine than butorphanol. Buprenorphine has high affinity for opioid receptors whereas butorphanol is kappa agonist with moderate affinity.

Gobeaux et al. [10], in his first study observed a significant reduction in the time of onset with fentanyl 0.1mg administered into axillary sheath along with local anaesthetics. However, there wasno prolongation of analgesic duration. In his second study, he found prolonged analgesia with pethidine 100mg without any change in onset time.

They concluded that, varying results were due to greater lipid solubility of fentanyl and pethidine compared to morphine. The same fact allows greater distribution of the drug at the site of action as afferent nociceptive fibres are surrounded by a layer of myelin which presents a significant obstruction to water soluble agents.

We found no significant difference with respect to side effects like nausea, vomiting, numbness between the two groups. At the same time there was no incidence of pruritis, respiratory depression or urinary retention.

The significant changes observed with respect to haemodynamic parameters were due to variability in the onset of pain between the two groups. The early raise of heart rate and blood pressure in group A were due to analgesic wear off. The same occurred in group B in the later period. On the average the number of supplemental Diclofenac sodium injections received were two in group A, where as patient's in group B received one supplement over 48 hours.

From our study, we observed that buprenorphine may be a superior adjunct than butorphanol, when administered with local anaesthetic solutions into brachial plexus sheath for providing perioperative analgesia following upper limb surgeries.

In our study we did not have a control group and the pH of the administered solutions are not studied which are the other important factors that influence block characteristics as mentioned earlier.

Although the analgesic properties of the opioids have been studied with the establishment of peripheral opioid receptor, it awaits further studies to establish the local anaesthetic action of the opioids. This could be established by using varying drug concentrations of opioids administered alone in the regional techniques.

Conclusion

Buprenorphine (3mcg/kg body weight) is superior to butorphanol (0.03mg/kg body weight), as an adjunct to local anaesthetic solution when administered into brachial plexus sheath for perioperative analgesia during upper limb surgery.

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A Prospective Observational Study – Epidural Catheter Insertion Site and Adequacy of Post-Operative Pain Relief in Children undergoing Thoracic and Upper Abdominal Surgeries

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Abstract

Background and aims: Effective postoperative pain relief from epidural analgesia has numerous benefits including earlier ambulation, rapid weaning from ventilators, lowered circulating stress hormone levels. Precise placement of epidural catheters ensures selective blockade of dermatomes affected by surgical procedure, allowing reduction of doses of local anaesthetics and additional analgesics. The aim of the study was to analyse efficacy of epidural analgesia in relation to distance between catheter placement and site of surgery. *Methods:* This was prospective observational study carried out for a year, total of 44 paediatric patients who underwent thoraco-abdominal surgery under general anaesthesia with epidural analgesia were considered and studied for general practice in our institute for epidural catheter placement, efficacy of epidural analgesia in relation to distance between catheter placement and site of surgery, complications of epidural catheter placement.Data were expressed as means (with standard deviations) and percentages (for categorical data). Unpaired t test and chi square test were used to compare continuous and categorical data respectively. *Results:* The total volume of local anaesthetic required in first 24 hrs postoperative in congruent group was 6.67±2.56ml/kg as compared to 8.60±2.938ml/kg incongruent group (p=0.025). In congruent group 16% of children required additional analgesic as compared to incongruent group where 36.84% of children required additional analgesics. *Conclusion:* Our study shows that putting the epidural catheter congruent to surgical incision required less of volume of local anaesthetic and additional analgesics and should be practiced preferably.

Keywords: Epidural Analgesia; Paediatric Patients; Congruent Group; Incongruent Group.

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Introduction

Paediatric epidural analgesia [1,2], combined with general anaesthesia is an excellent technique for a balanced intra-operative anaesthesia and post-operative analgesia [3]. It decreases the requirement of intra-operative anaesthetic agents [4], enabling fast and smooth recovery. Precise placement of epidural catheters for continuous epidural anaesthesia ensures the dermatomes affected by surgical procedure to be selectively blocked, allowing for lower doses of local anaesthetics and sparing of unnecessary blockade in the regions where blockade is not desired [5,6]. Performing regional anaesthesia in children may be perceived as difficult because of risk of inadvertent cord injury as epidural catheters are inserted under anaesthesia. Also many anaesthetist believe that keeping longer length of epidural catheter inside the space will help reach the tip of the catheter near required dermatome level since there are no fibrotic bands inside epidural space in children as against in

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adults. We hypothesised that congruent placement of epidural catheters will result in less amount of local anaesthetic to be given epidurally and better analgesia as against non-congruent placement of catheter.

Methods

This was a prospective observational study. Subsequent to Institutional Research Board approval we enrolled all patients under the age of 12 yrs of American Society of Anaesthesiologist (ASA) risk I and II undergoing thoracic and upper abdominal surgeries over the period of 1yr. Patients of either sex above 12 yrs of age, those undergoing lower abdominal/ extremities surgeries, ASA grade III or IV patients, infection at site of insertion of epidural needle, coagulopathy or on anticoagulation therapy, vertebral deformities, refusal of parental consent for procedure were excluded. The demographic data obtained were age, weight, sex and primary surgery. Intra-operative data included the type of surgical procedure, anaesthetic technique and agents, attempts and difficulties encountered during epidural catheter placement. Data concerning the epidural catheter were recorded which included level of placement, amount of bolus epidural drug and infusion rate administered via the catheter, and technical problems for catheter placement, number of attempts, number of operators and experience of operator. After the conclusion of surgery all patientswere shifted to post-operative recovery room for monitoring. Postoperative data was collected by an independent observer who was blinded to the epidural insertion site. Child's back was dressed by using large sized gauze piece dressing so that assessor will not know site of catheter insertion. The parameters assessed in the recovery room included the quality of analgesia which was measured by pain score in immediate post-operative period and then every 8hrs till the epidural catheter was removed, total volume of local anaesthetic infusion, need for rescue analgesic or additional analgesia. If pain score was equal to or more than 3, rescue analgesic in form of intravenous (IV) fentanyl 1μg/kg was administered. The assessment of post-op pain was based on FLACC scale.

Data was expressed as means (with standard deviations) and percentages (for categorical data). Unpaired t test and chi square test were used to compare continuous and categorical data respectively. P value less than 0.05 is considered significant.

Results

A total of 44 patients with ASA physical status I or II who underwent thoracic and upper abdominal surgeries were included into study. We divided patients in two groups based on difference of dermatome segment between insertion of epidural catheter and the midpoint of dermatomes involving surgical incision.Out of 44 patients 25 patients got epidural catheters which were inserted within 2 spaces (57%) from midpoint of dermatomes to be covered as against 19 patients had epidural catheter insertion site further away (43.18%). When catheter was inserted by anaesthetist experienced in paediatric epidural catheter insertion 61% times catheter insertion site was congruent as against only 50% times it was congruent when inserted by less experienced anaesthetist.

These two groups were compared with respect to minimum and maximum pain score on day 0 and day 1, volume of local anesthetic per kg required on day 1and additional analgesic required for adequate pain relief during first 48 hours. The total volume of local anaesthetic required in first 24 hrs post-operative in group where epidural catheter was inserted within 2 segments from incision was 6.67±2.56ml/kg as compared to 8.60±2.938ml/kg in group where epidural catheter was inserted at distance more than two segments from incision. This was statistically significant (p .025).

Table 1: FLACC Scale

Categories	Scoring		
	0	1	2
Face	No particular expression or smile	Occasional grimace	Frequent quivering
Legs	Normal position/relaxed	Uneasy restless	Kicking
Activity	Lying quietly	Squirming shifting back and forth	Arched , rigid
Cry	No cry	Moans/whimpers	Crying steadily
Consolability	Content, relaxed	Reassured by touching	Difficult to console

In group where epidural catheter was inserted within 2 segments from incision significantly less number of children required additional analgesic (16%) as compared to group where epidural catheter was inserted at distance more than two segments from incision (36.84%).

Table 2:

	Less than 2 segments	More than 2 segments	P value
Total volume of local anaesthetic per kg required in first 24hrs	6.67±2.563	8.60±2.938	.025

In the group where epidural catheter was inserted at distance more than two segments from incision, day 0 maximum and minimum pain score was 3.47±1.67 (mean±SD) and 1.58±0.67 respectively as compared to group where epidural catheter was inserted within 2 segments from incision in whom day 0 maximum and minimum pain score was 2.63±0.69 and 1.21±0.37 respectively which was statistically significant (p .045)

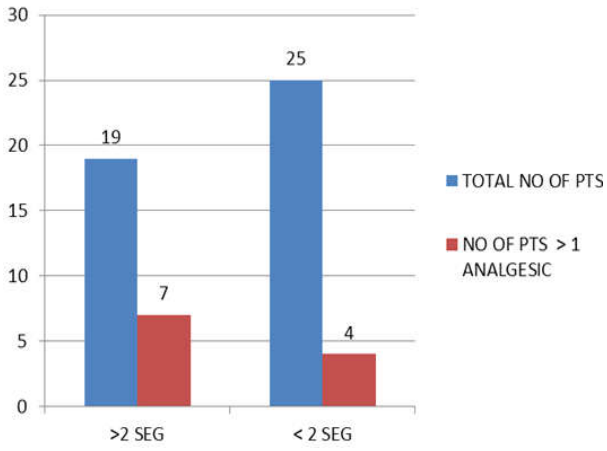

Fig. 1:

In the group where epidural catheter was inserted at distance more than two segments from incision, day 1 maximum and minimum pain score was 2.84±1.25 and 0.88±.72 respectively as compared to group where epidural catheter was inserted within 2 segments from incision in whom day 0 maximum and minimum pain score was 2.79±.98 and 1.00±.67 respectively which was statistically insignificant.

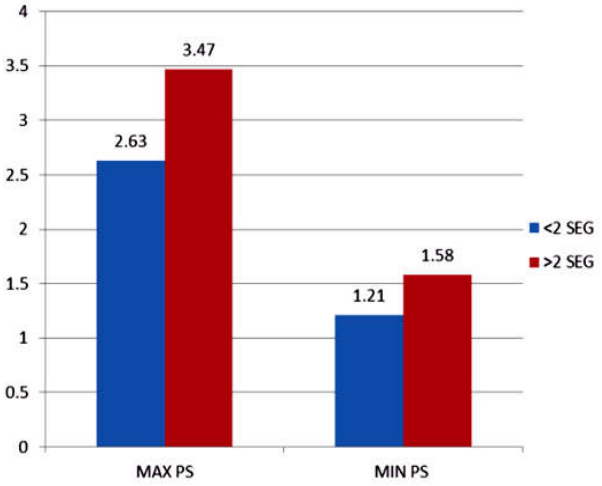

Fig. 2: Pain score on pod 0

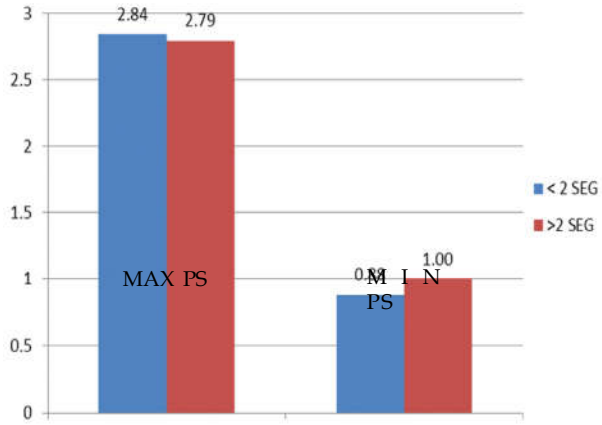

Fig. 3: Pain score on pod 1

Discussion

In this prospective observational study epidural catheter insertion site and adequacy of post-operative pain relief in children undergoing thoracic and upper abdominal surgeries was assessed by the requirement of total volume of local anaesthetic infusion, need for rescue analgesic and or additional analgesia.

Several investigators have reported on the use of the caudal or lumbar approach for thoracic epidural anaesthesia. Bosenberg et al reported on the use of the caudal route [8]. Their study consisted of three parts: (1) a human cadaver study to determine feasibility of passing a catheter through the sacral hiatus to the thoracic epidural space, (2) an animal study to determine any potential trauma

to the canal, and (3) a human study on patients requiring biliary tract surgery. The results in their human phase were excellent. In 19 out of 20 cases the epidural catheter was placed within one vertebra of the desired level. However this human study was done in infants ranging from 2.7 to 6.5 kg. On 14 occasions some slight resistance to the passage of the catheter was encountered but that passage was successful with minimal flexion or extension of the infant's spine.

Gunter and Eng investigated the feasibility of placing thoracic epidural catheters through the caudal approach in children from 1 to 10 years of age [9]. In 20 patients studied, the radiographically determined catheter tip position was within two vertebrae of the target position in 17 of the 20 subjects. However, theses authors used catheter with stylets. Their study concluded that it is possible to use the caudal approach to thoracic epidural anaesthesia in children as old as 10 years.

Blanco et al reported on their series of thoracic epidural anaesthesia through the caudal space [10]. They studied 47 children up to 8 years age. They used an 18 G Tuohy needle and a catheter without a stylet. The L_4-L_5 area was reached in 46 of 47 children but only in 16 (30%) the targeted T_{10}-T_{12} area was reached. They also found that age was a limiting factor because, in their children over 1 year of age, the level of success decreased significantly. In their study on using the lumbar approach for thoracic epidural anaesthesia in infants and children, out of 39 patients studied, the catheter tip reached T_{10}-T_{12} in 7 patients, L_2 in 1, L_3 in 8 and L_4-L_5 in 23. Forty-eight percent of the catheters that were easily advanced remained at the L_4-L_5 level [11]. Thus concluding that easy insertion of catheter is not the reliable sign of epidural catheter having reached at desired site [11].

In our group of patients we did not use radio-opaque catheters so we could not ascertain the position of tip of catheter. Instead we used inadequacy of pain relief as seen by requirement of additional analgesic and requirement of large volume of LA to achieve desired band as surrogate marker of catheter positioning. We found that patients who had incongruent catheter insertion 37% children required 2 additional oral analgesics suggesting inadequate epidural analgesia probably due to incorrect position of catheter tip and 52% patients required very large volume of local anaesthetic drug to achieve required band of anaesthesia. These findings suggest that in around 52% patients the catheter did not reach desired site. We cannot compare our results with any other study as no study in literature has used this methodology. Since we had used lumbar route and not caudal for epidural catheter insertion we may compare our results with Blancos second study [11] that used lumbar approach for thoracic in which only around 20% catheters reached the desired site. We had better rates of adequate catheter positioning as seen clinically in that 48% patients probably had desired position and this difference in findings may be due to significant number of catheters were actually placed in lower thoracic region.

Another major issue of placing thoracic epidural catheter under anaesthesia is safety. Retrospective review of three years involving 63 patients done by D. Tobias and colleagues showed that placing direct thoracic epidural catheter is feasible and quite safe in experienced hands and technique can be easily taught [12].

We did not find any incidence of nerve injury in our study population however our patient number was very small to draw such a conclusion and all epidural catheters were placed by highly experienced anaesthetists or under direct supervision of experienced anaesthetist.

Our study shows that putting the epidural catheter congruent to surgical incision required less of volume of local anaesthetic and additional analgesics and should be practiced preferably.

Conclusion

Placing epidural catheter congruent to surgical incision required less volume of local anaesthetic per kg in first 24hrs and needed less additional analgesic for adequate pain relief as compared to patients in which epidural catheter was not congruent.

Prior Publication: Nil

Support: Nil

Conflicts of Interest: Nil

Permissions: Nil

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Original Research Article

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Efficacy of Cisatracurium over Atracurium in Patients undergoing Lower Abdominal Surgeries at a Tertiary Care Hospital

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Abstract

Context: Atracurium is associated with hemodynamic instability in patients. Cisatracurium has been developed to overcome this side effect which is an isomer of atracurium. *Aim:* To study the efficacy of Cisatracurium in patients undergoing lower abdominal surgeries. *Settings and Design:* Present randomized controlled trial was conducted at Department of Anesthesiology, Malla Reddy Institute of Medical Sciences, Hyderabad. *Methods:* The patients being operated for lower abdominal surgeries were randomly allocated into two groups. 30 patients were in Atracurium group while 30 patients were in Cisatracurium group. The changes in the heart rate and mean arterial pressure was observed after giving injection of anesthetic and immediately after the intubation. *Statistical analysis:* The data was analyzed using means and proportions. Student's t test for means and chi square for proportions was used. *Results:* Both the groups were comparable in baseline characteristics. The baseline heart rate was similar for both the groups. But heart rate after injection and after intubation in Atracurium group was significantly more compared to the heart rate after injection in Cisatracurium group ($p < 0.05$). The change of mean MAP was significantly more in Atracurium group after giving injection from baseline compared to Cisatracurium group. But the difference of means of change in MAP from giving injection to intubation was statistically not significant between the two groups ($p > 0.05$). Again the change in mean MAP was significantly more in Atracurium group after intubation from baseline compared to Cisatracurium group. *Conclusion:* Cisatracurium was found to be more effective than Atracurium in terms of stabilized heart rate and mean arterial pressure.

Keywords: Atracurium; Cisatracurium; Heart Rate; Comparison; Characteristics.

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Introduction

Muscle relaxants are required for surgeries performed under general anesthesia. These muscle relaxants used have effects on the hemodynamics of the patient undergoing surgery under general anesthesia [1].

The mechanism of action by which these muscle relaxants are responsible for hemodynamic changes can be release of histamine, can be through the sympathomimetic action, can be through blockage of ganglions, or can be through antimauscarine effects on heart or a combination of these mechanisms. Atracurium is one such muscle relaxant commonly used in patients undergoing surgeries under general anesthesia. Atracurium belongs to benzyl isoquinolinum group. It is a non depolarizing relaxant. It exerts its action independently without affecting the metabolism of the body. It does not affect the metabolism of kidney and liver. Hence, it is a safe and attractive option

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in patients having underlying renal and liver disease and undergoing surgery under general anesthesia. But inspite of these advantages associated with Atracurium, as it causes muscle relaxation by histamine release, it affects the hemodynamics of the patients. Because of this property of Atracurium its use can be a problem in certain patients especially patients undergoing cardiovascular surgeries [2].

Hence the isomer of Atracurium called Cisatracurium can be used to overcome this disadvantage associated with use of atracurium. It is also metabolized just like that of atracurium. But ester hydrolysis mechanism is not seen the metabolism of Cisatracurium and hence patient can be hemodynamically more stable when it is used as compared to atracurium [3].

Muscle relaxants are used in patients undergoing surgeries under general anesthesia. These muscle relaxants act by release of histamine. This leads to hemodynamic changes in the body like lowered blood pressure, erythema of face and head. This usually occurs with plasma concentration of drug becomes two to three times of its initial level. Dose of the muscle relaxant given as well as the speed with which the drug is administered to the patient determines the severity of these side effects [4].

It has been shown that in patients undergoing surgery under general anesthesia, having pre-existing cardiac disease, when Cisatracurium given in the dose of 0.3 mg/kg will not alter the mean arterial blood pressure [5].

It has been found that contrary to atracurium, Cisatracurium will not increase histamine plasma level to >8x ED95. Hence, patients will not experience the side effects associated with high levels of histamine in the plasma and this is particularly useful for patients having pre-existing heart disease [6].

Thus use of Cisatracurium seems to have an edge over the use of atracurium not only for coronary graft surgeries but also patients undergoing other surgeries [7].

Present study was planned to study effectiveness of Cisatracurium over atracurium in patients undergoing abdominal surgeries with special reference to hemodynamic changes like heart rate and mean arterial blood pressure.

Methods

Study Design

Present study was hospital based randomized controlled trial.

Study Period

The study was carried out over a period of six months from December 2017 to May 2018.

Settings

The study was carried out at Department of Anesthesiology, Malla Reddy Institute of Medical Sciences, Hyderabad

Sample Size

Total of 60 patients undergoing abdominal surgeries under general anesthesia were studied over a period of six months

Ethical Considerations

Institutional Ethics Committee Permission was obtained before the start of the study. Informed consent and high risk consent was obtained from all selected patients for the present study.

Inclusion Criteria

1. Patients undergoing abdominal surgeries under general anesthesia
2. Patients willing to participate in the present study

Exclusion Criteria

1. Patients found to have multiple disorders
2. Patients not willing to participate in the present study

Grouping, Randomization and Methodology

Sixty eligible patients as per the abovementioned inclusion and exclusion criteria were randomly allocated to one of the two groups in equal numbers. 30 patients received atracurium and were labeled as atracurium group. 30 patients received Cisatracurium and were labeled as Cisatracurium group.

Baseline characteristics like age, sex, ASA grade, MP grade, mouth opening, neck movements, type of surgery undergone and condition at intubation was noted and recorded in the pre designed, pre tested, and semi structured study questionnaire.

Hemodynamic characteristics like heart rate and mean arterial pressure was recorded at baseline i.e. before giving the injection of muscle relaxant, again immediately after giving the injection of muscle relaxant and third time immediately after intubation and recorded.

Statistical Analysis

The data was entered in the Microsoft Excel worksheet and analyzed using means and proportions. Statistical tests like student's t test was used for comparing differences of mean between the two groups and Yate's corrected chi square for comparing differences of proportions between the two groups.

Results

Table 1 shows comparison of baseline clinical characteristics between the two groups. The two groups were comparable with each other in terms of mean age, distribution of males and females in two groups, and also comparable for ASA grades and MP grades as the difference in these characteristics was statistically not found to be significant. ($p > 0.05$).

Table 2 shows comparison of type of surgery done for patients in two groups. Both the group of patients underwent similar type of surgery. Thus both the groups were comparable to each other in terms of type of surgery performed as the difference in these characteristics was statistically not found to be significant. ($p > 0.05$).

Table 3 shows comparison of mean heart rate between the two groups. The baseline heart rate was similar for both the groups. But heart rate after injection in Atracurium group was significantly more compared to the heart rate after injection in Cisatracurium group ($p < 0.05$). Similarly, heart rate after intubation in Atracurium group was significantly more compared to the heart rate after intubation in Cisatracurium group ($p < 0.05$).

Table 4 shows comparison of change in mean MAP between the two groups. The mean MAP increased by 4 mmHg in Atracurium group after giving injection from baseline while the mean MAP decreased by 5.4 mmHg in Cisatracurium group after giving injection from baseline. This difference of means was found to be statistically significant ($p < 0.05$). But the difference of means of change in MAP from giving injection to intubation was statistically not

Table 1: Comparison of baseline clinical characteristics between the two groups

Clinical characteristics		Atracurium group (N = 30)	Cisatracurium group (N = 30)	T value/chi square value	P value
Age (years)		35.1±2.5	34.4±2.3	1.1286	0.2637
Sex	Male	15 (50%)	15 (50%)	0.0667	0.7963
	Female	15 (50%)	15 (50%)		
ASA grade	I	26 (86.7%)	26 (86.7%)	0.1442	0.7041
	II	04 (13.3%)	04 (13.3%)		
MP grade	I	20 (66.7%)	12 (40%)	3.211	0.07008
	II	10 (33.3%)	18 (60%)		

Table 2: Comparison of type of surgery done for patients in two groups

Type of surgery done	Atracurium group (N = 30) Number	%	Cisatracurium group (N = 30) Number	%	Chi square value	P value
Cholecystectomy	12	40	14	46.7	1.0529	0.788458
Appendicectomy	12	40	10	33.3		
Hernioplasty	06	20	04	13.3		
Hysterectomy	00	00	02	6.7		

Table 3: Comparison of mean heart rate between the two groups

Heart rate (beats/min)	Atracurium group (N = 30)	Cisatracurium group (N = 30)	T value	P value
Baseline HR	86.1±5.8	84.6±3.8	1.1849	0.2409
HR after injection	88.6±7.4	82.5±4.1	3.9493	0.0002
HR after intubation	97.4±9.1	85.2±14.8	3.8461	0.0003

Table 4: Comparison of change in mean MAP between the two groups

Mean change in MAP (mmHg)	Atracurium group (N = 30)	Cisatracurium group (N = 30)	T value	P value
From baseline to injection	4±2.7	-5.4±4.9	9.2027	0.0001
From injection to intubation	7.4±5.3	6.6±5.3	0.5846	0.5611
From baseline to intubation	11.4±5.1	1.16±5.03	7.8299	0.0001

significant between the two groups ($p > 0.05$). Again the mean MAP increased by 11.4 mmHg from baseline to intubation in Atracurium group compared to only an increase of mean MAP of 1.16 mmHg in the Cisatracurium group. This difference was found to be statistically significant.

Discussion

The two groups were comparable with each other in terms of mean age, distribution of males and females in two groups, and also comparable for ASA grades and MP grades as the difference in these characteristics was statistically not found to be significant. ($p > 0.05$).

Both the group of patients underwent similar type of surgery. Thus both the groups were comparable to each other in terms of type of surgery performed as the difference in these characteristics was statistically not found to be significant ($p > 0.05$).

The baseline heart rate was similar for both the groups. But heart rate after injection in Atracurium group was significantly more compared to the heart rate after injection in Cisatracurium group ($p < 0.05$). Similarly heart rate after intubation in Atracurium group was significantly more compared to the heart rate after intubation in Cisatracurium group ($p < 0.05$).

The mean MAP increased by 4 mmHg in Atracurium group after giving injection from baseline while the mean MAP decreased by 5.4 mmHg in Cisatracurium group after giving injection from baseline. This difference of means was found to be statistically significant ($p < 0.05$). But the difference of means of change in MAP from giving injection to intubation was statistically not significant between the two groups ($p > 0.05$). Again the mean MAP increased by 11.4 mmHg from baseline to intubation in Atracurium group compared to only an increase of mean MAP of 1.16 mmHg in the Cisatracurium group. This difference was found to be statistically significant.

Ghorbanlo M et al. [8] compared efficacy of Cisatracurium in patients undergoing cardiovascular surgeries under general anesthesia. They divided the patients into two groups and noted the two groups were comparable to each in terms of age, sex, premedication with cardiac drugs, basic underlying disease and pre-surgery ejection fraction. But the groups differed significantly in terms of hemodynamic indices with better results obtained in group using Cisatracurium. Thus the author concluded that as a muscle relaxant, Cisatracurium is better and advantageous over the other. We also concluded that Cisatracurium was better hemodynamic stabilizer for patient than atracurium.

Correa CMN et al. [9] compared atracurium and Cisatracurium in different doses. They noted that atracurium in the dose of 1 mg/kg and Cisatracurium in the dose of 0.25 mg/kg had similar mean arterial pressure. When the authors administered both the drugs in the doses of 4 mg/kg then atracurium was found to decrease the MAP to 62.8±4.5 and Cisatracurium was found to reduce the MAP to 82.5±2.3 mmHg in comparison to control levels. The authors concluded that "The doses of Cisatracurium used in this study did not because a reduction in blood pressure significant enough to justify the use of the preventive measures used in the atracurium groups."

Jirasiritham S et al. [10] divided the patients into two groups one of which received atracurium and one of which received Cisatracurium. The baseline demographic data was comparable between the two groups. The authors found that the dose required for intubation and maintenance in the Cisatracurium group was lesser compared to the other group. The authors concluded that Cisatracurium was safe and provided hemodynamic stability in patient undergoing kidney transplant and recommended its use even though it is costly.

Jabalameli M et al. [11] found that IOP decreased in both the groups after injection of muscle relaxant and at two minutes increased. Then it decreased at five minutes and ten minutes after intubation. The authors observed that SBP and IOP were more in the atracurium group compared to the Cisatracurium group and the difference was statistically significant two, five and ten minutes post intubation. Thus the author concluded that Cisatracurium prevents the rise of IOP post intubation in patients undergoing general anesthesia.

El-Kasaby AM et al. [12] observed that heart rate and mean arterial blood pressure was significantly more after intubation in atracurium group with dose of 2xED (95) in group 1 and same dose of Cisatracurium was given in group 2 but after 5-20 minutes the difference was statistically not significant when compared with doses of 4xED (95) in group 3 and 6xED (95) in group 4. Onset time was significantly lesser in atracurium group with dose of 2xED (95) compared with same dose of Cisatracurium. Thus the author concluded that in same doses the atracurium was better neuromuscular blocking agent than Cisatracurium. Cisatracurium in higher doses was found to be more effective

neuromuscular blocking agent, provided hemodynamic stability and there were no signs of release of histamine clinically.

Conclusion

Thus we conclude that Cisatracurium was found to be more effective than Atracurium in terms of stabilized heart rate and mean arterial pressure. It can be used in all patients undergoing any type of surgery under general anesthesia.

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Original Research Article

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Selective Left Endobronchial Intubation in Paediatric Cases: Lesson Learnt Using Single Lumen Tube

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Abstract

Background: Selective left endobronchial intubation in right thoracoscopy is technically demanding. We are presenting our mid term experience of selective left bronchus intubation using the previously published maneuver with single lumen endotracheal tube. *Methods:* 135 consecutive children below 12 years underwent right thoracoscopy from June 2014-Jan 2017. Endotracheal tube was kept in the freezer for 60 seconds to provide slight stiffness. Selective left bronchial intubation was done using neck extension, head tilt towards the right and left chest elevation maneuver. The tip of tube was rotated by 90° after 9cm to guide it towards left main bronchus. Maximum of three attempts were tried and ET tube kept in the trachea if selective intubation was not possible. *Results:* Selective left bronchus intubation could be done in 131 (97.03%). Follow-up ranged from 3 to 12 months. All cases were asymptomatic at last follow up. Selective intubation could be done on first attempt in 126 (93.33%), second attempt in 3 (2.22%), third attempt in 2 (1.48%). In 4 (2.96%) cases left endobronchial intubation could not be achieved. Mean operating time was 1.30 hours (Range: 1.00-2.30 hours). There were 115 empyeama (tubercular-13), 18 hydratid cysts and 2 esophageal duplication cyst. The intercostal drain was kept for a mean period of 3 days (Range: 2-4 days). All the cases were kept nil orally for 6 hours and discharged at a mean duration of 5 days (Range 4-6 days). *Conclusions:* Thoracoscopic procedures for right sided pathology could safely and easily be performed using this novel technique.

Keywords: Selective Left Endobronchial Intubation; Thoracoscopy; Empyema.

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Introduction

Video-assisted thoracic surgery [1,2] is finding an ever-increasing role in the diagnosis and treatment of a wide range of thoracic disorders that previously required sternotomy or open thoracotomy. VATS require lung decompression in the form of selective endobronchial intubaion of the opposite side so that the operating space could be offered. Unlike abdominal surgeries thoracic surgeries are slightly demanding due to the requirement of technical expertise of selective endobronchial intubation and less available working space due to restricted chest wall pliability. The selective endobronchial intubation in a limited facility setup is a challenge and thus requires certain modification. We previously described selective left endobronchial intubation [3] using single lumen endotracheal tube. Here we are presenting our midterm results and lessons learnt.

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Methodology

This study included 135 patients, below12 years of age, which required right VATS. All patients had primary right lung pathology with otherwise normal hematological reports.

All patients underwent pre- anaesthetic check up. Informed consent obtained. All patients were pre-medicated with Inj. Glycopyrolate 0.04 $mg.kg^{-1}$, Inj.Ondensetrone 0.1 $mg.kg^{-1}$ and Inj. Fentanyl 1 $mcg.kg^{-1}$. Intravenous induction was done with Inj. Vecuronium 0.1 $mg.kg^{-1}$ and Inj. Thiopentone sodium 5$mg.kg^{-1}$. after adequate relaxation intubation was done with the help of macintosh blade of proper size according to age of the patient with one size smaller ET tube.

A head ring was placed under the occiput, laryngoscopy was done and endotracheal tube was passed through the vocal cords, as the black marking on the ET tube passed the cords, patient was lifted-up 35-45 degree on the left side with the help of assistance by placing both hands under the left chest and then head was rotated 90 degree towards the right side while keeping laryngoscope and ET tube in- place. Now ET tube was rotated 90 degree towards the left side and was pushed further inside.

Left endobronchial intubation was confirmed by absent air entry on the right side and presence of air entry on the left side of the chest by auscultation. Endotracheal tube was fixed and then left lateral position was given for surgical procedure.

HR, ECG, NIBP, $EtCO_2$ and SpO_2 monitored throughout the procedure. Anaesthesia was further maintained with O_2+ N_2O (60:40), Isofluorane with controlled mechanical ventilation. IV DNS given according to holliday and segar's [4] 4-2-1 formula. At the end of surgery endotracheal tube was withdrawl and both lungs were inflated. Patient reversed with Inj.Neostigmine 0.5$mg.kg^{-1}$ and Inj. Glycopyrolate 0.04$mg.kg^{-1}$, it was decided to extubate while the child fully awake.

Results

A total of 135 consecutive cases requiring right thoracoscopy for various indications formed the study group. Selective left bronchus intubation could be done in 131 (97.03%). Follow-up ranged from 3 to 12 months. All cases were asymptomatic at last follow-up. Selective intubation could be done on first attempt in 126 (93.33%), second attempt in 3 (2.22%), third attempt in 2 (1.48%). In 4 (2.96%) cases left endobronchial intubation could not be achieved thus the procedure was performed with endotracheal tube kept in the trachea and CO_2 insufflation to create the space. Mean operating time was 1.30 hours (Range 1.00- 2.30 hours). There were 115 empyema cases out of which 13 turned out to be tubercular on subsequent biopsies. There were 18 hydatid cysts and 2 oesophageal duplication cyst also which were managed thoracoscopically with this approach. The intercostal drain was kept for a mean period of 3 days (Range: 2-4 days). All the cases were kept nil orally for 6 hours and discharged at a mean duration of 5 days (Range: 4-6 days).

Discussion

Achieving one lung ventilation (OLV) in the pediatric population is very challenging to the anesthesiologists. Various maneuvers and techniques thus have been described in literature. Double lumen endotracheal tubes are currently the most acceptable method for one lung ventilation. Unfortunately the smallest size [5] of double lumen endobronchial tube currently available is no. 26 (left sided) which could be used in children above 8 years of age. In infants and young children, the available sizes of the double lumen tubes or the Univent tubes do not match the anatomy of this age group.

The first suggested technique is to position the child with his left side up, and his head turned to the right [6], so that the mediastinum and gravity may push the left bronchus down to align with the trachea.

A second technique is to rotate the bevel of the tube 180^o and the head turn to the right so that the bevel of the tube will shift to the right, while its tip will be on the left of the midline which favors left bronchial intubation [7].

In all these techniques, the head and neck of the child are turned to the right which optimizes the alignment of the trachea with left main bronchus. The endotracheal tube is blindly advanced into the bronchus until the breath sounds on the operative side disappear.

So, here we kept endotracheal tube in freezer for 60 seconds (duration was arbitrarily decided based on our previous experiences) to make it slightly stiff. This provided the advantage that the tube was pliable enough to be maneuvered to the concerned side and also the use of metal stylet or bougie could be avoided. Tube was held in anteriorly concave position without considering the direction of bevel (right or left), followed by the maneuver [3] i.e. patient was lifted-up 35-45 degree from left side with the help of

assistance by placing both hands under the left chest and then head rotated 90 degree towards the right side while keeping laryngoscope and ET tube in- place then ET tube was rotated 90 degree towards the left side and was pushed further inside. We have learnt from our experience till now that it is the combination of all the three inputs viz, tube pliability, position of the patient and the rotation of the tube that make selective intubation possible. In conditions where any of the components are missing, the probability of the selective intubation becomes difficult.

In our study we used pressure control mode for mechanical ventilation with 8 to 12 $ml.kg^{-1}$ tidal volume, hypercapnea, low inspiratory flow with FiO_2 60%. We found that using one size smaller endotracheal tube for endobronchial intubation make selective intubation more probable. We also modified the operating position from true lateral to semilateral in an attempt to prevent flooding of the normal lung with secretions. With this experience we feel that this maneuver and modified position can be used to do thoracoscopy in most of the pediatric conditions.

Conclusion

So, here we concluded that thoracoscopic procedures for right sided pathology could be safely and easily performed by using this technique with the help of single lumen endotracheal tube.

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Clonidine, Fentanyl or their Combination for Postoperative Epidural Analgesia in Lower Limb Surgeries: Comparative Study

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Abstract

Background: Prolonged post-operative analgesia helps in early ambulation and prevents chronic post-surgical pain. Hence, effectiveness of using a combination of two adjuvants with ropivacainefor epidural analgesia is required to be known. *Objectives:* To compare the effectiveness, duration of post-operative analgesia and side effects of fentanyl and clonidine used alone with ropivacaine or in combination. *Materials and Methods:* 105 American Society of Anaesthesiologists physical statusclass1 and 2 patients with 18 to 70 years of age posted for elective lower limb surgeries under combined spinal epidural technique were randomly assigned into 3 equal groups. Surgery was done under spinal anaesthesia and postoperatively, Group RC received 8ml 0.2% Ropivacaine + Clonidine 60mcg, Group RF received 8ml 0.2% Ropivacaine + Fentanyl 75mcg and Group RFC received 8ml 0.2% Ropivacaine + Clonidine 30mcg + Fentanyl 37.5mcg epidurally. The Visual Analogue Scores, onset of analgesia, peak effect of analgesia, duration of analgesia, haemodynamic parameters and side effects in each group were recorded and statistically analysed with $p<0.05$ considered as significant. *Results:* Group RFC had faster onset of analgesia, earlier peak analgesic effect and longer duration of analgesia compared to group RC and RF. VAS scores were comparable between group RC and RFC. No statistically significant difference between the groups was noted with respect to haemodynamic parameters. Only one patient had nausea and vomiting in group RFC. *Conclusion:* Both clonidine and fentanyl can be used as adjuvants in lower doses without compromising the analgesic efficacy and also lower the incidence of side effects.

Keywords: Postoperativeanalgesia; Epidural; Ropivacaine; Fentanyl; Clonidine.

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Introduction

Post-operative pain may have a great impact on post-surgical outcomes.Adequate analgesia is important to ease patient suffering, improve well-being and to prevent cardiovascular and respiratory complications. Improved pain control can shorten the length of hospital stay, early ambulation and reduce postoperative complications and improve patient satisfaction. Multimodal or balanced analgesia is an ideal approach to prevent postoperative pain. Epidural analgesia is a critical component of multimodal perioperative pain management and improves patient outcome [1,2,3].

Ropivacaine is replacing bupivacaine for epidural analgesia because of its similar analgesic properties, lesser motor blockade and less cardiotoxicity. Decreased motor blockade without pain will help in early ambulation of the patients and prevent complications like deep venous thrombosis,

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pulmonary thromboembolism and pneumonia [4]. Addition of an adjuvant further enhances the analgesic efficacy. Opioids are the gold standard as adjuvants along with local anaesthetics in the central neuraxial blocks. They provide adequate pain relief when given in low doses but can also cause nausea and vomiting, pruritus and respiratory depression when given in high doses. Shorter acting lipophilic opioid like fentanyl is popular as an adjuvant to local anaesthetics. Clonidine inhibits the descending pathway of pain and also acts on spinal α -2 receptors to produce analgesia. It is one of the most popular adjuvant used for paediatric caudal epidural analgesia [5,6].

Since clonidine and fentanyl act through different mechanisms to produce analgesia, the rationale to combine these drugs is that the component drugs may produce analgesia by additive or synergistic mechanisms. And the combination of the adjuvants may allow the usage of reduced doses of each drug with correspondingly fewer dose-related side effects [7].

After searching the literature, we found that very few studies [8,9] have used a combination of clonidine-fentanyl along with ropivacaine for epidural post-operative analgesia. Thus, we conducted a study to evaluate the analgesic efficacy and duration of analgesia along with side effects profile when ropivacaine is added with clonidine or fentanyl or in combination in low doses administered as intermittent boluses via epidural route.

Materials and Methods

One hundred five (105) patients posted for elective lower limb surgeries were selected for the study after taking an informed written consent. Approval from the ethical committee was obtained. The study was conducted from November 2015 to July 2017. The study population was divided by simple random sampling using shuffled sealed opaque envelope method into 3 equal groups (n=35).

Inclusion criteria were patients between 18 to 70 years of age with American Society of Anaesthesiologists Physical Status (ASAPS) class 1 & 2.

Exclusion criteria were any contraindications to neuraxial anaesthesia, sensitivity or allergy to any of the study drugs, pregnant patients, BMI more than 30kg/m^2 and patients shorter than 150 cm and taller than 180 cm.

A routine pre-anaesthetic evaluation was conducted on the evening before surgery and relevant investigations done. The patients were pre-medicated with tablet alprazolam 0.5 mg and tablet ranitidine 150 mg orally at bed time on the previous night before surgery. They were kept nil orally for 6 hours prior to surgery for solid food and 2 hours for clear liquids.On the day of surgery, patient's basal vital parameters were recorded. Monitoring was done using multiparameter monitor having pulse oximetry, Electrocardiogram (ECG), Non-invasive Blood pressure (NIBP). Intravenous line was obtained with an 18-gauge cannula.

With the patients in sitting position under aseptic precautions, epidural space was identified by loss of resistance technique using 18G Tuohy needle via the midline approach at L2-3 inter spinous space. An epidural catheter was threaded for 3 cm inside the epidural space. A test dose of 3ml of 2% lidocaine with 1:200000 adrenaline was injected through the catheter after negative aspiration of blood and cerebrospinal fluid. After waiting for 5 min to rule out intravascular or intrathecal placement of the catheter, lumbar puncture was performed at the level of L3-4 through a midline approach using 25G Quincke spinal needle and 3ml of hyperbaric bupivacaine was injected after confirming free flow of clear cerebrospinal fluid. Epidural catheter wasfixed, patients were turned to supine position and surgery was allowed to be started. If the surgery outlasted the spinal anaesthesia and patient required epidural top-ups, such patients were excluded from the study.

After the surgery, patients were shifted to post-operative recovery room. Analgesia effect was measured using Visual analogue scale (VAS). First epidural top-up of the study drug was given once the VAS score was 5 and above.

Group RC – received 8ml of 0.2% Ropivacaine + Clonidine 60mcg

Group RF – received 8ml of 0.2% Ropivacaine + Fentanyl 75mcg

Group RFC – received 8ml of 0.2% Ropivacaine + Fentanyl 37.5mcg + Clonidine 30mcg

The study drug was prepared by an anaesthesiologist who was involved with randomisation, but was not involved further in the study. The anaesthesiologist who administered the test drug was also the observer of the parameters. Thus, the observer and the patients were blinded for the study drug. The total volume of the drug injected was made to 10ml in all three groups by adding 0.9% normal saline.

The VAS score, heart rate, systolic, diastolic and mean arterial blood pressure, respiratory rate, SpO_2

and ECG were monitored at 0, 5, 15, 30 and 60 min and then hourly from the time of giving the study drug tillpatient's VAS score was 5 or more and the rescue analgesic as top-up with 0.2% ropivacaine with 75 mcg of fentanyl was given.

The following parameters were studied based on the VAS scores

- Onset of analgesia- From the administration of the first epidural top-up to the time required for the VAS score to decrease by two from the initial VAS score
- Peak effect of the drug- From the administration of the first epidural top-up to the time required for the VAS score to decrease to 1 or 0.
- Duration of analgesia- From the administration of the first epidural top-up until the patient requires a rescue analgesic top-up.

Patients were also monitored for any side effects like nausea, vomiting, sedation, respiratory depression and pruritus.Ramsay sedation scoring was used to assess the sedation

Based on the previous study [10] and considering a prolongation of duration of analgesia of 60 minutes as significant with α =0.05 with power of 80% sample size was calculated to be 29 in each group. A sample size of 105 with 35 patients in each group were taken to compensate for the drop outs.

All the statistical calculations were done using SPSS version 21 for windows. Descriptive statistics were done by calculating mean, standard deviation, range and proportion appropriately. The inferential statistics were done using Chi-square test, Repeated measure ANOVA, One-way ANOVA with post hoc test and Kruskal-Wallis test.

Significant figures: $p>0.05$ is not significant, $p<0.05$ is significant, $p<0.01$ is highly significant.

Results

The demographic profile of the patients comparing age, sex, weight, height and also type of surgeries show no statistically significant difference and were comparable in all the three groups in our study. All base line vital parameters were similar in all three groups (Table 1).

The mean onset of analgesia and peak analgesic effect were achieved faster in group RFC (Table 2). Mean onset of analgesia in group RC was 7.92±1.21 min, in group RF is 6.51±1.53 min and in group RFC is 5.9±1.24 min. There was statistical significant difference between group RC and RFC (P=0.03) but there was no significant difference between group RF and RFC (P=0.1) and group RC and RF (P=0.09). The peak effect in group RC was seen at 18.23±2.21 min, in group RF at 16.11±1.96 min and in group RFC at 15.34±2.36 min. There was statistically significant difference between Group RC and RFC (p=0.02) and between group RC and RF (p=0.03).The difference was insignificant between group RF and RFC (p=0.07)

Table 1: Comparison of baseline haemodynamic parameters and duration of surgery between the three groups

	Group						P
	Ropivacaine with clonidine		Ropivacaine with fentanyl		Ropivacaine with clonidine and fentanyl		
	Mean	SD	Mean	SD	Mean	SD	
VAS_baseline	5.89	.87	6.20	.80	6.06	.80	0.3
HR_baseline	85.11	13.45	82.03	10.50	89.91	12.17	0.05
SBP_baseline	128.49	14.13	130.26	12.93	130.74	9.25	0.7
DBP_baseline	75.60	9.40	72.51	11.33	76.40	8.71	0.2
MAP_baseline	92.77	9.96	91.80	10.22	94.40	8.28	0.5
RR_baseline	13.20	1.08	13.11	1.05	13.71	1.20	0.06
Duration of surgery	183.65	10.12	187.24	9.87	190.05	6.31	0.07

Table 2: Comparison of mean onset of analgesia, mean peak analgesic effect and mean duration surgery (minutes) between the three groups

	Ropivacaine with Clonidine (RC)	Ropivacaine with Fentanyl (RF)	Ropivacaine with Clonidine and Fentanyl (RFC)	P value
Mean onset of analgesia	7.92±1.21	6.51±1.53	5.9±1.24	0.01
Mean peak analgesic effect	18.23±2.21	16.11±1.96	15.34±2.36	0.02
Mean duration of analgesia	188.40±27.60	187.29±15.90	199.77±13.21	0.017

Group RFC had longer duration of analgesia compared to the other two groups (Table 2). The mean duration of analgesia in Group RC was 188.40±27.60 min, in Group RF was 187.29±15.90 min and in Group RFC was 199.77±13.21 min. There was statistically significant difference between group RC and RFC (p=0.017) and between group RF and RFC (p=0.03). There was no significant difference between group RF and RC (p=0.12)

We observed a decreasing trend in the VAS scores over time in all three groups. There was statistically significant difference in the VAS scores between RC and RF groups (p=0.001) and RF and RFC groups (p=0.011). The analgesia with RC and RFC were almost comparable (p=0.9). The results of our study indicate that patients in RC and RFC group had better analgesia. All the patients in the three groups had VAS score less than 1 upto 120 minutes. Although statistically significant difference was there among the groups, clinically it was not significant.

There was no statistical significant difference in the incidence of side effects between the three groups (p=0.055) (Table 3). 14.3% of the patients in RC group and 5.4% in RF group had sedation (score ≥4). Nausea and vomiting was seen in 2.7% of the patients in RF group. Only one patient (2.85%) in RFC group had significant sedation.

The haemodynamic parameters like heart rate, systolic, diastolic and mean arterial blood pressure and respiratory rate were comparable in all three groups and were not statistically significant (Figure 1,2,3,4). There was no significant bradycardia, hypotension or respiratory depression observed in any group.

Table 3: Comparison of side effects between the three groups

	Ropivacaine with Clonidine (RC)		Ropivacaine with Fentanyl (RF)		Ropivacaine with Clonidine and Fentanyl (RFC)	
	Number of patients	Percentage	Number of patients	Percentage	Number of patients	Percentage
Nil	30	85.7	32	91.9	34	97.15
Sedation (score≥4)	5	14.3	2	5.4	1	2.85
Nausea and Vomiting	0	0	1	2.7	0	0

P=0.055

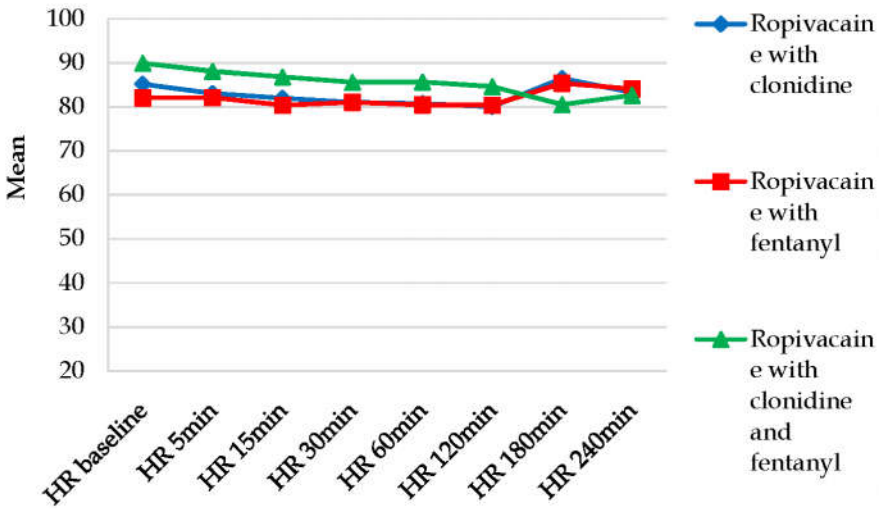

Fig. 1: Mean Heart rate (per min) at various time intervals

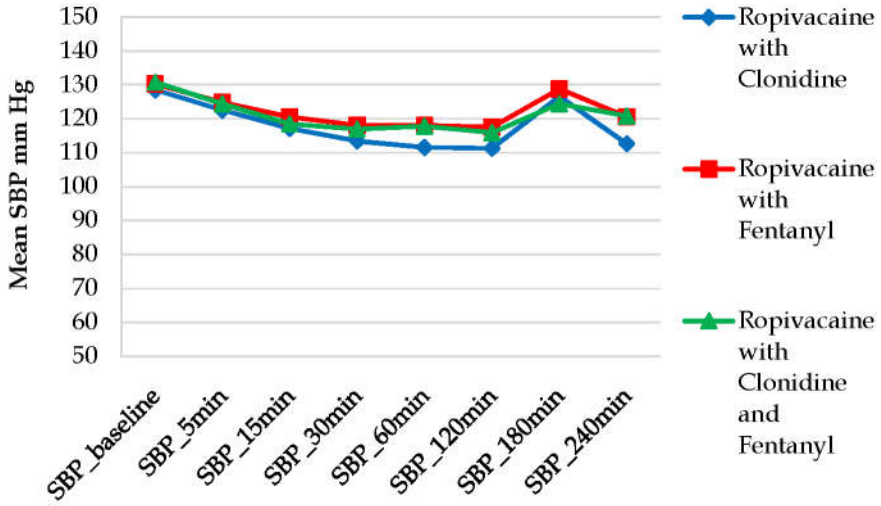

Fig. 2: Mean Systolic Blood Pressure (SBP) at various time intervals (mm Hg)

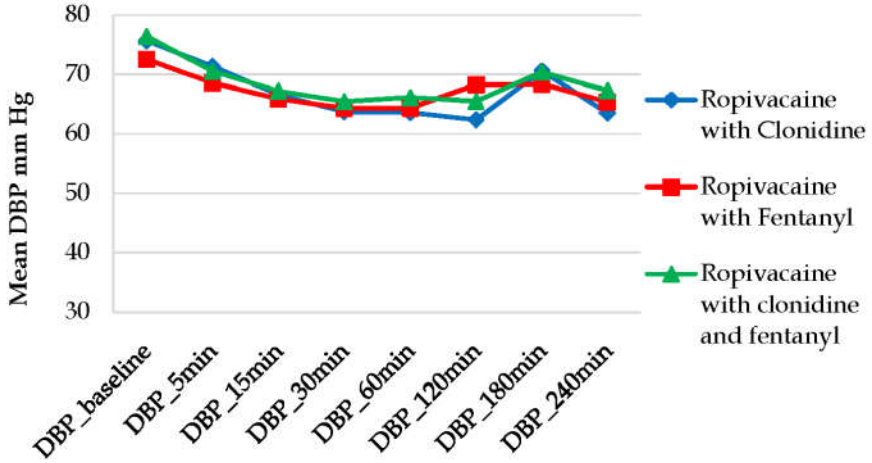

Fig. 3: Mean Diastolic Blood Pressure (DBP) at various intervals (mm Hg)

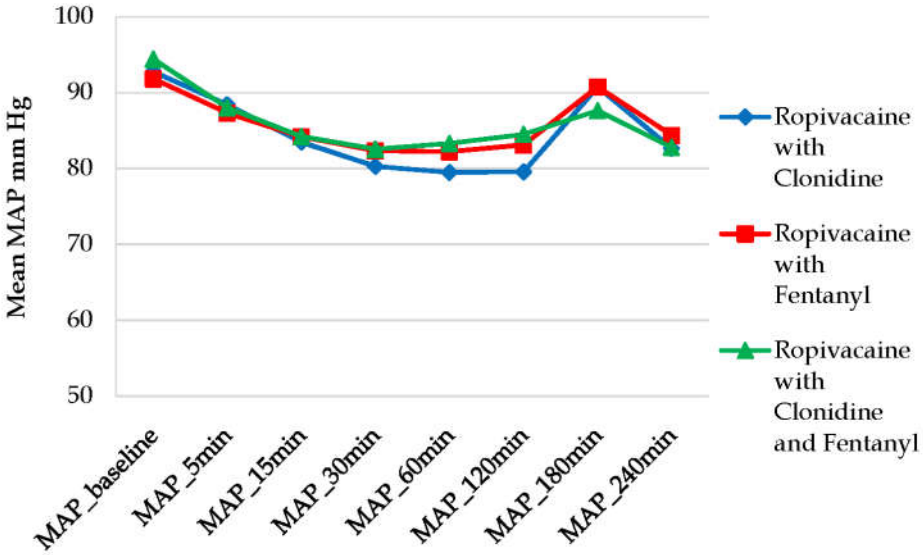

Fig. 4: Mean Mean Arterial Pressure (MAP) (mm Hg) at various intervals

Discussion

Epidural analgesia is a very effective route for post-operative pain relief. The most commonly used epidural local anaesthetic for post-operative analgesia is ropivacaine because of its less motor blockade and decreased cardiotoxicity. The duration of action of ropivacaine when used alone will be short and hence requires adjuvants to prolong the analgesia. Opioids like fentanyl and α2 agonists like clonidine are the most commonly used adjuvants along with ropivacaine.The combination of local anaesthetic and adjuvants effectively inhibit multiple areas of neuronal excitability to provide a dose sparing effects of local anaesthetics. The synergistic interaction between local anaesthetics and adjuvants during epidural administration is reported in many previous studies [10,11].

Many studies have found that 0.2% ropivacaine is better for providing effective post-operative analgesia without producing motor blockade [12,13]. Many studies have found the ideal concentration of ropivacaine for post-operative analgesia is 8 ml of 0.2% for intermittent boluses. Hence we have taken 8ml of 0.2% ropivacaine which was recommended for lumbar epidural analgesia [14]. 8ml of 0.2% ropivacaine with adjuvants like clonidine and fentanyl for postoperative analgesia was found it to be effective [8,15,16].

The mean onset of analgesia was achieved faster in group RFC compared to the other two groups. Similar results were found in Agarwal et al study [20]. However, in a study done by Ahirwar A et al. [19] comparing 0.125% ropivacaine with addition of fentanyl or clonidine there was no significant difference in the onset of analgesia between the three groups.

The peak analgesic effect was achieved faster in group RFC in our study compared to the other two groups but there is no statistically significant difference between RF and RFC group. This shows that even after reducing the dose of fentanyl combining clonidine will improve the time for peak effect of analgesia.

The mean duration of analgesia was prolonged in group RFCcompared to group RC and RF.Addition of Fentanyl and clonidine to ropivacaine 0.75% for epidural anaesthesia showed longer duration of action than with addition of fentanyl alone [9]. There is no statistically significant difference between RF and RC group but there is statistically significant difference between RFC and RC/RFC and RF group. VAS score was better with RFC compared to RF and RC groups which was significant statistically (p value 0.01). Although statistically significant difference was there among the groups, clinically it was not significant.

Clonidine produces dose dependent spinal cord anti-nociception mainly through stimulation of α2 adrenoceptors in the dorsal horn, mimicking the activation of descending inhibitory pathways [17]. Fentanyl when given through central neuraxis acts on spinal opioid receptors and also being highly lipophilic gets into circulation faster and acts on supraspinal opioid receptors. So both these drugs when used as adjuvants to local anaesthetics produce a better and longer duration of analgesia. This has been confirmed by various studies. When these drugs have to be used alone with local anaesthetics, the dose required is higher. This was found out by our study when we used 75 mcg fentanyl and 60 mcg clonidine. When these drugs used in dose mentioned in our study the side effects would also increase. This was again found in our study where in there was increase in sedation in patients with clonidine group and increased incidence of nausea and vomiting in patients with fentanyl group.

Hence anhypothesis was made that the combination of these two adjuvants would produce minimal side effects without comprising either the quality or duration of analgesia. The same thing was observed by various authors when they combined clonidine and fentanyl along with ropivacaine either administered as single doses or as infusions. Study done by Foster et al who compared combination of clonidine 2 mcg/ml and fentanyl 5 mcg/ml with 0.2% ropivacaine used as infusion with a rate 3 to 7 ml/hr in patients with Total Knee Arthroplasty for post-operative analgesia. In this study authors found out that clonidine produces prolonged duration of analgesia and reduces the need for rescue pain medication and decreases the incidence of post-operative nausea and vomiting.

In another study done by Bajwa et al. who used either fentanyl or clonidine alone in the dose of 75 mcg or a combination of these two drugs in dose of 37.5 mcg each along with 0.75% ropivacaine as epidural anaesthesia for lower abdominal surgeries. The authors found out that the combination of fentanyl and clonidine in half the doses have the same quality and duration of analgesia in comparison with fentanyl group and significant decrease in the

incidence of post-operative nausea and vomiting (40% in fentanyl group vs 10% in RCF group).

In another study conducted by Bahaddur Singh et al. who used 0.75% ropivacaine along with 50 mcg fentanyl alone or a combination of 50 mcg fentanyl and 50 mcg clonidine. In this study the dose of fentanyl in combination group was not reduced. The authors found out that there is a significant prolongation of analgesia without reduction in incidence of nausea and vomiting in the combination group. This shows that the fentanyl dose if not reduced would produce the same incidence of nausea and vomiting in spite of adding clonidine. 14.3% of the patients in RC group and 5.4% in RF group had sedation (score ≥ 4). Nausea and vomiting was seen in 2.7% of the patients in RF group. One patient in RFC group had significant sedation. Ropivacaine plus fentanyl caused higher incidence of sedation thanropivacaine plus clonidine and ropivacaine + fentanyl + clonidine [8]. 40% of the patients had nausea/vomiting and 30% of the patients had sedation in the ropivacaine fentanyl group. They have used epidural fentanyl intraoperatively and for postoperative analgesia which might be the reason for higher incidence of side effects. However, there was no significant difference in side effects between ropivacaine-fentanyl and ropivacaine-fentanyl-clonidine groups in one of thesimilar studies [17].

Thus, the addition of low doses of both fentanyl and clonidine to ropivacaine has resulted in reduction of side effects without affecting the quality of analgesia.

The sample size may not be adequate to observe a statistically significant difference between the groups with regard to side effects. The duration of action and side effects were lesser compared to other studies, as we have studied the effects of only one top-up. The study might have given significant results because of the additive effects of multiple top-ups if the study period had been longer.

Conclusion

Thus, it can be concluded that addition of small dose clonidine and fentanyl to 0.2% ropivacaine produced a faster onset of action, earlier peak analgesic effect, prolonged duration of analgesia, stable haemodynamic parameters and also lower incidence of side effects when given epidurally for post-operative pain relief in lower limb surgeries.

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Knee Joint Osteo Arthritis: Role of Radiofrequency in Managing Pain

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Abstract

Background: Pain due to knee joint osteo arthritis is one of most common health problems in old age and many treatment options have been used to control pain but none of them is completely effective and also have their side effects. The knee joint is supplied by genicular nerves which convey the sensory input to higher centers. The aim of present study was to evaluate the effectiveness of radio frequency ablation of genicular nerves in controlling pain due to knee joint osteo arthritis and to compare the pain relief and effect on analgesic intake with control group at 1st, 4th, 8th and 12th week of post procedure period. *Materials and Methods:* Fifty, American Society of Anaesthesiologist, grade 1 and 2 adult patients in age group of 40 to 70 years and suffering from knee joint osteoarthritis and on regular analgesic drug intake were randomly divided into two groups. 22G Radiofrequency cannula with 100 mm length and 10mm active tip and radio frequency machine G4 Cosman was used for sensory and motor stimulation for locating and ablation of genicular nerves. In Group I (Control group), the radiofrequency needles were placed extra articularly around knee joint under C-Arm guidance and genicular nerves were located with sensory and motor stimulation and one ml of 1%xylocaine was given at each needle site. No thermal or pulsed RF was given. In Group II (Study group), the RF needles were placed extra articularly at specified genicular nerves and after sensory and motor stimulation one ml of 1% xylocaine was given at each needle site. Radio frequency was given with target temperature of 70°c for three cycles, each of 1.5 minutes duration. Post procedure observations were made by an independent anesthetist not associated with procedure team. The post procedure VAS scores and analgesic intake were noted at 1st, 4th, 8th and 12th week in both groups. Statistical Analysis Used – SPSS version 14.0 (SPSS Inc., Chicago, IL), Chi square test, student's t test. p-Value < 0.05 was taken as statistically significant. *Results:* The VAS score in Gp I, in immediate post procedure period was 0.80±0.500 as compared to base line score of 6.80±0.645 9 ($p< 0.001$). The VAS at 1st, 4th, 8th and 12th week follow up was 6.56±0.651, 6.88±0.666, 6.92±0.640 and 6.92± 0.572 and change was statistically insignificant ($p >0.05$). In immediate post procedure period the VAS score in Gp II, was 0.92±0.572 as compared to pre procedure VAS of 7.0±0.707 ($p <0.001$). The VAS at 1st, 4th, 8th and 12th week follow up was 1.84±0.987, 1.96±0.978, 2.36±1.075 and 2.60±1.041 respectively and the change in VAS was highly significant ($p <0.01$). The mean consumption of capsule Raceclo per week in pre procedure period in Gp I & II was 6.44±0.917 and 6.44±0.961 showing no significant intergroup difference statistically ($p >0.05$).In Gp I, the mean weekly consumption of capsule Raceclo at 1st, 4th, 8th and 12th week follow up was 5.52±0.823, 6.161 ±0.746, 6.28±0.737 and 6.68±0.690 respectively and the change was statistically insignificant($p >0.05$). The mean post procedure weekly consumption of capsule Raceclo in Gp II, at 1st, 4th, 8th and 12th week was 0.60±1.190, 0.56±1.356, 0.96±1.567 and 1.52±1.447 respectively and the decrease in analgesic consumption was statistically highly significant on intra group and inter group comparison. All the Gp II patients except one were relieved of pain. Two patients in Gp II reported pain relief in other knee also. No complications such as infection hemorrhage; thermal injury and sensory or motor weakness/loss were reported.

Keywords: Genicular Nerves; Knee; Osteo Arthritis; Radio Frequency.

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Introduction

Osteoarthritis (OA) of knee joint is one of the most common causes of pain and disability in elderly population and more than 100 million of population worldwide is believed to be suffering from it [1].

More than 50% of adults above age of 65 years show radiological changes of OA in knee joint. The patients with OA knee joint presents with morning stiffness and aggravation of pain with weight bearing and relieved by rest. On physical examination there is tenderness, usually on medial side of knee with limitation of movements in advanced stages.

As per statement quoted "India is expected to be chronic disease capital with 60 million people suffering with arthritis by 2025". As there is overall increase in life expectancy, the alarming increase in prevalence of knee OA is also expected [2]. The associated risk factors like obesity, progressive sedentary life style, diet routine and work conditions also play important role in OA .The OA knee is chronic degenerative and often progressive joint disease.

Despite of development of newer diagnostic modalities, the X-ray of knee joint remains the most accessible tool in evaluating knee OA, available even in peripheral institutes. Radiographs are taken in various views to see joint space narrowing and osteophyte formation. Kellgren-Lawrence grading scheme and Osteoarthritis Research Society International classification score establish guidelines to evaluate OA progression [3,4].

As there is no known cure for OA, the primary aim of treatment is to reduce pain, maintain joint mobility and to restrict the functional impairment. Combination of diet control and regular exercise reduces the obesity and restores the joint mobility. Physical therapy, which aims to strengthen the supporting muscles groups and improve flexibility, is mainstay of treatment which may even delay the need for surgical intervention [5].

Total knee replacement currently remains the definite treatment for refractory OA knee joint. Radio frequency ablation of sensory nerves has recently emerged as alternative treatment for pain control in chronic pain conditions. The sensory innervations of knee joint is through genicular nerves [6,7,8].

The aim of present study was to compare the pain relief provided by radio frequency ablation of Genicular nerves of knee with control group at 1, 4, 8, and 12 weeks of post procedure period.

Material and Methods

After approval of institutional research ethics committee, the study was conducted in prospective randomized double blind manner in patients clinically diagnosed with OA knee joint in pain clinic of our institution. The patients willing to participate in this study were informed about the purpose of this study, procedure details, VAS scoring in PAC clinic and their informed consent in writing were obtained. The patients were also informed that they can opt out of the study any time without assigning any reason

The target sample of 50 patients was divided into two groups of 25 patients in each group using random allocation software. The random number was kept in envelope under custody of consultant in charge and the envelope was opened at the time of procedure in operation theatre and the patient was assigned to respective group. Post procedure observations and follow up were made by independent anesthetist not associated with block giving team.

The inclusion criteria included patients aged between 40-70 years, with pain localized to knee joint with no referral, without gross structural deformity of knee, ASA grade I and II, on drug treatment for knee pain for at least 6 months and radiological findings (X-ray) showing Kellgren–Lawrence grading between 1-3.

Exclusion criteria included age less than 40 years or more than 70 years, visible gross deformity of knee, ASA grade III or above, patient refusal to participate in study, radiological changes showing Kellgren–Lawrence grading 4, hemorrhagic diathesis, on anti platelet/anti coagulant therapy, local or systemic infection, acute knee pain or prior knee surgeries and any psychiatric illness.

All patients underwent pre-anesthetic checkup and investigations like hemoglobin, fasting blood sugar, serum urea and creatinine, bleeding time (BT), clotting time (CT), ECG and X-rays (chest and knee joint) checked. Premedication was given (Tab. Alprazolam 0.25 mg) at bed time. Overnight fasting was ensured in all patients. In operation theatre the monitors were attached to record heart rate (HR), non invasive blood pressure (NIBP), ECG and pulse oximetry (SpO_2). Intravenous line was secured with 20 G cannula and 0.9% normal saline started. Following the standard monitoring, the patients were asked to lie supine on radio lucent operation table

with affected knee supported on pillow. Free rotation of the C-ARM around knee joint to obtain antero-posterior (AP view) and lateral view was ensured. The C-ARM was used to guide the direction and depth for placement of radiofrequency needles. The procedure was carried out under intravenous sedation with inj. Fentanyl (1 µg/kg body weight) and local anesthesia (xylocaine 1%). In case of discomfort during needle placement or during RF procedure, Inj. Fentanyl was used (1µg/Kg body weight).

The affected knee was cleaned with iodine based antiseptic solution and was draped properly. The needle entry sites were marked under C-ARM guidance and skin over needle entry sites were anaesthetized with 1% xylocaine. 22G Radiofrequency cannula with 100 mm length and 10mm active tip (Cosman RFK, Cosman medical Inc, USA) were used for the procedure. The procedure was carried out using radio frequency machine G4 Cosman Version 2(Cosman medical, Burlington, Massachusetts, USA) for sensory and motor stimulation to locate genicular nerves and also for ablation of these nerves (Fig. 1).

Fig. 1: Radio frequency generator (COSMAN G 4, Version 2)

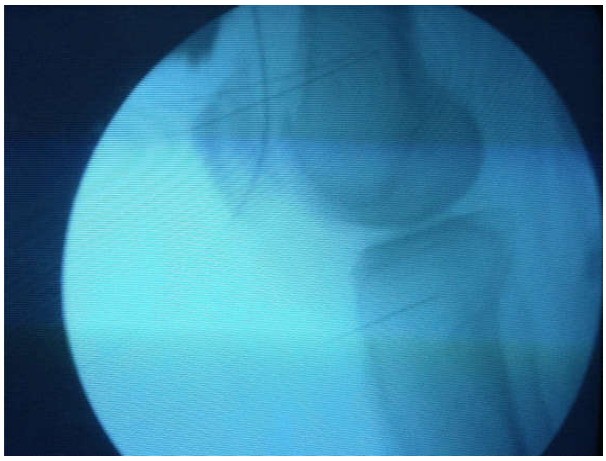

Fig. 2: Targeting the genicular nerves in lateral view of knee joint.

The nerves targeted include superior lateral genicular nerve, superior medial genicular nerve and inferior medial genicular nerve (Fig. 2).

The patients were divided into two groups of 25 each. In Group I (Control group, n-25), the radiofrequency needles were placed extra articularly around knee joint under C-Arm guidance and genicular nerves were located with sensory stimulation (50Hz and 0.2 V) and motor stimulation (2 Hz and 0.5V). After locating above mentioned genicular nerves, one ml of 1% xylocaine was given at each needle site. No thermal or pulsed RF was given. Needles were removed and sterile dressing applied.

In Group II (Study group, n-25), the RF needles were placed extra articularly at above mentioned genicular nerves after sensory (50Hz and 0.2V) and motor stimulation (2 Hz and 0.5V). After locating the above mentioned genicular nerves, one ml of 1% xylocaine was given at each needle site. Radio frequency was given with target temperature of 70°C for three cycles, each of 1.5 minutes duration. Needles were removed and sterile dressing applied.

Following the procedures, the patients in both groups were kept in recovery area for two hours for observation of any complication or side effects and were discharged later. Post procedure observations were made by an independent anesthetist not associated with procedure team. The patients were directed to attend the pain clinic OPD on specified dates at interval of 1, 4, 8 and 12 weeks or were contacted on phone.

In both groups, rescue analgesic was capsule Raceclo (containing Acelofenac 100 mg as sustain released pellets and rabeprazole 20 mg as enteric coated pellets) s to be used once a day after meals. If pain persists after taking Cap. Raceclo then additional analgesic drug as tablet tramadol 50 mg (tablet Contramal, Abbot) SOS up to maximum dose of 400 mg/day was advised.

All the data collected was analyzed statistically using student's t test.

Results

The total of 50 patients were divided into two groups of 25 patients each using random allocation software. The mean age (in years) in Gp I (control group) was 63.68±6.47 and in Gp II (study group) was 61.40±5.75 (p 0.194).Thus the mean age in both groups was comparable. Mean weight (in Kg) in group I was 60.00±6.33 and in Gp II was 62.20± 8.25 (p 0.296) and was comparable. Out of total patients

62%were female (31/50) and 38%were male (19/50). In Gp I, 15 patients were females and 10 patients were male while in Gp II 16 patients were female and nine patients were male and both groups were comparable. In Gp I mean heart rate was 83.56±5.76 and in Gp II was 83.32±5.95 (p 0.885) and was comparable. The base line MAP in Gp I and II was 98.76±8.08 and 97.92±9.15 respectively and was comparable with p value 0.732. Mean SpO_2 in Gp I and II was 94.44±2.16 and 94.72±2.26 and was comparable (p 0.657). No statistically significant change was noted during procedure in heart rate, MAP and SpO_2 in both groups (Table 1).

The VAS in Gp I at pre procedure time was 6.80±0.645 and in Gp II was 7.00±0.707 and difference was statistically insignificant (p 0.302). In Gp I, VAS in immediate post procedure period was decreased to 0.80±0.500 and the change in VAS was statistically significant (p < 0.001).In Gp II, VAS in immediate post procedure period was 0.92±0.572 and the change was statistically significant (p < 0.001). When both groups were compared for VAS in immediate post procedure period the change was statistically insignificant (p 0.302). (Table 2; Fig. 3)

In Gp I, VAS at one week follow up was 6.56±0.651 which was close to initial baseline of 6.80±0.645 and the difference was statistically insignificant (p 0.056) indicating that by first week the pain has returned to original intensity .In Gp II the VAS at one week follow up was 1.84±0.987 from baseline VAS of 7.00±0.707 and the difference was statistically highly significant (p < 0.001). (Table 2; Fig. 3)

Table 1: Baseline parameters comparing two groups

Age	Gp 1 Gp II	63.68±6.47 61.40±5.75	p 0.194
Sex (F/M)	Gp 1 Gp II	15 /10 16/09	p 0.05
Weight (kg)	Gp I Gp II	60±6.33 62.20±8.25	p 0.296
HR(bpm)	Gp I Gp II	83.56±5.76 83.32±5.95	p 0.885
MAP (mmHg)	Gp I Gp II	98.76±8.08 97.92±9.15	p 0.732
SpO_2	Gp I Gp II	94.44±2.16 94.72±2.26	p 0.657

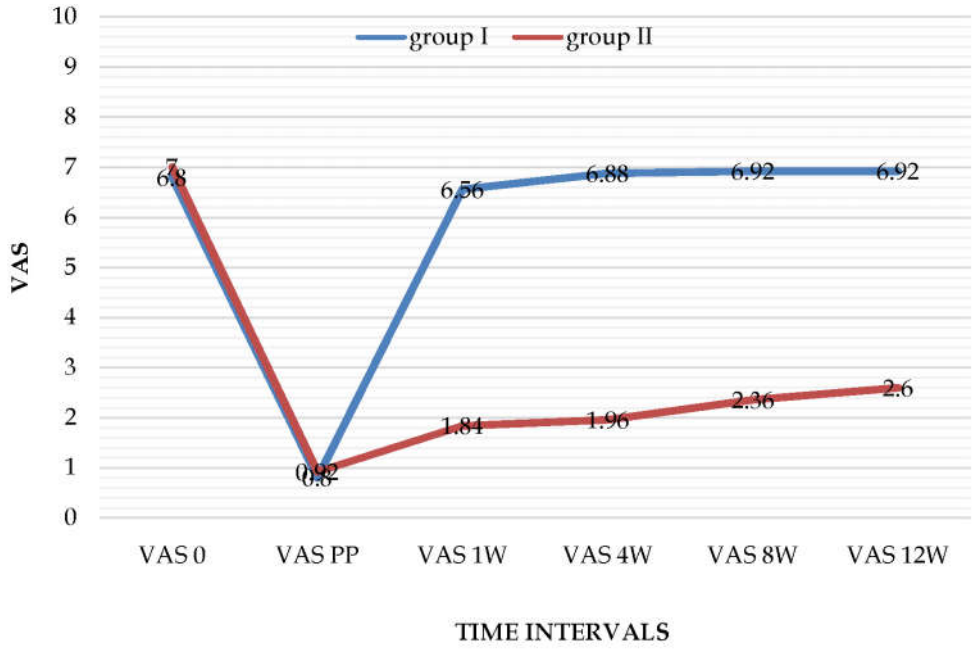

Fig. 3: Comparison of VAS scoring in pre and post procedure periods

Table 2: VAS Scoring in post procedure period

VAS	Mean ± SD		P value
	GP I	Gp II	
VAS 0 pre procedure	6.80±0.645	7.00±0.707	0.302
VAS post procedure	0.80±0.500	0.92±0.572	0.433
VAS at 1 wk	6.56±0.651	1.84±0.987	0.000
VAS at 4th wk	6.88±0.666	1.96±0.978	0.000
VAS at 8th wk	6.92±0640	2.36±1.075	0.000
VAS at 12th wk	6.92±0.572	2.60±1.041	0.000

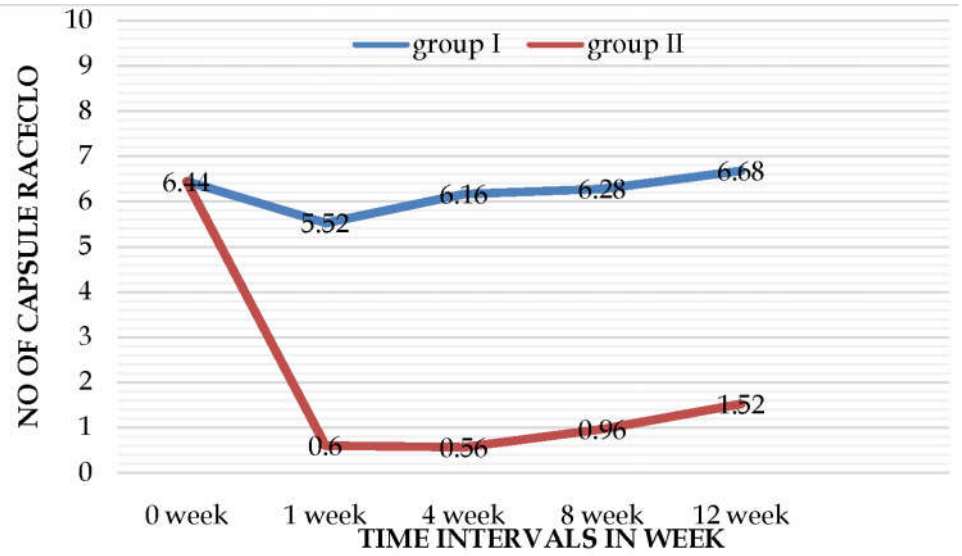

Fig. 4: Mean consumption of cap. Raceclo in two groups

VAS scores at 4th week follow up in Gp I was 6.88±0.666 which was almost same to pre procedure VAS scores and was statistically insignificant (p > 0.05) while in Gp II it was 1.96±0.978 from baseline VAS score of 7.00±0.707 and change was statistically highly significant (p< 0.001). (Table 2; Fig.3)

In Gp I, VAS scores at 8th week follow up was 6.92±0.640 and was close to base line VAS score and was statistically insignificant (p >0.05). In Gp II, VAS score at 8th week follow up was 2.36±1.075 from base line VAS score of 7.00±0.707 and the change was significant statistically (p< 0.001). VAS scores at 12th week follow up in Gp I was 6.92±0.572 and when compared to pre procedure VAS scores the change was insignificant statistically (p > 0.05). In Gp II, VAS scores were 2.60±1.041 at 12th week which was significantly lower than base line VAS scores (p< 0.001) (Table 2; Fig. 3).

When both groups (Gp I and II) were compared for VAS scores at one, four, eight and twelve weeks intervals , the VAS scores were significantly lower in Gp II at all intervals (p< 0.001) (Table 2; Fig. 3).

The mean consumption of cap. Raceclo per week in pre procedure period in Gp I was 6.44±0.917 and in Gp II was 6.44±0.961 and was comparable (p >0.05). In Gp I, mean consumption of cap. Raceclo at first week of follow up was 5.52±0.823 while in Gp II the mean consumption was 0.60±1.190. The mean consumption was lower in both the groups but the decrease was highly significant in Gp II (p< 0.001) (Fig. 4).

In Gp I, mean consumption of cap. Raceclo at 4th, 8th and 12th week was 6.16±0.746, 6.28±0.737 and 6.68±0.690 respectively which is close to base line consumption of 6.44±0.917 (p>0.05) while in Gp II it was 0.56±1.356, 0.96±1.567 and 1.52±1.447 respectively with the baseline initial consumption of 6.44±0.961 (p <0.001) (Fig. 4).

When both groups were considered for mean consumption of cap. Raceclo at 4th , 8th and 12th week, it was less in Gp II and the difference was statistically highly significant (p <0.001) (Fig. 4).

In this study all patients used cap. Raceclo as rescue analgesic and none of the patients in both groups required tab. Contramal as second line analgesic.

In Gp I, in immediate post procedure period, 13 out of 25 patients gave excellent review while 12 patients said it was good showing that they were satisfied with the procedure initially but by the first week of follow up, all the patients in the Gp I started experiencing pain in the knee joint and the whole 25 patients in group I were not satisfied from 1st to 12th weeks of follow up.

In Gp II, in the immediate post procedure period, 14 out of 25 patients gave excellent review and 11 patients said it was good, which is similar to the immediate post procedure reviews of Gp I patients . At 1st week follow up, out of 25 patients, 6 patients gave excellent review and 18 patients said it was good while one patient was not satisfied.

On further follow up at 4th week, 2patients gave excellent review, 22 said it was good and same one patient was not satisfied. At 8th week follow up, 1 patient gave excellent review, 23 said it was good and one patient was not satisfied. On the final follow up at 12th week, 24 patients in Gp II said that the effect of intervention done 12 weeks back was good, while one patient, who was not satisfied from 1st week of follow up consistently said that she was not satisfied.

Discussion

Knee osteoarthritis (OA) is one of the most common causes of disability in older adults, with an estimated prevalence of symptoms in 20-30% of individuals over 65 years of age. Pain associated with knee OA may have a many reasons including intra articular chemical mediators of pain, mechanical compression, vasospasm, irritation of richly innervated periosteum, synovium and joint capsule as well as peripheral genicular nerve sensitization and also central nervous system component. Knee OA, in general, is treated conservatively with weight loss (when indicated), physical therapy, oral analgesic medications, and intra articular corticosteroid or hyaluronic acid injections. If this approach fails to provide adequate pain relief and functional restoration, patients may be offered total knee arthroplasty (TKA), if they are surgical candidates.

While, TKA is generally a safe procedure, like any major open surgery, it is associated with a risk of serious complications; a large cohort study of 83,756 patients demonstrated the annual incidence of venous thrombo embolism (0.6%), myocardial infarction (0.5%), stroke (0.5%), and a 90 days mortality (0.7%) to all be significantly higher than the general population. More over some patients may not be candidate for TKA due to co morbidities or other reasons.

Radiofrequency ablation (RFA) of genicular nerves of knee joint presents a promising intervention for patients with chronic painful knee due to osteo arthritis having failed conservative management and are either not willing or not eligible for TKA. The exact mechanism by which the Radio frequency works over the affected area is still not well understood, but RF lesion is believed to stop nociceptive (A-γ and C-fibers) pain input from the periphery to the central nervous system without destroying the motor or sensory (A-β) fibers. More specifically, the postulated mechanism of action for clinical benefit of thermal RFA involves the heat generation resulting in thermo coagulation and localized neuronal tissue destruction. These lesions have been shown to demonstrate the characteristics of scar formation, including an acute inflammatory response, cell necrosis and fibrosis with collagen fiber deposition, occurring over 3 weeks following the procedure. It has been shown that the basal lamina of Schwann cells may be preserved after RFA (Radiofrequency Ablation), which would allow nerve regeneration. The ablative heat is provided via flow of electrical current, generating a well-delineated lesion. Additionally, RFA produce a local electrical field, which is thought to promote neuro modulation by inhibition of the excitatory C-fibers.

In this study, both the groups were comparable in demographic variables like age, weight and sex. There were more number of female patients in both the group with total number of 31 out of total 50 patients (i.e. 62%) and 19 out of 50 patients (i.e. 38%)were males. General physical examination and investigation of all the patients were within normal limits.

There was statistically significant reduction in VAS scores in both groups in immediate post procedure period and can be explained due to analgesia provided by inj fentanyl which was given at the start of procedure and also to administration of xylocaine at genicular nerve sites blocking the transmission of pain impulse from knee joint in both groups.

No significant reduction in VAS scores were noted in Gp I at 1st, 4th, 8th and 12th week follow up while in Gp II significant reduction in VAS scores were observed at same time intervals. The patients in group II were relieved of pain due to nerve ablation caused by radiofrequency treatment.

The results were comparable with studies by Mashahiko Ileuchi et al. [8] where the RF treated group had significantly decreased knee pain as measured by the VAS scores for 2–3 months compared with the control group. Similar results were observed by Choi et al., where the knee pain VAS scores were lower at all post-procedure assessment points compared with baseline ($p < 0.001$) in both the case and control group [9]. By contrast, in the control group the VAS pain scores were lower than baseline up to one week. When comparing knee pain improvement from baseline, the RF group showed superior improvement compared with the control group at both 4th week ($p < 0.001$) and 12th week ($p < 0.001$). Wen-Sheng Shen et al, concluded that RF have better efficacy in relieving refractory pain for longer duration and promoting functional recovery in patients with knee OA than regular treatment [10]. The resembling and comparable results were seen by Pakize Kirdemir et al., Ferdinand Iannaccone et al and Sonai datta showing significant pain relief in patients treated with radiofrequency ablation of genicular nerves [11,12,13].

We also compared the requirement of rescue analgesic in the form of Capsule Raceclo prescribed to be used once a day after meal when required. The mean consumption of rescue analgesic was significantly lower in Gp II up to 12th week of observation implying that there is significant decrease in the use of analgesic in the group II patients after the radiofrequency ablation of genicular nerves of the affected knee joint. In Gp II, only one patient complained of no relief in pain intensity during observation period. The procedure outcome depends upon patient's response to sensory stimulation. If patient complains of diffuse pain in knee at the time of sensory stimulation then stimulating needle is close to genicular nerve and better results are obtained. If patient complains of pain due to needle touching the bone periosteum then target genicular nerve is away from RF needle and poor results are obtained. In Gp II, two patients reported pain relief in other knee also and this may be due to pain relief in more affected knee leading to removal of abnormal stress placed on less affected knee and also due to decrease in central sensitization.

In the current study, no complications such as infection, hemorrhage, thermal injury, or sensory or motor loss in the procedure area or leg developed in any of the 50 patients. No participant reported a post-procedure adverse event during the follow up period, and there were no withdrawals from the study owing to an adverse event.

Summary

The RF thermal ablation procedure of genicular nerves of knee joints is an effective, safe, and minimally invasive treatment that can be offered to the patients having osteoarthritis-related chronic knee pain. In this study, we could appreciate the therapeutic efficacy of thermal radiofrequency genicular nerve ablation in providing pain relief till 12 weeks of follow ups and would recommend it as a treatment of choice for the conservative management of pain relief due to osteoarthritis of knee joint in all age group from 40 to 75 years old patients which have prolonged period of analgesic intake for the pain control and those who are either not fit to undergo surgical management or those who do not wish to undergo surgery. Superomedial, inferomedial, and superolateral genicular nerve branches

have been targeted because the genicular nerves are the main innervating articular branches for the knee joint, and as these nerves are adjacent to the periosteum connecting the bone, they can be located using bony landmarks under x-ray imaging.

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Original Research Article

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To Evaluate the Hemodynamic Effects of Induction doses of Propofol and Etomidate under Entropy Guidance: A Prospective, Observational Study

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Abstract

Context: Entropy monitoring enables us to administer the anaesthetic doses of induction agents with precision so as to avoid intraoperative awareness, light planes of anaesthesia on one hand and delayed recovery, haemodynamic instability on the other. *Aims:* To evaluate the haemodynamic effects of induction doses of propofol and etomidate under entropy guidance, in patients undergoing under general anaesthesia. *Study design*: A prospective, observational study. *Methodology*: This study was conducted on 100 patients of ASA I and II between the age group 18-60 years. The patients in group A, were induced with etomidate and group B, with propofol till entropy reached a value of 40. Haemodynamic parameters at and after induction were noted. *Results*: All statistical calculations were done using SPSS 21 version. The mean of mean arterial pressure at 1 minute after induction in group A and B was 85.9±10 and 75.5±8 respectively (p=0.00) and after laryngoscopy, in group A and B was 98.4±8.1 and 105.3±9.1 respectively (p=0.00). Significant rise in the heart rate was seen with propofol after laryngoscopy and intubation. (p=0.018) *Conclusion*: On induction doses under entropy guidance, the haemodynamic effects observed with propofol were more pronounced than that of etomidate. Propofol caused more hypotension than etomidate after induction, whereas, there was statistically significant rise in heart rate after laryngoscopy and intubation.

Keywords: Intravenous; Propofol; Etomidate; Induction; Haemodynamic Parameters; And Entropy.

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Introduction

With the advances in technology soaring high, the depth of anaesthesia can be assessed with newer monitors, which help in preventing awareness from inadequate doses of anaesthetics and side effectsfrom higher doses.

Spectral entropy, bispectral index and narcotrend enable us to determine the depth of anaesthesia [1,2] and are currently in vogue. Entropy monitoring adopts a scale from 0 to 100. The readings between 40 and 60 represent satisfactory level of anaesthesia. Using lower doses of anaesthetics, the side effects of induction agents may be reduced but may lead to inadequate anaesthesia and awareness. The advantage of entropy monitoring is that it enables to administer the dose of induction agent with precision.

Propofol, has achieved popularity, partially because of its short half- life, rapid recovery profile and less sedative effect [3]. The fall in blood pressure is seen more with higher doses of propofol, fast speed on injection [4,5] and is dose dependent. Etomidate

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has a rapid onset of action with a greater cardio stability.

In this study, we aim to evaluate the hemodynamic effects of induction doses of etomidate and propofol using entropy guidance for laryngoscopy and intubation.

Aims and Objectives

- To evaluate the hemodynamic effects of induction doses of etomidate and propofol using entropy guidance for laryngoscopy and intubation as a primary outcome measure.
- To observe the side effects, if any, of the induction agents as a secondary outcome measure.

Materials and Methods

This study was conducted in the department of anaesthesiology after obtaining approval from the Institutional Ethical Committee and a written informed consent from all the patients. This prospective, observational study was conducted for two years on 100 patients, aged 18-60 years, of ASA grade I & II, who were scheduled to undergo elective surgical procedure under general anaesthesia.

Patients with associated comorbidities, extremes of age, pregnant patients and anticipateddifficult airway (MP grade III and IV) were excluded from the study.

Allocation of Groups

100 healthy patients were randomly allocated in two groups.

Group A: (n=50) Induction dose of IV etomidate (0.2 mg/Kg -0.3mg/Kg) was given till entropy of 40 was achieved.

Group B: (n=50) Induction dose of IV propofol (2mg/Kg-3mg/Kg) was given till entropy of 40 was achieved.

Methodology

Pre anaesthetic evaluation was done a day prior to surgery and all the investigations were carried out. All patients were kept fasting for 8 hours. In operation theatre, IV line was secured with 18 G cannula and normal saline was started. Baseline vitals parameters systolic blood pressure (SBP), diastolic blood pressure (DBP), mean blood pressure (MAP), heart rate (HR), oxygen saturation (SpO2), end tidal carbon dioxide ($EtCO_2$) were noted. Study drug was prepared according to the groups allocated randomly by a computer generated randomization. Patients were premedicated with IV glycopyrrolate 0.2mg/kg, IVmidazolam (0.05 mg/Kg) and IV fentanyl 2µg/kg and pre oxygenated with 100% oxygen via facemask. Anaesthesia was induced with IV induction agents (propofol/etomidate), as per the study group, while observing entropy. Induction dose at entropy 40 was observed. After ensuring adequate mask ventilation, neuromuscular blockade was achieved with IV vecuronium 0.1mg/kg. Patient was ventilated via facemask for four minutes followed bylaryngoscopy and endotracheal intubation. After confirming position of endotracheal tube, anaesthesia was maintained with oxygen and nitrous oxide (40:60), sevoflurane (0.5-1%) and intermittent top ups of IV vecuronium (0.02mg/kg) with controlled ventilation. Systolic blood pressure (SBP), diastolic blood pressure (DBP), mean blood pressure (MAP), heart rate(HR), oxygen saturation (SpO_2), end tidal carbon dioxide ($EtCO_2$) were noted at induction and 1, 2, 3, 4, 5, 10 min thereafter. On conclusion of surgery, patients were reversed with IV neostigmine 0.05 mg/Kg and IV glycopyrrolate 0.02mg/Kg and extubated after fulfillment of extubation criteria.

Any intraoperative side effects such as hypotension, bradycardia, hypertension, tachycardia, myoclonic jerks, seizures, pain on injection, bronchospasm or laryngospasm were noted.

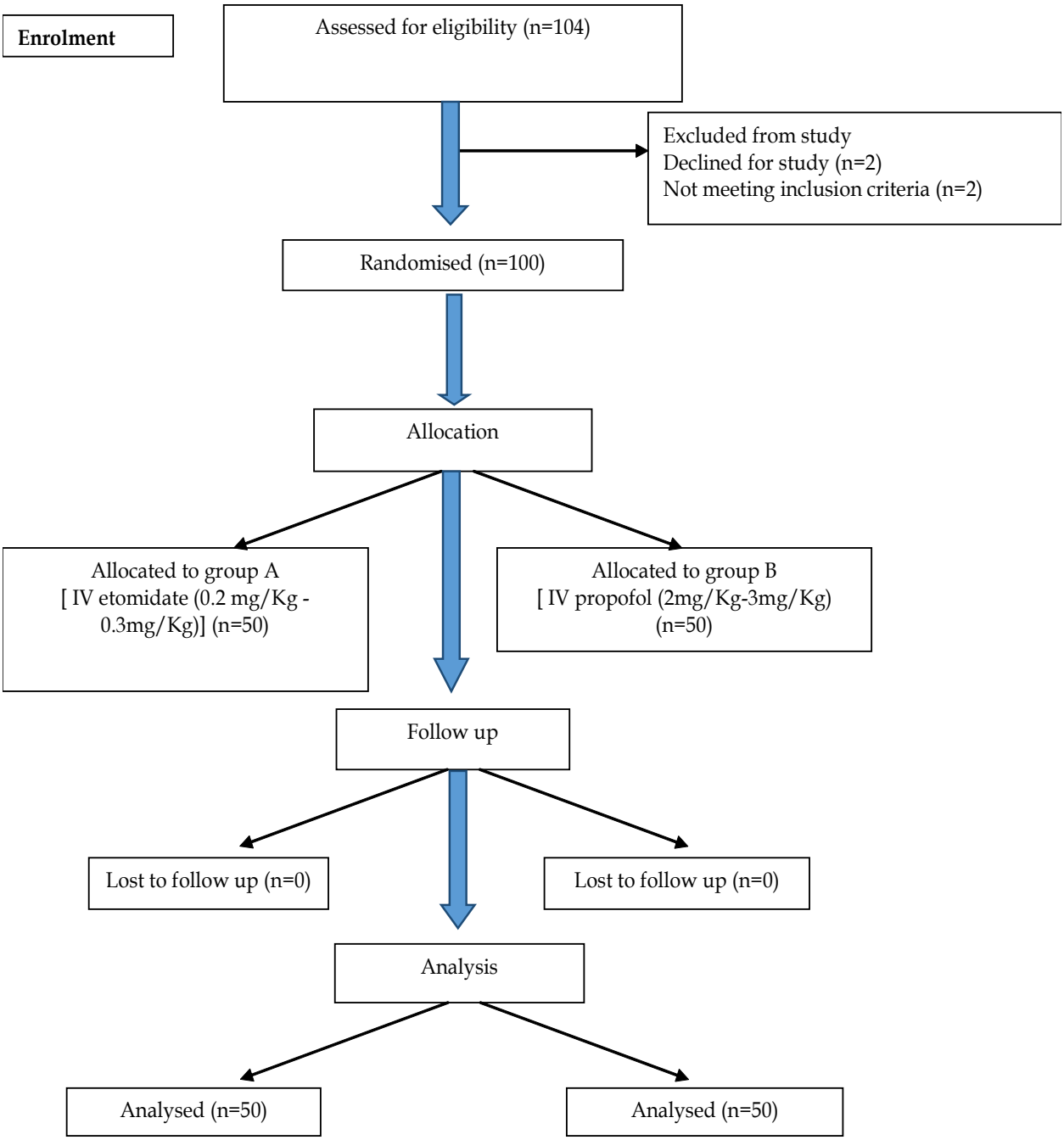
Parameters Observed were

- Baseline vitals [SBP, DBP, MAP, HR, SpO_2, $EtCO_2$] at induction and 1, 2, 3, 4, 5, 10 minutes after intubation.
- Adverse effects

The data from the above study was systematically collected, compiled and statistically analyzed to draw relevant conclusions. Data were described in terms of range, mean±SD,and percentages as appropriate. Comparison of quantitative variables between study groups was done using Students t test and Mann Whitney U test for independent samples for parametricand non parametric data respectively. A p value of <0.05 was considered to be significant. SPSS 21 version was used for calculations for Microsoft windows.

This study did not impose any financial burden to participants.

Consort 2010 Flow Diagram



Observations and Results

This prospective randomized comparative study was conducted on 100 healthy adult patients, aged 18-60, in MMIMSR to evaluate the haemodynamic effects of induction doses of etomidate and propofol using entropy monitor and determine their side effects, if any, intraoperatively.

All patients were evaluated for demographic data, haemodynamic parameters at baseline, before and after induction and intubation, side effects and complications.

The following observations were made and results were analysed statistically using appropriate statistical tests.

Patients in both the groups were comparable with respect toage, sex, ASA grade and MP grading. ($p>0.05$)

The mean dose of induction agent, according to entropy (DE) in group A was 16.7±2.4 and mean dose according to entropy (DE) in group B was 105.8±17.2.

As shown in Table 1, on comparison of systolic blood pressure in both groups at different time intervals, it was evident that in group B significant fall in SBP was observed compared to group A at T1, T2 and T3 ($p<0.005$). After laryngoscopy more rise in SBP in group B compared to Group A. ($p=0.004$)

As evident from the Table 2 above, in group B significant fall in DBP was observed compared to group A at T1, T2 and T3 ($p<0.005$). After laryngoscopy more rise in DBP in group B compared to Group A was observed. ($p=0.000$)

As depicted by Table 3, on comparison of mean arterial pressure in both the groups at different time intervals in group B significant fall in MAP was observed compared to Group A at T_1, T_2, and T_3 ($p<0.005$). After laryngoscopy more rise in MAP at T_5 in group B compared to group A. ($p=0.000$).

Time interval Group A (n-50) Table 4 shows, comparison of heart rate in both groups at different time intervals. As evident from the table above after laryngoscopy (T_5) significant rise in HR in group B (propofol) compared to group A (etomidate) was observed. ($p=0.018$).

Table 1: Systolic blood pressure of patients in both groups at different time period

Time interval	Group A (n-50)		Group B (n-50)		T	DF	p-value
	Mean	SD	Mean	SD			
T	121.2	14.6	123.4	14.2	-0.756	98	0.452^{NS}
T_0	125.3	12.9	128.2	12.4	-1.145	98	0.255^{NS}
T_1	116.2	14.2	100.6	10.8	6.174	98	0.000*
T_2	116.8	11.0	100.9	9.2	7.802	98	0.000*
T_3	118.7	9.5	109.5	7.5	5.343	98	0.000*
T_4	119.8	7.8	114.8	8.1	3.082	98	0.003*
T_5	131.3	9.9	137.2	10.2	-2.936	98	0.004*
T10	121.4	6.5	118.3	9.1	1.928	98	0.057^{NS}

*T0 - Baseline, T1 - 1 min after induction, T2 - 2 min after induction, T3 - Laryngoscopy time, T4- 1 min after laryngoscopy and intubation.

Table 2: Diastolic blood pressure of patients in both groups at different time period

Time interval	Group A (n-50)		Group B (n-50)		T	DF	p-value
	Mean	SD	Mean	SD			
T	73.6	8.4	74.4	9.5	-0.498	98	0.620^{NS}
T_0	77.3	7.5	78.5	8.3	-0.783	98	0.435^{NS}
T_1	70.8	8.6	63.1	7.4	4.753	98	0.000*
T_2	70.8	6.9	64.6	5.5	4.844	98	0.000*
T_3	71.8	6.7	68.7	5.5	2.448	98	0.016*
T_4	72.5	5.4	73.1	7.2	-0.438	98	0.663^{NS}
T_5	82.5	8.9	89.3	8.9	-3.821	98	0.000*
T10	72.7	4.8	73.1	6.0	-0.401	98	0.689^{NS}

Table 3: MAP among patients in both groups at different time period

Time interval	Group A(n-50)		Group B (n-50)		t	DF	p-value
	Mean	SD	Mean	SD			
T	89.7	9.2	90.7	10.2	-0.552	98	0.582^{NS}
T_0	93.4	8.4	95.1	8.9	-1.012	98	0.314^{NS}
T_1	85.9	10.0	75.5	8.0	5.704	98	0.000*
T_2	86.2	7.8	76.6	6.1	6.798	98	0.000*
T_3	87.3	6.9	82.4	5.4	3.926	98	0.000*
T_4	88.2	5.5	86.9	6.7	1.031	98	0.305^{NS}
T_5	98.4	8.1	105.3	9.1	-4.006	98	0.000*
T10	89.0	4.3	88.2	6.4	0.707	98	0.481^{NS}

Table 4: Heart rate of patients in both groups at different time period

Time interval	Group A (n-50)		Group B (n-50)		t	DF	p-value
	Mean	SD	Mean	SD			
T	79.1	10.2	78.1	9.1	0.536	98	0.593^{NS}
T_0	83.2	8.9	85.0	10.3	-0.910	98	0.365^{NS}
T_1	83.6	9.1	84.9	10.5	-0.687	98	0.493^{NS}
T_2	83.8	9.1	84.7	9.6	-0.448	98	0.655^{NS}
T_3	84.0	8.6	85.6	8.9	-0.898	98	0.372^{NS}
T_4	83.6	7.8	86.2	7.9	-1.640	98	0.104^{NS}
T_5	94.1	10.2	99.7	13.0	-2.407	98	0.018*
T10	83.4	6.2	77.1	8.8	4.160	98	0.000*

Adverse Effects of Drugs

Incidence of pain on injection was 42% in group B and 0% in group A. Incidence of myoclonus was 16% in group A and 0% in group B. Adverse reaction was observed only in 2% patients in group B. Nausea vomiting was seen 6% in group A and 2% in group B.

Discussion

Monitoring of the level of consciousness of the patient under general anaesthesia, can be done most commonly by methods using EEG based indices [6]. Higher values of EEG are an indication of awake state and lower values are indication of sedation or loss of consciousness.

Datex Ohmeda has two sets of indices, state entropy (SE) and response entropy (RE). SE is has a frequency range of 0.8 to 32 Hz and it covers the hypnotic elements of EEG, while RE is has a frequency ranging from 0.8 to 47 Hz, which includes a significant amount of facial EMG. The EEG band that has lower frequency and denotes the cortical activity is the state entropy (SE). The response entropy (RE) is an indicator of analgesia [7].

The readings between 40 and 60 are considered as satisfactory level of anaesthesia. This is the point where awareness can be avoided and unnecessary prolongation of recovery is also prevented. The values of RE and SE differ more during intubation due to nociception and extubation because the effects of drugs on nervous system has diminished and the patient is regaining consciousness [8].

In the present study, we have used entropy monitor to evaluate the hemodynamic effects of induction doses of propofol and etomidate under entropy guidance.

As shown in Table 5, in our study the baseline heart rate was comparable among groups,mean HR in group A was 79.16±10.241 and in group B was 78.12±9.115. (p value= 0.593). Statistically significant rise in HR was seen 1 minute after laryngoscopy and intubation in group B (mean 99.7±13.0) but no significant rise in group A (mean 94.1±10.2) p value was 0.018.

Kaushal RP et al. in 2015also studied hemodynamics of etomidate and propofol after induction in patients undergoing cardiac surgeries. Baseline HR in Etomidate and propofol group was 80.66±23.53 and 91.03±2.07 respectively. After intubation HR in etomidate group was 85.83±23.53 and in propofol group was 96.93±20.34 [9].

Table 5: Showing change in HR of both groups in different studies

Study author and year	Etomidate (A)					Propofol (B)				
	T_0	T_1	T2	T3	T4	T_0	T_1	T2	T_3	T4
Kaushal [9] RP et al 2015	80.66± 23.53	80.6± 12.92	-	-	85.83± 23.53	91.03± 2.07	88.53± 18.20	-	-	96.93± 20.34
Shah SB [10]et al 2015	77.1± 10.046	80.3± 8.819	80.32± 8.450	79.53± 16.305	78.6± 13.037	82.53± 11.40	87.69± 8.054	88.68+ 7.620	84.96± 8.181	85.49± 0.241
Present study	79.1± 10.2	83.6± 9.1	83.8± 9.1	83.6± 7.1	94.1± 10.2	78.1± 9.1	84.9± 10.5	84.7+ 9.6	86.2± 7.9	99.7± 13.0

Table 6: Showing changes in MAP of both groups in different studies

Study author and year	Group (A) T_0	T_1	T2	T3	T4	Group (B) T_0	T_1	T2	T_3	T4
Masoudifar M[11] et al 2013	97.2± 18	-	-	91.6± 30	121.4± 25.1	95.1± 16.7	-	-	84± 26.6	87.8± 22.2
Shah SB [10]et al 2015	98.03± 9.58	82.47± 8.23	81.77± 6.38	104.8± 9.06	97.10± 0.32	97.43± 5.69	73.10± 9.98	69.24± 8.3	91.17± 13.09	88.17± 9.58
Present study	89.7± 9.2	85.9± 10.0	86.2± 7.8	88.2± 5.5	98.4± 8.1	90.7± 10.2	75.5± 8.0	76.6± 6.1	86.9± 6.7	105.3± 9.1

Shah SB et al. also compared haemodynamic effects of propofol and etomidate after induction, laryngoscopy and intubation and concluded that propofol caused sustained increase in heart rate while etomidate keeps the heart rate stable. Baseline HR in etomidate group was 77.1±10.04 and in propofol group was 82.53±11.4 which was comparable. After intubation HR in etomidate group was 78.6±13.03 and in propofol group was 85.49±0.241 [10].

As shown in table 6, in our study baselin e MAP was comparable in both groups. Mean MAP in group A was 89.7±9.2 and in group B was 90.7±10.2. After induction there was fall in MAP in group B but no significant fall in group A. Mean MAP 1 min after induction in group A and B was 85.9±10 and 75.5±8 respectively. After laryngoscopy mean MAP in group A and B was 98.4±8.1 and 105.3±9.1 respectively.

Masoudifar M et al. found that baseline MAP in etomidate and propofol group was 97.2±18 and 95.1±16.7. After induction mean MAP in etomidate and propofol group was 91.6±30 and 84±26.6. Hypotension occurred in 26.1% of group B and 8% of group A (p = 0.09) [11].

Shah SB et al. [10] also compared haemodynamic effects of propofol and etomidate after induction, laryngoscopy and intubation and concluded that there was significant fall in MAP after induction with propofol compared to etomidate. Baseline MAP in etomidate and propofol group was 98.03±9.58 and 97.43±5.67 respectively. One min after induction the mean MAP in etomidate and propofol group was 82.47±8.23 and 73.10±9.98.

Few adverse effects of etomidate and propofol were noted in our study. Myoclonus was observed in 16% patients with etomidate and none with propofol. Pain on injection was observed in 42% patients receiving propofol and 0% with etomidate. Nausea and vomiting was seen in 6% patients with etomidate and only 2% with propofol. Kaushal RP et al. [9] observed no incidence of nausea vomiting, adverse reaction, myoclonus and pain on injection in both groups

Miner et al also concluded higher incidence of myoclonus (20% vs. 1.8%) in etomidate and propofol groups respectively. Pain on injection was observed only in propofol group [12]. Aggarwal S et al. concluded that pain on injection was seen in 50% patients with propofol and 4% patients with etomidate [13].

Conclusion

The haemodynamic effects observed after induction doses of propofol were more pronounced than that of etomidate. Propofol caused more hypotension than etomidate after induction, whereas there was statistically significant rise in heart rate after laryngoscopy and intubation.

Pain on injection was observed to be more in patients receiving propofol than etomidate. Nausea and vomiting was commoner with etomidate than propofol.

Thus, etomidate may be a better alternative induction agent to maintain cardio stability under entropy monitoring.

Acknowledgement

Nil

Conflict of Interest

Nil

Key Messages

On induction of anaesthesia with entropy monitoring, haemodynamic effects of propofol were more pronounced than that of etomidate

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Original Research Article

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Comparison of Effects of Intrathecal Fentanyl versus Dexmedetomidine in Patients undergoing Transurethral Resection of Prostate

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Abstract

Objectives: Comparison of block characteristics and postoperative analgesic efficacy of Fentanyl and Dexmedetomidine, as a adjuvant to intrathecal hyperbaric 0.5% Bupivacaine for patients undergoing Transurethral resection of Prostate(TURP). *Methods:* 100 patients belonging to ASA physical status I & II were divided into two groups of 50 each. Group F (Fentanyl group) received 2ml Inj. Bupivacaine heavy with 25µg of Fentanyl. Group D (Dexmedetomidine group) received 2ml Inj. Bupivacaine heavy with 5µg of Dexmedetomidine. The time of onset of sensory and motor block, haemodynamic status, duration of motor blockade and postoperative analgesia and adverse effects, if any were compared in both the groups. *Results:* Time from injection to highest sensory level and Onset of Bromage 3 was similar in both groups. The time taken to reach the level of T10 after injection was significantly less and the time taken to regression to Bromage 0 was significantly more in group D compared to group F ($p<0.001$). Intraoperatively both groups remained haemodynamically stable. Incidence of bradycardia was more in Group D and incidence of pruritus was more in Group F, though it was not statistically significant ($p=0.402$). Intraoperative sedation was higher in Group D ($p<0.001$) and postoperatively Visual analogue scores were significantly lower with group D ($p<0.001$). *Conclusion:* Dexmedetomidine appears to be an attractive adjuvant to intrathecal Bupivacaine than Fentanyl as there is significantly longer duration of motor block. It provides good quality of intraoperative analgesia, haemodynamically stable conditions, minimal side effects, and excellent quality of postoperative analgesia.

Keywords: Intrathecal; Bupivacaine; Fentanyl; Dexmedetomidine; Bromage; Postoperative Analgesia; Transurethral Resection of Prostate.

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Introduction

The patients undergoing Transurethral resection of prostate (TURP) are elderly, with co-existing cardiac and pulmonary diseases with compromised reserves. Spinal anesthesia is the anesthetic technique of choice for this procedure, as these elderly patients tolerate regional anesthesia better and the signs and symptoms associated with TURP like water intoxication, fluid over load, bladder perforation can be detected at the earliest [1,2]. Moreover these patients often suffer from severe postoperative pain due to the usage of transurethral balloon to prevent bleeding from the prostatic bed or capsule [3]. Adequate postoperative pain control is essential to prevent adverse consequences of surgical insult.

The concept of adding adjuvants to spinal anesthesia has come forward by administering opioids like morphine, fentanyl and α_2 agonists like

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clonidine, dexmedetomidine. Thereby reducing the dose requirement of bupivacaine and its adverse effects and also enhancing postoperative analgesia [2,4]. Intrathecal morphine was more frequently used for excellent and long lasting postoperative analgesia. But because of its hydrophilic properties, it caused delayed respiratory depression. Whereas for lipophilic opioids like fentanyl and sufentanil, the risk of respiratory depression is predominantly limited to the initial 2 hours after intrathecal injection. Dexmedetomidine, a selective α_2 receptor agonist is the d- enantiomer of medetomidine, a substance that provides sedation, anxiolysis, hypnosis, analgesia and sympatholysis. Intrathecal α_2 receptor agonists have been found to have antinociceptive action for both somatic and visceral pain [5].

The present study is aimed at evaluating the efficacy of intrathecal Fentanyl and dexmedetomidine as an adjuvant to intrathecal Bupivacaine (Hyperbaric) in patients undergoing TURP.

Materials and Methods

Source of Data

This Prospective, Randomized, controlled study was conducted on hundred consecutive patients undergoing TURP between June 2014 to December 2015 in our hospital. They were randomly assigned in to 2 groups, group F (*Fentanyl,* n=50) and group D (*Dexmeditomidine*, n=50). Randomization was done using sealed envelope technique. The study was approved by the institutional ethics committee. Written informed consent was obtained from all the patients enrolled in the study.

Inclusion Criteria

- ASA physical status class I and II
- Age between 60–80 years.

Exclusion Criteria

- Deformities of the spine
- Hypersensitivity to any of the drugs in the study
- Contraindications to spinal anaesthesia – patient refusal, bleeding diathesis Infection at the site of injection, Severe hypovolemia, Increased intracranial tension
- Heart block or dysrhythmia
- Patient on calcium channel blockers, adrenergic antagonist or ACE inhibitor
- Severe stenotic valvular heart disease.

Sample Size Calculation:

Based on the following formula,

$$n = \frac{2 (Z_\alpha + Z_\beta)^2 \ \sigma^2}{\Delta^2}$$

Where,

Z_α is the standard normal value (95% confidence interval) = 1.96

Z_β is the power of the test (80%) = 0.84

To detect the mean difference of 82.7 minutes (time to rescue analgesia) and the pooled standard deviation of 24.4 we need a sample size of 50 in each group.

Methodology

Preanesthetic evaluation was done one day prior to the surgery. Patients were evaluated for any systemic diseases and laboratory investigations recorded. The procedure of spinal anaesthesia was explained to the patients and written consent was obtained. The patients were educated about the use of visual analogue scale. After preparation of operating room, the patients are shifted, intravenous access was secured with 18G cannula. Baseline vitals were recorded. Under strict asepsis, using 25 G Quincke spinal needle, lumbar puncture was performed at L_3 – L_4 space in left lateral position, midline approach. Group F received 2ml of 0.5 % hyperbaric bupivacaine + 25µg Fentanyl (vol 0.5ml) and Group D received 2ml of 0.5 % hyperbaric bupivacaine + 5µg Dexmedetomidine (vol 0.5 ml). The following parameters were studied.

- Intraoperatively pulse rate, Non-invasive blood pressure (systolic, diastolic and mean), electrocardiogram, SpO_2 were recorded every 2 minutes for the first 10 minutes, every 10 minutes for the next 50 minutes and every 15 minutes till the end of surgery.
- Time of onset of T_{10} sensory block and peak sensory block was noted using pin prick method, time of onset of Bromage 3 motor block was noted.
- Motor block was assessed with *Modified Bromage scale* [6]: *Bromage 0*- the patient is able to move the hip, knee and ankle, *Bromage 1*- the patient is unable to move the hip but is able to move the knee and ankle, *Bromage 2*- the patient is unable to move the hip and knee but able to move the ankle, *Bromage 3* - the patient is unable to move the hip, knee and ankle.

- *Modified Ramsay sedation scale [7]* was used for assessing intraoperative sedation 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.
- Hypotension (> 20% fall of baseline blood pressure) was treated with bolus dose of 6 mg ephedrine intravenously. Bradycardia (pulse rate < 50 bpm), was treated with 0.6 mg atropine intravenously. Incidence of respiratory depression defined as respiratory rate < 9 breaths /min and SpO_2 < 90% on room air, was noted. Side effects if any were noted.
- Postoperatively regression of the motor blockade to reach modified Bromage 0 was noted.
- ***Visual analogue scale*** was used to assess postoperative pain. Supplemental analgesia was given for visual analogue score ≥ 6. Time of supplemental analgesia was noted.

Statistical Analysis

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois, USA) version 16. Patient demographic characteristics, continuous variables, time to T10, time to peak sensory block level, time to two segment regression, time of first analgesic requirement were analysed using students 't' test. American Society of Anaesthesiologist (ASA) physical status, Peak sensory block level, maximum motor blockade and other categorical data (side effects) were analysed using chi square. p value < 0.05 was considered as statistically significant.

Results

The mean age of group F is 67.2 years and group D is 68.0 years and the difference is not statistically significant. Similarly, the mean height (cm) and weight (kg) in both the groups are comparable statistically. The distribution of ASA grade is also similar between both the groups (Table 1).

The time taken to reach the level of T10 after injection was significantly less and the time taken to regression to Bromage 0 was significantly more in group D compared to group F (Table 2). Though there is fall in heart rate, systolic, diastolic and mean blood pressure in both the groups, the degree of fall is similar (Table 4,5 and Graph 1). No significant difference in respiratory rate and oxygen saturation between both

Table 1: Demographic data

Variables	Group F	Group D
Age (years)	67.2±4.73	68.0±5.39
Height (cm)	155.66±5.16	156.10±5.83
Weight (kg)	58.12±12.35	56.90±10.18
ASA 1/2	26/24	31/19

Values are mean ± Standard Deviation, number (frequency).
ASA: American Society of Anesthesiologist physical status.

Table 2: Comparison of Block characteristics

Variables	Group F	Group D	P value
Time from injection to T10 (minutes)	3.38±0.83	2.62±0.56	<0.001
Time from injection to highest sensory level (minutes)	11.47±1.23	11.72±1.23	0.314
Onset of Bromage 3(minutes)	10.38±1.08	10.59±1.00	0.317
Regression to bromage 0 (minutes)	152.90±8.31	419.70±16.85	<0.001

Table 3: Highest sensory level of patients studied

Highest sensory level	Group F		Group D	
	No.	Percentage	No.	Percentage
T8	0	-	2	4
T9	11	22	12	24
T10	39	78	36	72
Total	50	100	50	100

the groups (Table 6). Few side effects were noted (Table 7) but was not statistically significant.

Group D patients had more sedation when compared to group F patients particularly at 60 and 90 minutes after the injection (Table 8, Graph 2). Finally group D patients had lower Visual Analog score than group F for 24 hours postoperatively (Table 9, Graph 3) and was statistically significant.

Table 4: Comparison of Mean Arterial Pressure (mmHg)

MAP (mmHg)	Group F	Group D	P value
Pre op	97.02±9.99	94.98±7.02	0.238
2 minutes	93.29±10.02	89.25±8.97	0.036
4 minutes	88.00±8.86	85.65±9.27	0.198
6 minutes	84.44±8.48	83.88±9.50	0.757
8 minutes	81.31±7.67	82.13±10.08	0.648
10 minutes	78.27±8.37	81.28±9.98	0.105
20 minutes	77.10±8.63	79.87±9.84	0.138
30 minutes	76.79±7.38	79.31±9.50	0.142
40 minutes	76.14±8.15	79.06±9.35	0.099+
50 minutes	76.46±8.49	78.88±8.95	0.169
60 minutes	78.31±8.62	79.38±8.41	0.533
75 minutes	80.91±7.65	79.94±7.98	0.541
90 minutes	84.19±7.14	81.64±8.02	0.096+

Table 5: Comparison of Heart Rate (beats per minute)

HR (BPM)	Group F	Group D	P value
Pre op	82.68±12.42	84.36±13.71	0.522
2 minutes	82.04±12.16	83.36±13.94	0.615
4 minutes	81.02±11.16	83.82±14.32	0.278
6 minutes	79.78±10.72	83.02±14.03	0.198
8 minutes	78.58±9.67	80.34±12.51	0.433
10 minutes	77.60±8.79	77.75±10.80	0.938
20 minutes	76.42± 8.14	76.26±11.38	0.936
30 minutes	75.46±7.70	75.48±11.20	0.992
40 minutes	74.68±7.67	74.92±10.87	0.899
50 minutes	74.48±7.70	74.92±9.70	0.802
60 minutes	74.18±7.57	74.98±8.64	0.624
75 minutes	73.40±7.57	74.90±8.54	0.355
90 minutes	72.78±7.11	73.84±8.22	0.492

Table 6: Comparison of RR and SpO_2 of two groups

Variables	Group F	Group D	P value
Respiratory rate(RR)	16.10±1.61	16.10±1.61	1.000
SPO2	97.92±0.75	97.92±0.75	1.000

Table 7: Side effects noted

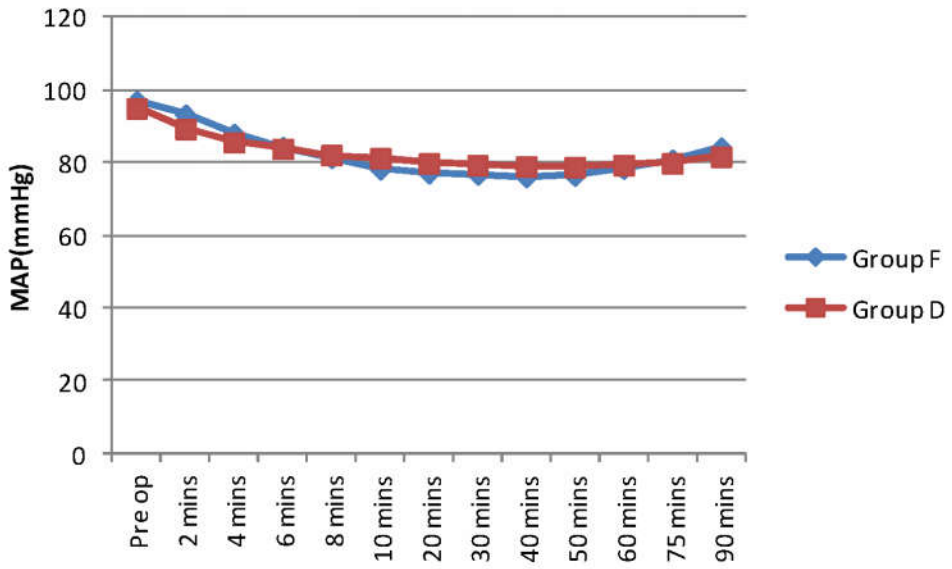
Side effects	Group F		Group D	
	No.	Percentage	No.	Percentage
Nausea	3	6	0	0
Vomiting	1	2	0	0
Pruritus	3	6	0	0
Hypotension	6	12	8	16
Bradycardia	0	0	7	14
Urinary retention	0	0	0	0
Respiratory depression	0	0	0	0

Table 8: Comparison of Modified Ramsay Sedation Score(MRSS) of two groups

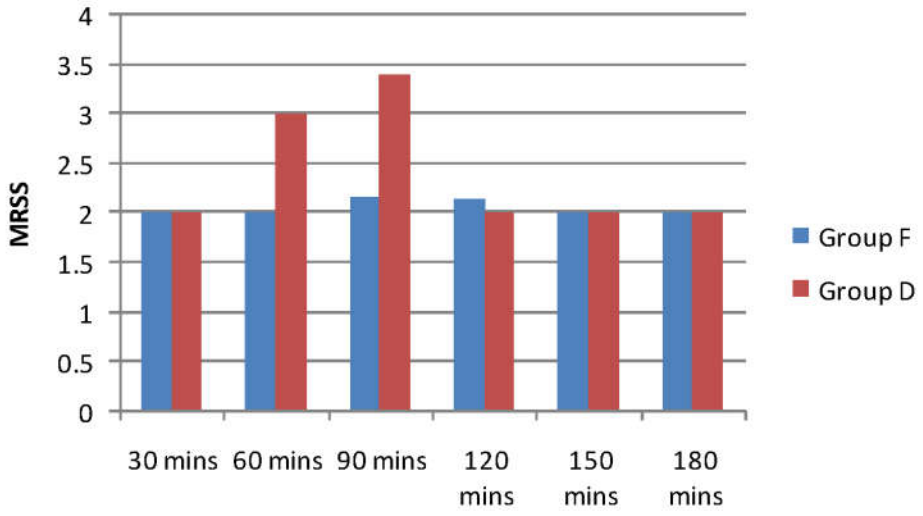
MRSS	Group F	Group D	P value
30 mins	2.00±0.00	2.00±0.00	1.000
60 mins	2.00±0.00	3.00±0.00	<0.001
90 mins	2.16±0.37	3.40±0.49	<0.001
120 mins	2.14±0.35	2.00±0.00	0.006
150 mins	2.00±0.00	2.00±0.00	1.000
180 mins	2.00±0.00	2.00±0.00	1.000

Table 9: Comparison of Visual Analogue Scale (VAS) of two groups

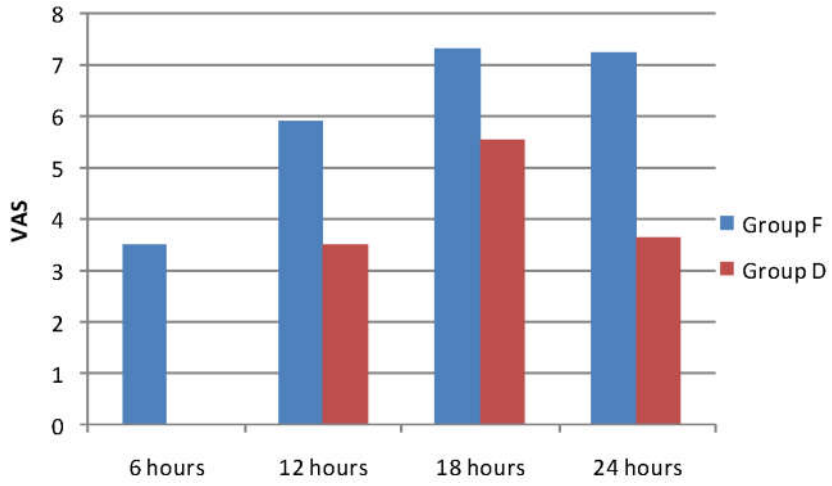
VAS	Group F	Group D	P value
6 hours	3.50±0.51	0.00±0.00	<0.001
12 hours	5.90±0.97	3.50±0.51	<0.001
18 hours	7.28±0.95	5.52±0.51	<0.001
24 hours	7.24±0.96	3.62±0.69	<0.001



Graph 1: Comparison of Mean arterial pressure (MAP) changes in both groups



Graph 2: Modified Ramsay Sedation Score (MRSS) in both groups



Graph 3: Visual analogue scale scores in both groups

Discussion

One of the age related conditions in males is benign hyperplasia of the prostate; as such the patients undergoing TURP are elderly, with co-existing cardiac, pulmonary and metabolic disorders and compromised reserves. Spinal anaesthesia is the most widely used technique for the procedure, as the elderly tolerate regional anaesthesia better. With spinal anaesthesia physiological disturbances are minimal and adequate muscle relaxation is provided which allows relaxation of the pelvic floor, perineal and thigh muscles for improved surgical access and also early recognition of fluid overload, bladder perforation [1,2]. Due to the age related changes in spinal anatomy, nerve physiology and cardiovascular reflexes in elderly, it is important to limit the distribution of spinal block to reduce the adverse haemodynamic and pulmonary effects. Low-dose bupivacaine causes minimum haemodynamic alterations, but may provide insufficient surgical anaesthesia and postoperative analgesia [8]. Various adjuvants such as opioids and α_2 agonists have been added to bupivacaine to shorten the onset of block, increase block quality and prolong the duration of block and postoperative analgesia, without compromising patient safety [2,4].

Fentanyl, a lipophilic opioid agonist, is used as an adjuvant, which prolongs the duration of spinal anaesthesia. Intrathecally, Fentanyl exerts its effect by combining with opioid receptors in the dorsal horn of spinal cord and also have a supraspinal spread and action [9]. *Dexmedetomidine*, an α_2 agonist drug, when given intrathecally, significantly prolongs the duration of spinal anaesthesia. Stimulation of the α_2 adrenoceptors in the substantia gelatinosa of the dorsal horn of the spinal cord, inhibits the firing of nociceptive neurons stimulated by peripheral Aγ and C fibres. It also inhibits the release of substance P by primary afferents of the dorsal horn, and suppresses the activity of wide dynamic range neurons evoked by noxious stimuli. Recent evidence suggests that the antinociception produced by alpha-2 agonists may be due in part to acetylcholine release in the spinal cord. As it has been suggested that the spinal cord is the major site of analgesic action for alpha-2 agonists, the epidural and intrathecal routes have been considered preferable to the intravenous route [10,11].

In our study design, Group F received 0.5% hyperbaric Bupivacaine 2ml with Fentanyl 25µg and Group D received 0.5% hyperbaric Bupivacaine 2ml with Dexmedetomidine 5µg intrathecally to the patients undergoing TURP. Fentanyl in the dose of 25µg had been successfully used as an adjuvant intrathecally for various lower abdominal surgeries [12,13]. Similarly, Dexmedetomidine in the dose of 5µg was found to provide good, prolonged analgesia for various urological procedures [12,14,15]. And hence we have decided the doses accordingly.

Demographic characteristics were comparable in both the groups (Table 1). The distribution of ASA grade was also similar between both the groups. The difference was not statistically significant. Our study has shown that the addition of either 5µg Dexmedetomidine or 25µg Fentanyl with hyperbaric bupivacaine significantly prolongs both sensory and motor block. But the time taken to reach the level of T10 after injection was significantly less in Dexmedetomidine group. The duration of motor blockade i.e) the time to regression was significantly

prolonged to 419.70±16.85 minutes in the Dexmedetomidine group while it was 152.90±8.31 minutes in the Fentanyl group. But the highest sensory level attained, the time taken to reach that level and the onset of Bromage 3 was comparable in both the groups. Thus Dexmedetomidine group of patients had early onset and more prolonged duration of blockade when compared to Fentanyl group.

Al-Ghanem et al. [12] had studied the effect of addition of 5µg Dexmedetomidine or 25µg Fentanyl intrathecally to10mg isobaric bupivacaine in patients undergoing vaginal hysterectomy and concluded that Dexmedetomidine produces more prolonged motor and sensory block than Fentanyl. Similarly, Esmaoglu A et al. [16] had studied the effects of Dexmedetomidine added to Spinal Levobupivacaine for Transurethral Endoscopic Surgery and concluded that addition of intrathecal dexmedetomidine for spinal anaesthesia shortens sensory and motor block onset time and prolongs block duration without any significant adverse effects. Many other studies also support this finding [13,17,18].

Though there is fall in heart rate, systolic, diastolic and mean blood pressure in both the groups, the degree of fall is similar. No significant difference in respiratory rate and oxygen saturation were found between both the groups. Incidence of nausea (6%), vomiting (2%) and pruritus (6%) was noted only in fentanyl group (Table 7). The incidence of hypotension (12% vs 16%) was similar in both the groups. But there was significant incidence of bradycardia (0%vs14%) in Dexmedetomidine group. Nausea, vomiting and pruritus after intrathecal Fentanyl is known but it was not significant in the present study. Biswas et al in their study had observed pruritus in 15% of patients who received intrathecal fentanyl [19]. Gupta R et al. had observed that intraoperative hypotension and ephedrine requirement was more in the Dexmedetomidine group [18]. Halder et al. had noticed statistically significant occurrence of bradycardia in dexmedetomidine groups in a randomized trial performed on eighty patients scheduled for elective lower limb surgeries [20].

Group D patients had more sedation when compared to group F patients particularly at 60 and 90 minutes after the injection. Finally group D patients had lower Visual Analog score than group F for 24 hours postoperatively and was statistically significant. So there was no requirement for rescue analgesia in Dexmeditomidine group for 24 hours postoperatively. Whereas fentanyl group of patients required supplementary analgesia from 12th hour onwards. Gupta R et al. [13] in their comparative study of intrathecal Dexmedetomidine 5µg and Fentanyl 25µg as adjuvants to bupivacaine, found that intrathecal Dexmedetomidine is associated with prolonged motor and sensory block, hemodynamic stability, and reduced demand for rescue analgesics in 24 hours as compared to Fentanyl. They also found that the sedation score was more in group D patients. Their mean sedation score was 3.8±0.5 in group D as compared to 2.2±0.53 in group F, which was statistically significant ($p<0.05$). In our study, the mean sedation score for group F was 2.16±0.37 and group D was 3.40±0.49 , which was statistically significant ($p <0.001$). Similarly, Eid HEA et al had observed that intrathecal dexmedetomidine group of patients had higher sedation score, lower post-operative analgesic requirement and hemodynamic stability [21]. Similar observation had been made in many other studies [18,22,23].

As the study involved 100 patients undergoing TURP, it was also easier to study the incidence of TURP Syndrome. Not even a single case of TURP syndrome was noted. The incidence was 0% and none of our patients required blood transfusion intra-operatively.

Conclusion

Addition of 5µg Dexmedetomidine with hyperbaric bupivacaine significantly prolongs both sensory and motor block. The post operative 24 hours analgesic requirement was also significantly less in the Dexmedetomidine group than Fentanyl group. To conclude, 5µg Dexmedetomidine seems to be an attractive alternative to 25µg Fentanyl as an adjuvant to spinal bupivacaine in surgical procedures. It provides good quality of intraoperative analgesia, haemodynamically stable conditions, minimal side effects, and excellent quality of postoperative analgesia.

Hence, Dexmedetomidine seems to be a better choice as intrathecal adjuvant with Bupivacaine when compared with Fentanyl.

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Conflicts of Interest: None

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Original Research Article

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A Prospective Randomized Double Blind Study on Postoperative Pain Relief in Lower Orthopedic Surgeries-Comparison between Intravenous Inj. Nalbuphine, Inj. Tramadol and Inj. Ketorolac

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Abstract

Introduction: Effective post surgical pain management is essential for the recovery and rehabilitation process. Intravenous injection brings more rapid pain relief than other methods.In this study, We had compared Inj. Nalbuphine, Inj. Tramadol and Inj. Ketorolac given intravenously for post operative pain relief in patients who underwent ower limb orthopaedic surgeries

Aim: To compare the analgesic efficacy and side effects of intravenous Nalbuphine, Tramadol and Ketorolac for postoperative pain relief in patients undergoing lower limb orthopaedic surgeries under spinal anesthesia.

Methodology: After obtaining informed consent and institutional ethical committee approval, 1 50 patients were randomly assigned to one of the three study groups (Group T, Group K, and Group N) based on computer generated random numbers

Each group consists of 50 patients

Group 'T' received Inj. Tramadol 2mg/kg IV

Group 'K' received Inj. Ketorolac 0.4mg/kg IV

Group 'N' received Inj. Nalbuphine 0.3mg/kg IV

Spinal anaesthesia was performed in sitting position using 25 G spinal needle under aseptic precaution using 0.5% Bupivacaine hyperbaric solution. Intra operatively hemodynamic variables like pulse rate, Blood pressure, ECG, SpO_2 monitored. 90 minutes after spinal Anaesthesia each group of patients were administered their respective drug intravenously irrespective of completion of surgery.

Post operatively following parameters were monitored every hour for a period of 24 hours.

1. hemodynamics
2. Pain score
3. Sedation Score.

Results: There is no significant difference in demography.The changes in hemodynamics and sedation are more in Group N than other groups.

Conclusion: Nalbupine has more analgesic effect than ketorolac and tramadol with more sedation.

Keywords: Ketorolac; Tramadol; Nalbupine.

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Introduction

The international association for the study of pain has described pain "as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage."Most patients who undergo major orthopaedic surgery experience moderate-to-severe pain and receive inadequate pain relief. Pain causes anxiety. Sleeplessness, metabolic, psychological, neuro-endocrinal and pulmonary problems that can adversely affect the patient and extend hospitalization. Effective post surgical pain management is essential for the recovery and rehabilitation process. Postoperative analgesic modalities include oral or parenteral analgesics, peripheral serve blocks, neuraxial blockade with local anesthetics, intraspinal opioids as well adjunctive techniques such as TENS (transcutaneous electrical nerve stimulation) and physical therapy.

Appropriate treatment begins with an understanding of the correct drug, route of administration and the mode of action. Early administration will achieve effective analgesic concentrations and make it easier to maintain the therapeutic level of the drug in the blood. Intravenous injection brings more rapid pain relief than other methods.

In this study, We had compared Inj. Nalbuphine, Inj. Tramadol and Inj. Ketorolac given intravenously for post operative pain relief in patients who underwent ower limb orthopaedic surgeries.

AIM

To compare the analgesic efficacy and side effects of intravenous Nalbuphine, Tramadol and Ketorolac for postoperative pain relief in patients undergoing lower limb orthopaedic surgeries under spinal anesthesia

Methodology

This is a prospective randomized double blinded study conducted at chengalpattu Medical College Hospital. A total of 150 patients undergoing lower limb orthopaedic surgeries under spinal anesthesia were included in this study.

Selection of Study Population

Inclusion Criteria

1. ASA I and ASA II Patients
2. Age between 20-50 years

Exclusion Criteria

1. Patient refusal
2. Coagulopathy
3. Contraindications to Spinal anaesthesia
4. Uncooperative patients
5. Patients with H/o Respiratory illness
6. Patients with H/o peptic Ulcer disease

Collaborating Dept

Orthopaedic surgery

Design of Study

Prospective randomized double blinded study

Period of Study

9 months (Feb 2011 to Nov 2011)

Materials and Methods

Preperative evaluation was done in preoperative assessment clinic in our hospital.

Investigations like Hemoglobin, Bleeding time, Clotting time, Platelet Count, Urine for Albumin & Sugar, Blood sugar, Blood urea, Sr. Creatinine, Electrocardiogram and X-ray chest were obtained.

After obtaining informed consent, patients were randomly assigned to one of the three study groups (Group T, Group K, and Group N)

Each group consists of 50 patients

Group 'T' Patients received Inj. Tramadol 2mg/kg IV

Group 'K' Patients received Inj. Ketorolac 0.4mg/kg IV

Group 'N' Patients received Inj. Nalbuphine 0.3mg/kg IV

After preparation and premedication as per the protocol, all the patients were preloaded with 20ml/kg of Ringer Lactate solution. Spinal anaesthesia was performed in sitting position using 25 G spinal needle under aseptic precaution. Local anaesthetic of choice for spinal anaesthesia was 0.5% Bupivacaine hyperbaric solution. Volume of the drug depended on the surgical procedure. Intra operatively hemodynamic variables like pulse rate, Blood pressure, ECG, Oxygen Saturation were monitored. 90 minutes after spinal Anaesthesia each group of

patients were administered their respective drug intravenously irrespective of completion of surgery.

Post operatively following parameters were monitored every hour for a period of 24 hours.

1. Pulse rate
2. Blood pressure
3. Respiratory Rate
4. SpO_2
5. Pain score
6. Sedation Score.

Pain score was assessed by **visual analogue scale** which is a tool used to help a person rate the intensity of pain. The visual analogue scale for pain is a straight line with one end meaning no pain and the other end meaning the worst pain imaginable. A patient marks a point on the line that matches the quality of pain he or she feels.

Once the VAS Score reached 3, the patients received the same drug as per their group as rescue analgesia. This was repeated on demand for a period of 24 hours.

Sedation in the post operative period was assessed by using Ramsay Sedation Score.

Ramsay Sedation Score

Score	Response
1	Anxious or restless or both
2	Cooperative, orientated and tranquil
3	Responding to commands
4	Brisk response to stimulus
5	Sluggish response to stimulus
6	No response to stimulus

Post operative nausea and vomiting was treated by giving Inj. Ondansetron 8 mg (5HT3 receptor antagonist) intravenously.

Observation and Results

Demographic Details

Demographic variable like age and weight of the three groups (group T, group K, group N) were analysed, using one way ANOVA (Analysis of Variation) test (Table 1).

Sex distribution between the three groups (group T, group K, group N) were analysed, using Chi square test (Table 2).

There is no significant difference in the demographic profile between the three study groups (group T, group K, group N), the p value being 0.77 for age, 0.66 for weight and 0.24 for sex distributions. Hence, the demographic profile of the groups included in the study was found to be similar.

Heart rate, mean arterial pressure, respiratory rate, pain score, sedation score of the patients in the three study groups (group T, group K, group N) were monitored every four hour till 16hrs then till 24 hrs. The results obtained were analysed, using one way ANOVA test.

The changes in pulse rate between the three groups (group T, group K, group N) was found to be statistically significant during 1 & 8 hours ($p<0.05$).

Table 1:

	Group T	Group K	Group N	P value (ANOVA)
Age in years	38.4± 11.9	40.16± 12	39.72±13.83	0.77
Weight in kgs	61.84± 5	62.94± 6.58	62.4±5.66	0.66

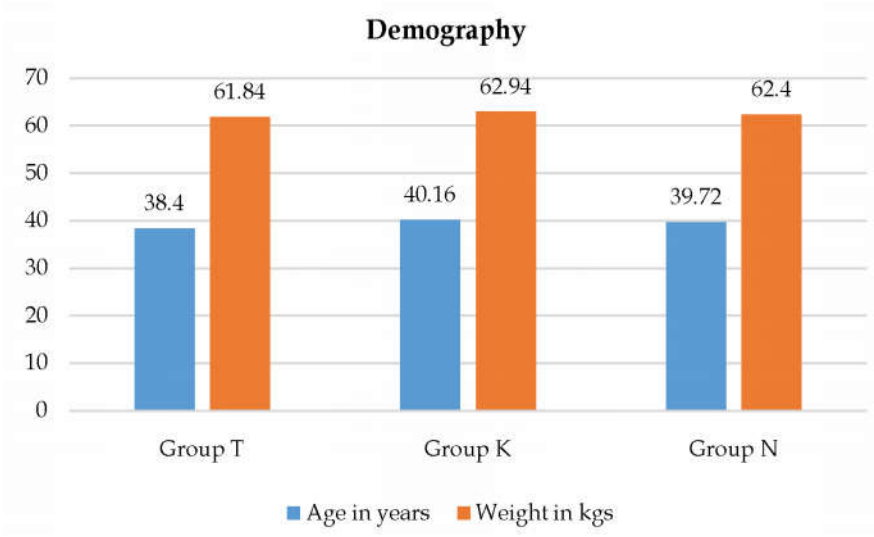
Table 2: Sex distribution between the three groups (group T, group K, group N) were analysed, using Chi square test

Sex	T	K	N	CHI SQ	P
Male	42(84%)	35(70%)	37(74%)	2.85	0.24
Female	8(16%)	15(30%)	13(26%)		

Table 3: Heart Rate

HR/hr	T	K	N	ANOVA	P
HR b	77.12±4.8	76.48±5.46	77.84±4.93	0.9	0.41
HR1	93.76±13.79	78.08±4.88	78.4±5.03	50.314	0.00
HR4	77.16±5.82	77.72±5.25	77.48±4.48	0.145	0.87
HR8	82.12±8.62	77.6±5.24	78.56±5.27	6.57	0.002
HR12	78.28±6.27	77.4±4.8	78.28±5.05	0.441	0.64
HR16	77.48±11.62	76.92±5.098	76.36±10.13	0.178	0.84
HR24	77.08±5.48	77.32±5.15	78.53±4.68	1.205	0.30

Graph 1:



Graph 2:

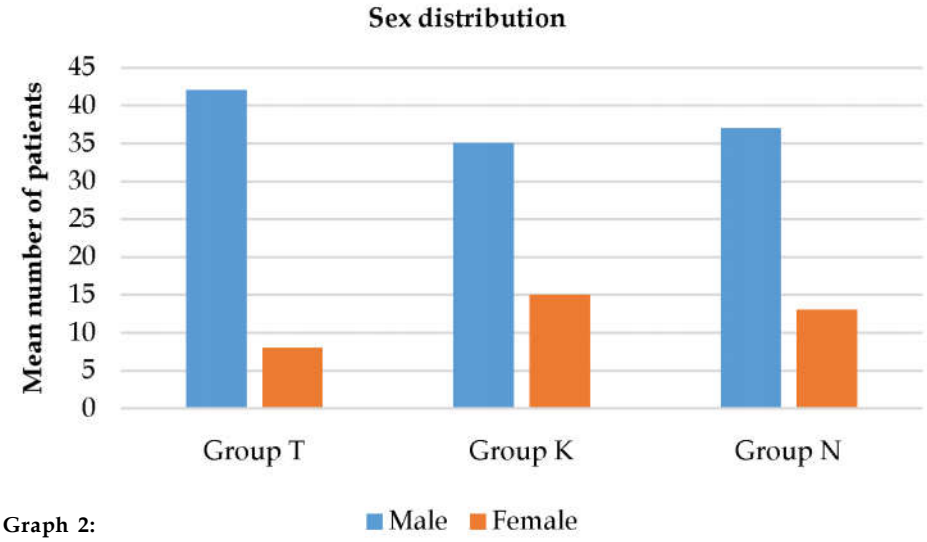
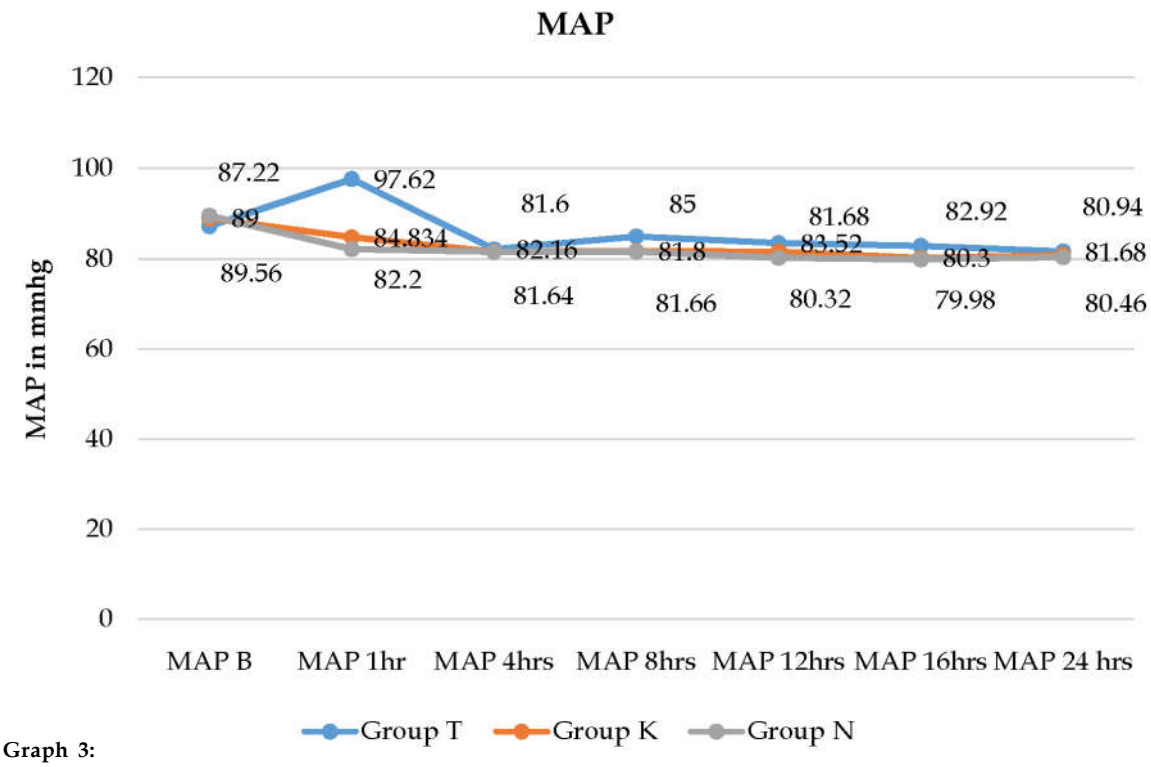


Table 4:

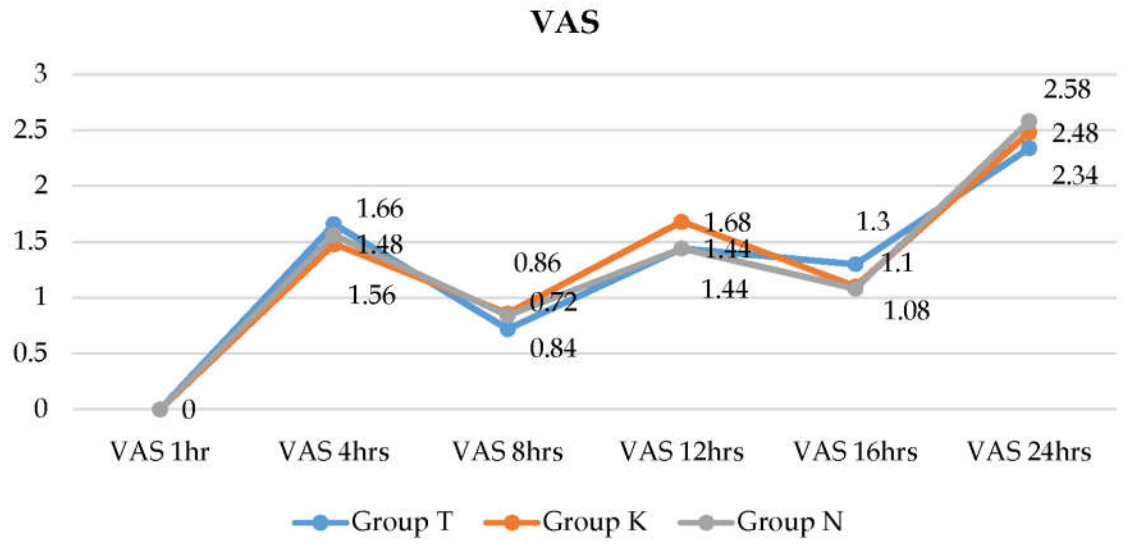
	Group T	Group K	Group N	P value (ANOVA)
MAP B	87.22± 6.22	89 ± 4.63	89.56 ± 4.82	0.07
MAP 1hr	97.62 ±12.78	84.84± 5.24	82.2± 6.42	0.00
MAP 4hrs	82.16± 6.74	81.64 ±6.39	81.6± 6.97	0.9
MAP 8hrs	85± 9.47	81.8± 6.17	81.66± 6.67	0.09
MAP 12hrs	83.52± 6	81.68± 7.57	80.32± 6.51	0.06
MAP 16hrs	82.92 ±7.23	80.3± 12.33	79.98 ±6.11	0.2
MAP 24 hrs	81.68± 6.24	80.94± 6.31	80.46± 12.84	0.79



Graph 3:

Table 5:

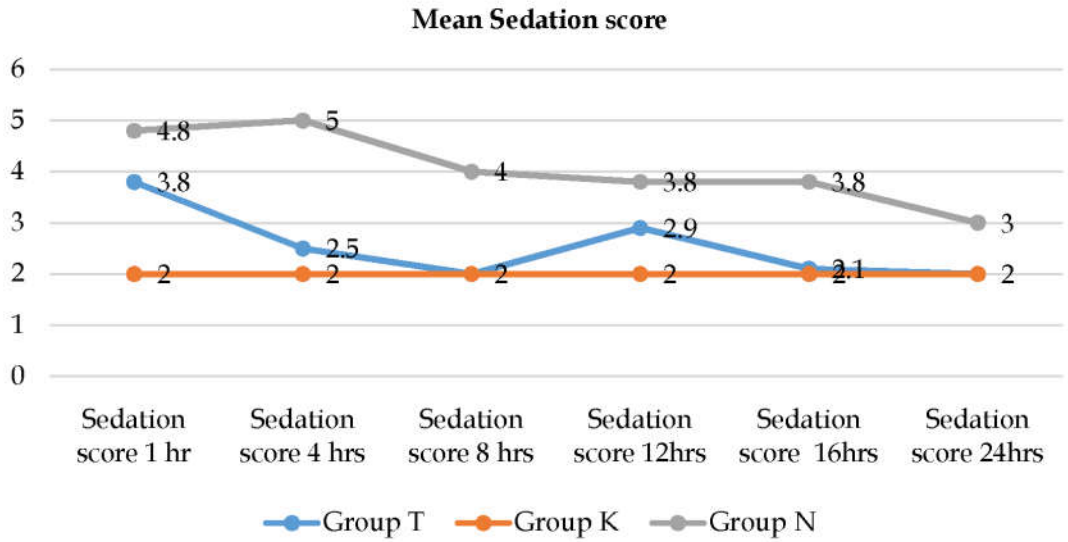
	Group T	Group K	Group N	P value (ANOVA)
VAS 1hr	0	0	0	
VAS 4hrs	1.66± 0.59	1.48± 0.58	1.56± 0.54	0.29
VAS 8hrs	0.72± 0.95	0.86± 1.13	0.84± 0.84	0.74
VAS 12hrs	1.44± 0.88	1.68± 0.68	1.44± 0.76	0.21
VAS 16hrs	1.3± 1.15	1.1± 1.1	1.08± 1.22	0.56
VAS 24hrs	2.34± 0.59	2.48± 0.51	2.58± 0.51	0.08



Graph 4:

Table 6:

	Group T	Group K	Group N
Sedation score 1 hr	3.8±0.4	2±0	4.8±0.2
Sedation score 4 hrs	2.5±0.5	2±0	5±0
Sedation score 8 hrs	2±0	2±0	4±0
Sedation score 12hrs	2.9±0.9	2±0	3.8±0.5
Sedation score 16hrs	2.1±0.4	2±0	3.8±0.3
Sedation score 24hrs	2±0	2±0	3±0



Graph 5:

Discussion

The study was conducted on a total of 150 patients belonging to ASA I and II who underwent lower limb orthopaedic surgeries under spinal anaesthesia. All the patients were adults ranging from 20 to 60 years. They were divided in to 3 groups of 50 each.

Group T: Received intravenous Tramadol 2 mg/kg

Group K: Received intravenous Ketorolac 0.4 mg/kg

Group N: Received intravenous Nalbuphine 0.3 mg/kg

All the 3 groups received their respective drug 90 minutes after spinal anaestheisa and the same drug was repeated when the pain score (VAS) reached 3 in the 24 hours period

Demographic Profile

The demographic profile shows the age, sex and weight distribution between the 3 groups. There was no significant difference between groups (group T, group K, group N) for age (p=0.77), weight (p=0.66) and sex (p=0.24)

Heart Rate and Mean Arterial Pressure

Alon E et al examined the analgesic of nalbuphine and tramadol in patients undergoing total abdominal hysterectomy. In his studies he found that blood pressure and heart rate were normal in both groups without significant differences between the groups. Putland et al, compared the analgesic efficacy of tramadol versus ketorolac in day care laparoscopic sterilization, in his study he found that blood pressure and heart were normal in both groups without significant differences between the groups. In our study patients in group T had a statistically significant increase in heart rate and mean arterial pressure in 1,7,8,15,19,20,21 hours ($p<0.05$). Whereas patients in other two groups had no significant change in the hemodynamic parameters.

Respiratory Rate

Ouaki et al compared the analgesic efficacy and side effects of tramadol and nalbuphine, he found that no significant changes in respiratory rate.

In our study group T showed statistically significant increase in respiratory rate in 1, 7, 8, 15, 19, 20, 21 hours over 24 hours ($p<0.05$). This significant variation in respiratory rate was not seen in Group K and Group N.

The significant increase in heart rate, mean arterial pressure, respiratory rate in group T could be due to nausea and vomiting following administration of tramadol.

The significant increase in heart rate, mean arterial pressure, respiratory rate in group T could be due to nausea and vomiting following administration of tramodol.

All the three groups (Group T, Group K and Group N) did not produce clinically significant respiratory depression over 24 hours.

Pain Score

Ali et al compared the analgesic efficacy of intravenous infusion of nalbuphine and tramodol in patients undergoing laparoscopic dye test,found that no significant differences between the two groups in post operative pain score(VAS)

Khalid Maudood siddiqui compared the analgesic efficacy of tramadol and nalbuphine in TIVA for dilatation and curettage, found that quality of analgesia was better in nalbuphine group

Diana Moyao – Garoia et al., compared the analgesic efficacy of nalbuphoine and tramadol through continous intravenous infusion for post operative pain relief found that tramadol appears to posses better post operative analgesic efficacy than nalbuphine.

Zackova M et al. compared the post operative analgesic efficacy of ketorolac and tramadol given intravenously during maxillofacial surgery found that there was no statistically significant difference between the ketorolac and tramadol groups in the pain scores measured.

Our study showed no statistically significant difference in pain scores in all the 3 groups ($p>0.05$).

Sedation Score

Khalid Maudood siddiqui et al. compared tramadol versus nalbuphine in total intranvenous anaesthesia for dilatation and evacuation found that tramodol had more sedating effect than nalbuphine. Patients receiving nalbuplhine woke up earlier and were well oriented compared to tramadol.

Ouaki, J et al. compared analgesic efficacy and side effects of tramadol versus nalbuphine in patients undergoing laparoscopic surgery for gastro-oesophageal reflux disease found that tramadol caused less early sedation than nalbuphine.

When Group T and Group N were compared, Group T showed statistically significant sedating effect in 2, 5, 8, 9, 10, 14, 15, 20, 21, 22 hours ($p<0.05$).

Post Operative Nausea and Vomiting

Zackova M et al. compared tramadol versus ketorolac in the treatment of post operative pain during maxillofacial surgery found vomiting was registered in more number of patients in tramadol group.

Diana Moyao Garcia et al. compared analgesic efficacy of nalbuphine versus tramadol administered through continous intravenous infusion for post operative pain control found that there was increased incidence of vomiting in tramadol group.

In our study Group T showed post-operative hausea, vomiting which is statistically significant in 1, 7, 8, 15 hous over 24 hours compared to Group K and Group N.

Total Number of Doses Requied Over 24 Hours

Total number of doses requied over 24 hours between Group T, group K and group N was found to be 3.28±0.453, 3.16±0.37, and 3.16±0.37 respectively with $p=0.23$.

Hence there was no statistically significant difference total number of doses required over 24 hours in all the 3 groups.

Cost Benefit

When cost benefit of three groups (group T, group K, group N) were compared, the cost benefit of group K is greater that group T which is greater than group N.

All the three drugs (group T, group K, group N) are equally efficacious in providing post operative analgesia. Tramadol caused significant post operative nausea and vomiting and sedation whereas Nalbuphine produced less sedatiion and did not cause vomiting when compared to tramadol. Ketorlac did not produce vomiting and significant sedation.

Conclusion

On comparing Tramadol, Ketorolac, and Nalbuphine it is found that Nalbuphine produced effective analgesia and clinically significant sedation and did not produce post-operative nausea and vomiting when compared to Tramadol and Ketorolac.

Hence it is concluded that Nalbuphine is an effective analgesic even though it is less cost effective.

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Original Research Article

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Study of 2-Chlorprocaine 1% with Adjuvants Fentanyl and Buprinorphine in Comparison with Plain 2-Chlorprocaine1% for Subarachnoid Blocks in Perianal Surgeries

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Abstract

Introduction: This study aims at comparing the anaesthesia characteristics between Buprenorphine and Fentanyl when added as an adjuvant to intrathecal 2-Chloprocaine 1% in an attempt to prolong the duration of spinal analgesia post operatively and are compared with the plain 2-Chloprocaine 1% intrathecally for perianal and perineal surgeries. *Methods:* The study was conducted on 63 patients divided into 3 groups. The control A was given 30mg (3 ml) of 2-Chloprocaine 1% with 0.5cc normal saline and study groups B and C were given 30mg (3ml) of 2-Chloprocaine 1% with 0.5cc (25µ) of Fentanyl and 0.2cc (60µ) of Buprenorphine with 0.3cc of normal saline respectively. Study included ASA I and II patients and were subjected to the following perennial and perineal surgeries like haemorrhoids, fissure-in-ano, fistula-in-ano, perianal and scrotal abscess, carcinoma rectum for rectal biopsy, hydrocele, phimosis. Standard spinal anaesthesia techniques were chosen for all patients including lateral position, midline approach with 25G quinke spinal needle. *Results:* There was no significant difference in time of onset of sensory block and motor blockade between the 3 groups and also no significant haemodynamic changes between the 3 groups. But there was a significant difference in mean total duration of analgesia and VAS score between 3 groups post operatively. *Conclusion*: The study shows that 2-Chloprocaine 1% provides an adequate block for perianal and perineal surgeries lasting 40-60 min. Addition of Buprenorphine 60µ and Fentanyl 25µ improves the quality of spinal anaesthesia and prolongs the duration of analgesia post operatively and Buprenorphine prolongation being much longer than Fentanyl.

Keywords: Adjuvants; Ambulatory Surgeries; 2-Chlorprocaine.

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Introduction

2-Chloprocaine 1% is an amino-ester local anaesthesia with a very short half-life and a favourable profile for short surgeries, approved by the Food and Drug Administration (FDA) for peripheral nerve blocks and epidural anaesthesia. It was first used for spinal anaesthesia in 1951 and has been successfully used since 1952 [1]. But due to neurological damage associated with its epidural use in1980s it never gained widespread popularity [2-4]. The drug was abandoned. Since then there was a continuous search for an ideal anaesthetic technique and an anaesthetic agent for all the short surgeries which can be taken as day care procedures. With the advent of many short acting drugs such as Remifentanyl and Propofol general anaesthesia was the preferred choice for short outpatient procedures. But the studies during those times was comparing regional with general anaesthesia with either long acting or intermediate acting local anaesthetic for spinal anaesthesia [5].

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Aims and Objectives

To study the anaesthesia characteristics ofBuprenorphine and Fentanyl when added as adjuvants to 2-Chloprocaine 1% in comparison with plain 2-Chloprocaine 1%, in terms of onset of time for sensory and motor blockage and duration of analgesia post operatively and side effects if any associated with administration of these two drugs as intrathecaladjuvants with 2-Chloprocaine 1%. This is done by comparing the effect of intrathecal 2-Chloprocaine 1% (30mg) with Fentanyl (25µ) and Buprinorphine (60µ) with that of plain 2-Chloprocaine 1% (30mg) in terms of

1. Time of onset and duration of sensory and motor blockade
2. Time to two segment sensory regression
3. Duration of effective analgesia post operatively
4. Haemodynamic changes
5. Adverse effects.

Materials and Methods

The study was conducted on 63 patients divided into 3 groups of 21 each, group A being the control group was given 30mg (3cc) of 2-Chloprocaine 1% with 0.5cc of normal saline. Group B was given 30mg (3cc) of 2-Chloprocaine 1% with 25µ of fentanyl (0.5cc) and group C was given 30mg (3cc) of 2-Chloprocaine 1% with 60µ (0.2cc) of Buprinorphine and 0.3cc of normal saline. Taking into consideration of the limited study in group B and no studies at all in group C, the study was conducted initially as a pilot study with 5 patients in each group and once the results were satisfactory it was continued in the larger size.

ASA I and II were included in the study with the exclusion criteria being history of allergy to the study drug, contraindications to the spinal block like spine abnormalities, haemorrhagic diathesis, localised skin sepsis, neurological diseases and patients with head injury, raised intracranial pressures. The selected patients were subjected to those perianal and perineal surgeries which were likely to be of the duration ranging from 20-60 mins like haemorrhoids, fissure-in-ano, fistula-in-ano, perianal abscess, scrotal abscess, hydrocele, phimosis and carcinoma rectum for biopsy. Standard anaesthetic technique including premedication at night prior to surgery, preloading the patient with Ringer Lactate prior to the spinal anaesthetic procedure and monitoring was done for all. The spinal anaesthetic drug as allocated to the groups were injected in left lateral position using 25GQuinkes needle through midline approach. The time of injection of the spinal anaesthetic drug was noted and the patient was made supine. Time of onset of the sensory and motor blockade was noted the maximum height of sensory blockade was noted. The haemodynamic parameters in terms of systolic BP , diastolic BP, mean arterial pressure, heart rate, SPO_2 were recorded at 0min (time of injection of the drug into the intrathecal space) and every 3min for the first 10min and every 10min till the completion of the surgery. Any adverse effects throughout the procedure were looked for. After the completion of surgery patient was shifted to recovery room and monitored for the time to two segment regression of sensory block, recovery of motor blockade and the time when patient complained for pain were noted down. Quality of analgesia was assessed by the maximum height of the sensory block achieved and patients comfort throughout the surgical procedure intraoperatively and VAS post operatively. Duration of sensory and motor blockade was calculated from the time of onset of sensory and motor blockade to the time to two segment regression of sensory block and recovery of motor blockade respectively. Duration of analgesia was calculated from the time of injection of study drug till the patient complained for pain.

Results and Observations

The data was entered into Microsoft excel datasheet and was analysed using SPSS 22 version software. Chi-square test was used as test of significance as test for qualitative data. Continuous data was represented as mean and SD. ANOVA (Analysis of Variance) or Kruskal Wallis test was the test of significance to identify the mean difference between more than two groups for quantitative and qualitative data respectively. p value (probability that the result is true) of < 0.05 was considered as statistically significant after assuming all the rule of statistical tests.

In Group A, mean age of subjects was 41.05± 14.30 years, 28.6% were females and 71.4% were males, 71.4% were ASA grade 1 and 28.6% were ASA grade 2, mean time of onset of sensory block was 3.81±1.99 min and mean time onset of motor blockage was 2.43 ± 0.9 min.

In Group B, mean age of subjects was 45.29±14.53 years, 33.3% were females and 66.7% were males, 62.5% were ASA grade 1 and 37.5% were ASA grade 2, mean time of onset of sensory block was

3.10±1.34 min and mean time onset of motor blockage was 2.67 ± 1.20 min.

In Group C, mean age of subjects was 37.81±9.97 years, 23.8% were females and 76.2% were males, 61.9% were ASA grade 1 and 38.1% were ASA grade 2, mean time of onset of sensory block was 3.29±1.68 min and mean time onset of motor blockage was 2.71±1.90 min.

There was no significant difference in age distribution,gender and ASA grades.

Timeof onset of Sensory Block and Motor Blockage between three groups showed no significant differences.

Also there were no significant differencesin haemodynamic parameters like Systolic BP, Diastolic BP, Mean Arterial Pressure, Heart Rate, SPO2 between the three groups at all intervals.

In the study among Group A, Group B and Group C, majority attained sensory level of T10 i.e. 52.4%, 47.6% and 57.1% respectively. There was no significant difference in Sensory level attained between three groups.

In Group A, mean total duration of surgery was 32.62±15.94 min, mean total duration of Sensory Regression by Two was 63.10±11.34 min and mean total duration of Motor Blockade was 72.90±16.37 min.

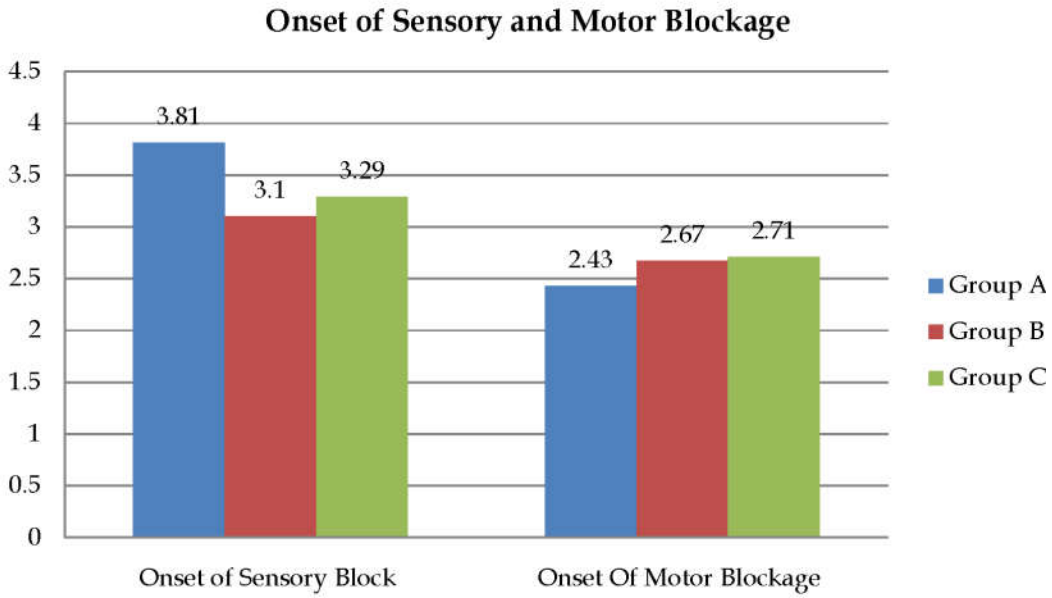

Fig. 1: Bar diagram showing Onset of Sensory and Motor Blockage between three group

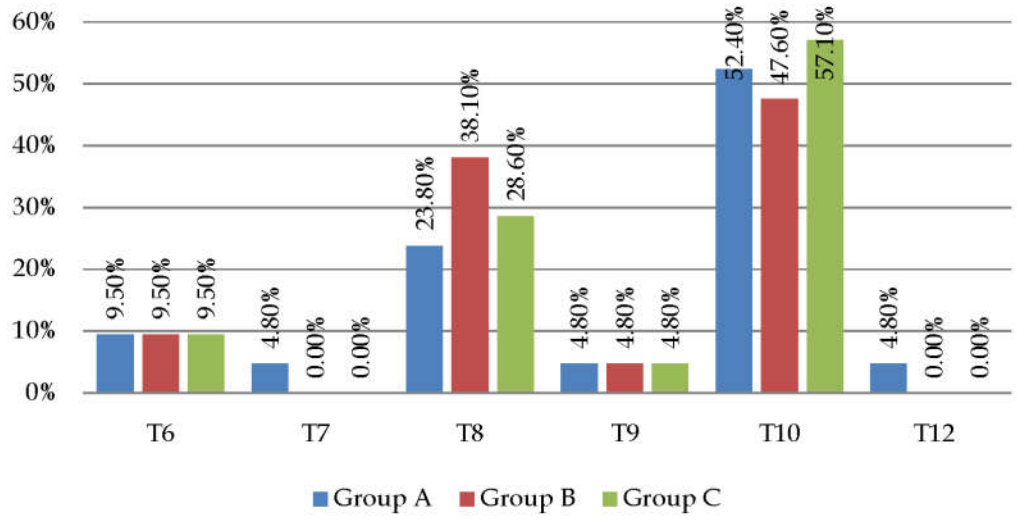

Fig. 2: Sensory level attained comparison between three groups

Table 1: Comparison of Profile of subjects between three groups

		Group A		Group B		Group C		P value
		Count	%	Count	%	Count	%	
Age (Mean ± SD)		41.05 ± 14.30		45.29 ± 14.53		37.81 ± 9.97		0.188
Sex	Female	6	28.6%	7	33.3%	5	23.8%	0.792
	Male	15	71.4%	14	66.7%	16	76.2%	
ASA Grade	1	15	71.4%	10	62.5%	13	61.9%	0.775
	2	6	28.6%	6	37.5%	8	38.1%	
Onset of Sensory Block (Mean ± SD) in min		3.81 ±1.99		3.10 ± 1.34		3.29 ± 1.68		0.372
Time Onset Of Motor Blockage (Mean ± SD) in min		2.43 ± 0.93		2.67 ± 1.20		2.71 ± 1.90		0.780

Table 2: Comparison of Durations between three groups

	Group A		Group B		Group C		P value
	Mean	SD	Mean	SD	Mean	SD	
Total Duration of Surgery	32.62	15.94	41.90	18.87	37.14	17.93	0.241
Total Duration of Sensory Regression by Two	63.10	11.34	62.52	18.06	69.33	13.81	0.256
Total Duration of Motor Blockade	72.90	16.37	69.29	15.15	69.86	13.32	0.704
Total Duration of Analgesia	96.38	17.90	109.33	33.77	123.00	42.90	0.041*
VAS Score	6.14	0.91	5.38	0.86	5.24	1.00	0.006*

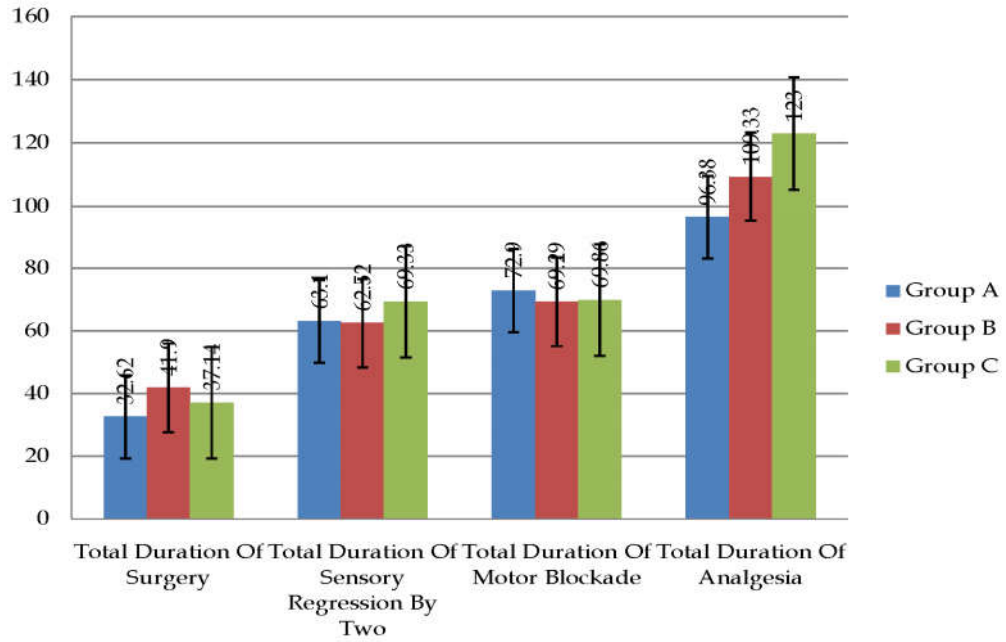

Fig. 3: Bar diagram showing Comparison of Durations between three groups

In Group B, mean total duration of surgery was 41.90±18.87 min, mean total duration of Sensory Regression by Two was 62.52±18.06 min, mean total duration of Motor Blockade was 69.29±15.15 min.

In Group C, mean total duration of surgery was 37.14±17.93 min, mean total duration of Sensory Regression by Two was 69.33±13.81 min, mean total duration of Motor Blockade was 69.86±13.32 min.There was no significant difference in mean total duration of Sensory Regression by Two and Motor Blockade between the three groups post operatively.

There was significant difference in mean total duration of Analgesia and VAS score between three groups, mean total duration of Analgesia was 96.38±17.90 min and mean VAS score was 6.14±0.91 in Group A, mean total duration of Analgesia was 109.33±33.77 min and mean VAS score was 5.38±0.86 in Group B and mean total duration of Analgesia was 123.00±42.90 min and mean VAS score was 5.38±0.86 in Group C. Median VAS score in Group A was 6, in Group B and Group C was 5.

The duration of Analgesia post operatively was more prolonged in Group C than that in Group B and Group A.

As far as adverse effects are considered, like itching, nausea, vomiting and urinary retention only one patient in group B had mild itching post operatively which was treated with antihistamines. There was no incidence of urinary retention in any of the opioid group.

Discussion

Subarachnoid Lidocaine 5% was popular for spinal anaesthesia for short surgeries lasting up to 60 mins because of its predictable duration and dense sensory and motor blockade. With development of preservative free 2-Chloprocaine 1% this drug has got an increasing popularity as an intrathecal agent for day care surgeries. 2-Chloprocaine 1% has similar onset time and rapid resolution for both sensory and motor blockage and also has advantage of decreased incidence of Transient Neurological Symptoms, which is 10-40% with Lignocaine 5% [6,7]. In comparison with long acting spinal anaesthetic like Bupivacaine 0.5%, 2-Chloprocaine 1% has a short and predictable duration of sensory block thus making it a preferred drug for day care surgeries [8].

Various dose ranges have been studied of 2-Chloprocaine 1%, ranging from 30-60mg showing minimum effective dose for surgeries of 40-60min duration is 30mg, below this dose it did not produce adequate sensory and motor blockage and also the level achieved was not sufficient to perform the surgeries comfortably [9,10]. Also various drugs such as morphine, pethidine, phenylephrine, neostigmine, ketamine, buprenorphine, fentanyl have been used as adjuvants to various local anaesthetics, but none proved ideal for this purpose [11,12,13,14].

Though 2-Chlorprocaine 1% has shown a better anaesthetic drug for short procedures like perianal surgeries with lower incidence of residual motor block and postoperative urinary retention, there are incidence of severe pain in the immediate post-operative period which needs to be taken care of in these kinds of surgeries.

Various adjuvants have been used to improve the quality of surgical block with minimum side effects to the patients and to increase the duration of analgesia post operatively. These studies are mainly comparing long acting local anaesthetics with combinations of opioids. Use of 2-Chlorprocaine 1%with opioids has been into question. There have been studies showing the antagonism of 2-Chlorprocaine 1% with epidural morphine [15] and epidural clonidine [16]. Conversely addition of fentanyl with 2-Chlorprocaine 1% found to be synergistic [17].

In his study, Kopacz studied the effect of adding fentanyl intrathecally, on the quality, duration and recovery from 2-Chlorprocaine 1% spinal anaesthesia. This was a volunteer based study with 8 volunteers.Buprenorphine is an opioid of the phenantherene morphine class with extremely high binding affinity at the μ and kappa receptors. It has partial agonist activity at μ and kappa receptor, partial or full agonist activity at delta opioid receptor and competitive antagonist activity at the k-opioid receptor. These multifaceted properties of buprenorphine has formed basis for its use intrathecally with various spinal anaesthetics in comparison with fentanyl [18]. Intrathecal buprenorphine enhances sensory blockade of the local anaesthetics without affecting the sympathetic activity. The benefits of this opioid are far more than the side effects like vomiting and nausea. It is easily available, easy to perform and most predictable drug [19]. No study has been done with the short acting 2-Chlorprocaine 1%.

A dose-ranging study using fentanyl and buprenorphine as an additive to 2-Chlorprocaine 1%, has shown that the addition of these two drugs as adjuvants this short acting local anaesthetic improves the quality of spinal anaesthesia intraoperatively in that the patient could tolerate the surgery well for upto 60-70 minutes in few of cases of haemorrhoids and multiple fistula-in-ano, where as few patients with plain 2-Chlorprocaine 1% were uncomfortable when the surgery was extended 3-5 minutes beyond 30 minutes, though the maximum sensory block achieved in all cases were same. And post operativelypatients were more comfortable in additives groups for longer periods of time with reduced VAS scores, the buprenorphine group having longer duration of post operative analgesia.

Conclusion

2-Chlorprocaine 1%, a short acting local anaesthetic with additives like fentanyl and buprenorphinecan be used safely in place of long acting spinal anaesthetic, Bupivocaine 0.5% for allshort surgical procedures and can be a drug of choice for all day care procedures. These

combinations of drugs can be used in other lower limb surgeries of short durations and lower abdominal procedures, more studies needs to be conducted.

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Conflicting Interest: None

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Original Research Article

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Role of Intraoperative Topical Application of 0.5% Bupivacaine in Tonsillar Fossa for Postopeartive Analgesia in Tonsillectomy Cases

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Abstract

Context: Tonsillectomy is the second most common surgical procedure performed in pediatric patients. Post-Tonsillectomy pain is regarded as a major morbidity in early post-operative period which delays the oral intake & discharge of patients. Topical application of Local Anesthetic like Bupivacaine at the site of trauma reduces post-operative pain resulting in early oral intake & early discharge unlike local infiltration in which complication rate is high for intravascular injection and convulsions. *Settings and Design*: Prospective randomized and comparative study of 40 ASA I and II patients of age group 6 to 15 years undergoing tonsillectomy under general anaesthesia. *Methods and Material:* Patients were divided into two groups randomly, group B (Bupivacaine group) – in which 2 cotton pledgets soaked in 0.1ml/kg of 0.5% Bupivacaine was kept in the tonsillar fossa for 5 minutes and group C (control group) which received 2 cotton pledgets soaked in 0.1ml/kg of 0.9% NaCl and kept in fossa for 5 mins. *Statistical Analysis Used*: One-way ANOVA was used for analyzing the data. For comparing binomial data like sex and ASA status, Chi square test was used. *Results*: The group with topical bupivacaine had less tonsillar fossa pain and requested post-operative analgesics very lately or not till discharge *Conclusion*: We conclude that topical application of cotton pledget soaked in 0.5% bupivacaine in tonsillar fossa for 5 minutes is effective in providing relief of post tonsillectomy pain and promote recovery.

Keywords: Post Tonsillectomy Pain; Topical 0.5% Bupivacaine; Intraoperative; Cotton Pledget; VAS Score.

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Introduction

Pain is the most significant obstacle to the rehabilitation of a patient following tonsillectomy. Despite advancement in anaesthetic and surgical techniques, the post-operative pain still remains a significant problem.Inadequate analgesia causes poor oral intake, which leads to lassitude, delayed recovery and occasionally requires overnight hospitalization in day care surgical practice. It may also prevent early return to school or work after surgery [1]. In the light of the problems associated with post-operative pain, various strategies for the management of post-tonsillectomy pain have been proposed like infiltration of local anaesthetics [2,3] non-steroidal anti-inflammatory drugs (NSAID) [4], narcotics and oral analgesics [5]. Application of sucralfate [6] as a protective barrier following tonsillectomy has been found to promote healing with significant pain

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reduction in the post-operative period. In spite of the various drugs being added to the Anaesthetist's armamentarium, post tonsillectomy pain in paediatric patients poses a real challenge to the anaesthetist. Bupivacaine is a local anaesthetic of the amide group. Because sensory nerve block is more marked than motor block, bupivacaine is especially useful in the relief of pain. Advantages of topical application of bupivacaine are no risk of intravascular injection and local anaesthetic toxicity. In our study, we have tried to show that application of local anaesthetic like bupivacaine at the site of trauma reduces post-operative pain resulting in early oral intake & early discharge.

Materials and Methods

After obtaining Institutional Ethics Committee approval and written informed parental consent,40 ASA I-II patients between 6 and 15 years of age, who were scheduled to undergo tonsillectomy were enrolled in this randomized, prospective and placebo-controlled study This is a Randomized Double blinded study conducted on 40 patients undergoing Tonsillectomy under General Anesthesia.

Inclusion Criteria

- Age group of 6-15 years,
- ASA physical status I and II patients

Exclusion Criteria

- Patients with history of acute tonsillitis within three weeks
- Bleeding diathesis
- Suspicious of malignancy,.
- Patients having history of febrile convulsion and epilepsy.
- Allergy to local anaesthetics excluded from this study.
- Patients with history of mental retardation or psychiatric illness
- Patients not willing to participate in the study.

All subjects were admitted a day before surgery. A written informed consent was obtained from their parents and they were briefed on how to score their pain on a 10-point visual analogue scale (VAS) where 0 represents no pain and 10 represents severe excruciating pain. Detailed otorhinolaryngological history and examination was carried out.The patients were randomly assigned to one of the 2 groups, group B (Bupivacaine group) and group C (control group) using the sealed envelope technique. The study medications were prepared by an anaesthesiologist who was not involved in anaesthesia management and postoperative follow-up. The anaesthesiologist who was involved in anaesthesia management and the postoperative followup, the surgeon, and the parents were all blinded.

A standardized anaesthetic protocol was followed for all patients. Atropine 0.02mg/kg and midazolam 0.1mg/kg were given intravenously as pre-medication to all patients. After giving calculated doses of propofol and atracurium, endotracheal intubation was done For Intraoperative analgesia intravenous fentanyl and paracetamol were used. Anaesthesia was maintained with sevoflurane, oxy-gen and nitrous oxide. Intravenous fluids were given as per individual requirement. Tonsillectomy was performed by sharp dissection snare technique in all the patients by the same surgeons. After securing haemostasis, both tonsillar fossae were packed with a gauze piece soaked in 3 ml of 0.5% bupivacaine solution for five minutes in Group B and group C (control group) received 2 cotton pledgets soaked in 0.1ml/kg of 0.9% NaCl kept in each fossa for 5 mins. Patients were reversed with inj. Atropine 0.02mg/kg plus inj. Neostigmine 0.05mg/kg and extubated after return of reflexes.

All the patients were asked to express the intensity of their pain on VAS (Visual Analogue Scale) at 0min(immediately after extubation), 30 minutes, 1 hour, 2 hours, 3 hours, 4 hours, 8 hours and 24 hours. The patients received suppository diclofenac sodium 2mg/kg as rescue analgesia in postoperative period.The time for first analgesic request was also noted.

Results

One-way ANOVA was used for intergroup comparisons of normally distributed data. For comparing binomial data like sex and ASA physical status, Chi square test was used. Data expressed as mean±SD. The two groups are comparable with respect to sex ratio and ASA physical status as shown in table 1. The mean age in Group B is 10±2.1yrs and in Group C 9±1.24 yrs.

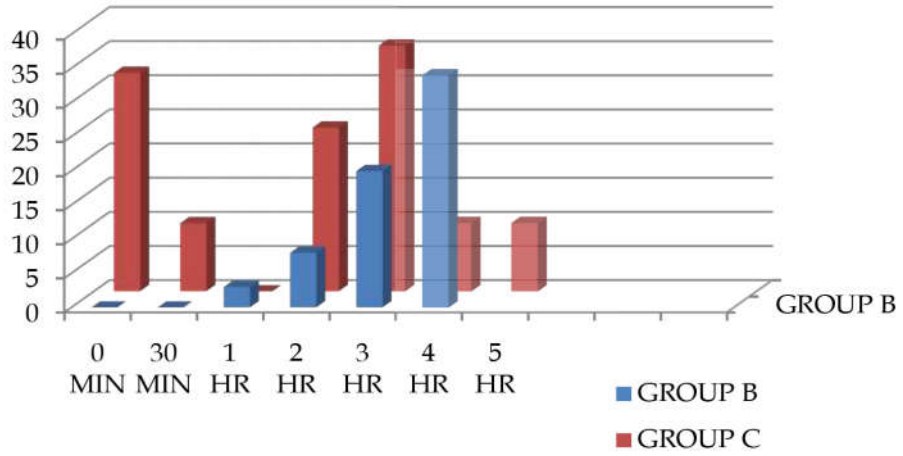
There was significant difference in the VAS scores at various time intervals,as shown in Table 2. The mean VAS scores in group C: 3.2±0.15, 1±0.24, 0±0.1, 2.4±0.25, 3.6±0.36, 1±0.5, 1±0.3, 1±0.4 where as in

Table 1: Demographic data

	Group B	Group C	p- value
Sex (M:F)	11:9	12:8	0.749
ASA status(I :II)	12:8	10:10	0.525

Table 2: VAS Scores in 2 groups

Time Interval	Group B	Group C
0 MIN	0+/-0	3.2+/-0.15
30 MIN	0+/-0.01	1+/-0.24
1 HOUR	0.3+/-0.105	0+/-0.1
2 HOURS	0.8+/-0.03	2.4+/-0.25
3 HOURS	2+/-0.05	3.6+/-0.36
4 HOURS	3.4+/-0.3	1+/-0.5



Graph 1: Showing time intervals for analgesic requirements in 2 group

group B: 0±0, 0±0.01, 0.3±0.105, 0.8±0.03, 2±0.05, 3.4±0.3, 1±0.2, 1±0.4 .

As shown in graph, there was significant difference in the time interval for analgesic requirement in the two groups with a P value of 0.000. In Group C, 32 patients required first dose of analgesia in immediate post-operative period within 30 mins, where as in Group B first dose requirement was after one hour in only 3 patients. The no: of repeated doses of analgesia is significantly less in Group B when compared to Group C.

Discussion

Pain control continues to be a challenge for tonsillectomy patients and is a leading cause of dehydration and unanticipated hospital admissions in post tonsillectomy patients especially in children. Colclasure and Graham noted a 1% readmission rate for patients undergoing tonsillectomy because of odynophagia and dehydration [7]. Anaesthesiologists and otolaryngologists have focused primarily on anaesthetic technique with maximal analgesic potential in the post-operative period.

The raw area left after tonsillectomy operation is a source of pain postoperatively through the release of certain chemicals and enzymes. The peripheral biochemical mechanism at the site of operation with arachidonic acid metabolites to mediate pain and inflammation may explain the post-tonsillectomy pain [8]. Here, local analgesic drug in our study that is bupivacaine 0. 5% proved itself to be effective in relieving post-tonsillectomy pain when applied locally. This protracted pain relief resulting by single use of bupivacaine cannot be explained by prolonged presence of the local anesthetic in the area of the surgery. An explanation for this long acting pain relief might be that the neural blockade prevents nociceptive impulses from entering the central nervous system

immediately after the surgery when applied to raw area and this suppresses formation of the sustained hyper excitable state responsible for the maintenance of post-operative pain. Local anesthetics induce the anti-nociceptive effect by acting on the nerve membrane. They can inhibit the release and action of agents like (prostaglandin, lysosomal enzymes, etc.) which sensitize and stimulate the nociceptors participating in inflammation [9]. Whether pre or post-operative topical anaesthetic or injection of bupivacaine affects the outcome has been studied by Molliex et al, who concluded that pre or post-operative timing has no clinical significance [10].

In our study we found that 0.5% bupivicaine soaked cotton pledgets kept in tonsillar fossa for 5 mins provided good postoperative analgesia. These results commensurate with study conducted by T. Hung et al. in 3-16yrs age group in Department of Otolaryngology, St George's Hospital, London, UK who concluded that topical bupivacaine soaked swabs on comparing with saline soaked swabs has a role in facilitating recovery in daycare tonsillectomy in children. They demonstrated that eating and drinking were started sooner and postoperative pain was lower at 1, 3, and 6 hours postoperatively in the case group [11]. Similar results were obtained in a study conducted by Ehsan-ul-Haq et al. in 205 patients in age group of 3 to 30yrs. In this study, right side is considered as test side and left side as control and post-operative pain was assessed on two sides separately, on VAS score [12].

Contrary to above findings, in a study done by Khan MI et al., they demonstrated that Topical application of 0.5% bupivacaine provides no significant pain relief in post-tonsillectomy patients in first 8 hours [13]. Similarly the results of another two studies suggest that topical application of bupivacaine pack in tonsillar fossa is not an effective method to reduce pain after tonsillectomy in the immediate post-operative period [14,15].

There are some studies on infiltration of bupivacaine in tonsillar fossa. We preferred topical bupivacaine application instead of local infiltration in our study because of the serious and life threatening complications associated with inadvertent intravascular bupivacaine like, cardiac arrhythmias, airway obstruction, cervical osteomyelitis, facial nerve paralysis [16], Horner's syndrome [17] and vocal cord paralysis [18].

Many other drugs have been studied for topical application in tonsillar fossa. In one study by Akbay et al. that investigated the analgesic efficacy of topical tramadol in the control of postoperative pain in children after tonsillectomy, they concluded that topical 5% tramadol with its local anesthetic effect seems to be an easy, safe, and comfortable approach for pain management in children undergoing tonsillectomy [19]. Similarly, topical ropivaicaine has been studied by Hanna Kaisa Tolska et al., for post tonsillectomy pain relief [20].

Finally the evaluation of pain was carried out on VAS as it is deemed one of the most accurate and reproducible pain scales. Although validated for children as young as 3 years, the VAS scale for pain can be confusing for children to use. No complication occurred in this study due to use of bupivacaine.

Conclusion

Tonsillectomy is a very common day care procedure that is associated with significant postoperative pain, which leads to delay in oral intake of patients, resulting in dehydration, extended stays and increased costs. Topical Application of Bupivacaine to the tonsillar fossa reduces post-tonsillectomy pain and facilitates faster initiation of feeding and decreasing hospital stay, thereby decreasing psychological and financial burden over the family.

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Original Research Article

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Comparison of Mannitol, Hypertonic Saline and Mannitol + Hypertonic Saline Combination for Brain Relaxation during Craniotomy

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Abstract

Background: Hyperosmolar solutions are most commonly used to relax brain and facilitate intracranial surgery. This study was planned to compare the effects of three equiosmolar, equivolemic solutions (mannitol, 3% hypertonic saline, and mannitol+3% hypertonic saline) on intraoperative brain relaxation. *Material and Methods:* This prospective randomized study was conducted in 90 patients of age group 18-65 years with traumatic brain injury undergoing craniotomy only after approval from the institutional ethics committee. Patients were randomly allocated into three groups; Group M (received mannitol 300 ml), GROUP S (Group received 3% Hypertonic Saline 300 ml), and GROUP M+S (received mannitol 150 ml and 3% Hypertonic Saline 150 ml). Brain relaxation score was assessed by neurosurgeon on a four point scale as perfectly relaxed-1, satisfactorily relaxed-2, firm brain-3, bulging brain-4. All the patients were assessed for Glasgow coma score at 24 hrs postoperatively and at the time of discharge from the intensive care unit. *Results:* Grade 1 and Grade 2 brain relaxation scores were 4/14, 4/16 and 8/12 in Group M, Group S and Group M+S respectively. ($p>0.05$) Total urine out was 1453.33±376.68 ml in group M, 823.33±238.43 ml in group S and 1313.33±156.96 ml in group M+S respectively. ($p<0.001$) There was non-significant rise and fall of electrolyte (Na^+ and K^+) level amongst the groups. Additional rescue dose of mannitol was required in all three groups in 12, 8 and 10 patients respectively. *Conclusion:* All three hyperosmolar solutions are equally effective in providing adequate intraoperative brain relaxation during decompressive craniotomy in traumatic brain injury.

Keywords: Hyperosmolar Solutions; Brain Relaxation; Hypertonic Saline; Mannitol Traumatic Brain Injury.

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Introduction

Brain injury has been one of the commonest injuries associated with trauma and also the most devastating types of injury affecting all age patients; which is the leading cause of death worldwide [1]. Most of the traumatic brain injury (TBI) patients require large volume fluid replacement because TBI with hypotension have multi system trauma. Fluids like Ringer Lactate (RL) which are hypo-osmotic should be avoided as they can cause cerebral edema while isotonic sodium chloride can lead to hyperchloraemic metabolic acidosis [2]. Hyperosmolar solutions are most commonly used to relax brain and facilitate intracranial surgery. Mannitol has been the agent of choice for treatment of increased intracranial pressure (ICP), as being hyperosmolar, it reduces ICP by withdrawing water from the brain parenchyma to the intravascular tissue with intact blood brain barrier (BBB). It further decreases ICP by decreasing the rate of formation of CSF thus decreasing CSF volume. Most

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common and serious side effects of mannitol are intravascular volume depletion, hyponatremia, rebound ICP elevation and renal failure [3,4]. Hypertonic saline (HS) has been considered as an attractive alternate to mannitol for satisfactory brain relaxation and decrease in ICP [5]. Brain trauma foundation guidelines recommend HS, when mannitol fails to reduce ICP [6]. As compared to mannitol, HS also has beneficial effects like maintainance of cardiac output, mean arterial pressure and thus reduction of extravascular lung volume, leading to improved gas exchange [7]. Compared to mannitol rebound phenomenon is less common with HS administration because the co-efficient to penetrate the BBB in HS is higher than mannitol [8]. It has also been used for a long time for haemodynamic resuscitation in states of shock secondary to trauma, gastrointestinal haemorrhage, burns and sepsis [9]. HS can be used in various concentrations (1.8-30%) with varying osmolar loads and reduces ICP by creating osmotic gradient and decreasing blood viscosity leading to cerebral vasoconstriction. It has been used either alone or in combination with hyperosmotic agents [10,11]. Many studies have been conducted to compare the effect of HS and mannitol [3,12-15] but not a single study was found on literature search which has compared (mannitol+HS) equivolemic combination to HS or Mannitol. So this study was planned to compare the effects of three equiosmolar, equivolemic solutions (mannitol, 3% hypertonic saline, and mannitol+3% hypertonic saline) on intraoperative brain relaxation and postoperative outcome in traumatic brain injury.

Material and Methods

This prospective randomized study was conducted in tertiary care teaching hospital only after approval from the institutional ethics committee. Total 90 patients of age group 18-65 years with traumatic brain injury undergoing craniotomy were enrolled after taking written informed consent. Patients with electrolyte imbalance, severe cardiac, renal, respiratory diseases, traumatic brain injury with extradural hematoma, any other injury causing hemodynamic instability, large intracranial haemorrhage which itself cause massive brain bulge were excluded out. Patients were randomly allocated into three groups by computer generated random number table, according to the dose and type of hyperosmolar agent used:-

GROUP M: Group receiving mannitol 300 ml

GROUP S: Group receiving 3% Hypertonic Saline 300 ml

GROUP M+S: Group receiving mannitol 150 ml and 3% Hypertonic Saline 150 ml

All the patients were preoperatively assessed for vitals, Glasgow Coma Score (GCS), arterial blood gases including electrolytes and CT scan finding. In the operation room, standard monitoring including electrocardiogram (ECG), non-invasive blood pressure (NIBP) and pulse oximeter were attached and baseline heart rate (HR), NIBP and SPO_2 reading were recorded. Patients were preloaded with 500ml of balanced salt solution and that was used for intraoperative fluid management. After preoxygenation, general anesthesia was induced with 2mcg/kg fentanyl and 2mg/kg propofol. Muscle relaxation was achieved by 0.9mg/kg rocuronium. Intraoperatively anesthesia was maintained using oxygen-air mixture (50:50) with 50mcg-100mcg/kg/min propofol infusion. Fentanyl and vecuronium for intraoperative analgesia and muscle relaxation was used. Mechanical ventilation was adjusted to maintain $EtCO_2$ at 30+2mmHg. HR and blood pressure was kept within 20% of the baseline value. Balanced salt solution was used as a maintainence fluid at 3ml/kg/hr with additional replacement for urine output and blood loss.

At the time of scalp incision, patient received study drug as per randomization over a period of 15 min for intraoperative brain relaxation. Hemodynamic variables were recorded before induction (T_0), then regularly at an interval of 15 min for 1st hour then ½ hourly introperatively. Serum electrolytes was recorded preoperatively (T_0), after the infusion of study drug (T_i), immediately (T_c) and 24 hour (T_{24}) after the completion of surgery. Urine output was recorded hourly. Details of fluid input, blood loss and blood transfused were noted. Brain relaxation was assessed by neurosurgeon on a four point scale as perfectly relaxed-1, satisfactorily relaxed-2, firm brain-3, bulging brain-4. If the respective gradings were assessed as 3,4 (surgeon), an additional 2.5ml/kg dose of mannitol was given and hyperventilation to decrease EtCO2 to 25mmHg. At the end of surgery, patients were either extubated or shifted to neurosurgical intensive care unit for elective mechanical ventilation. All the patients were assessed for GCS at 24 hrs postoperatively and at the time of discharge from the intensive care unit (ICU). Total duration of stay in ICU was also noted.

ANOVA and paired student 't' test were used for analysis of hemodynamic and laboratory variables. Difference between the groups was analyzed using Chi-Square test. $p<0.05$ was considered significant.

Results

Demographically all the patients in each group were having similar characteristics. There was no significant difference in mean age, sex, preoperative GCS, preoperative serum electrolytes and duration of surgery among the three groups. [Table 1,2].

Total urine out was 1453.33±376.68 ml in group M, 823.33±238.43 ml in group S and 1313.33±156.96 ml in group M+S respectively. It was significantly less in group S. ($p<0.001$) Total blood loss was significantly more in group S (746.67±348.13 ml) as compared to group M (576.67±238.43 ml) and group M+S (563.33±171.92 ml). ($p<0.05$).

There was no significant difference in patients with grade 1 and grade 2 (which was acceptable to neurosurgeon) brain relaxation. These scores were 4/14, 4/16 and 8/12 in Group M, Group S and Group M+S respectively. ($p>0.05$). Additional rescue dose of mannitol was required in all three groups in 12, 8 and 10 patients respectively [Table 1].

There was slight rise in serum sodium levels in both the groups S and M+S after the infusion of study drug though this increase in serum sodium levels were statistically not significant ($p>0.05$). This rise was transient which returned near baseline values on completion of surgery in both the groups. In group M, there was slight non-significant decrease in sodium levels immediately after the infusion of study drugs which persisted upto 24 hours postoperatively [Figure 1].

Potassium levels decreased after the infusion of study drug in groups M and M+S, though this decrease was not statistically significant ($p>0.05$). However there was a slight rise in potassium levels in group S but this rise was also not statistically significant [Figure 2].

The mean length of stay in the ICU in groups M, S, M+S was 5.73±2.18, 5.46±1.89 and 5.00±2.10 days respectively ($p>0.05$). In present study, mortality was not found in any group during ICU stay. There was no difference in the mean baseline GCS, mean GCS at 24 hours postoperatively and mean GCS at the time of discharge from the ICU among the three groups. Mean GCS score was significantly improved in group S from preoperative 9.53±3.15 to 11.13±2.03 at the time of discharge. ($p<0.05$) [Table 2].

Table 1: Comparison of demographic data, surgery data, anaesthesia data and brain relaxation score in all the three groups

	Group M (n=30)	Group S (n=30)	Group M+S (n=30)	P value
Age (yrs) (Mean ±SD)	35.27±9.76	35.53±9.13	36±5.91	0.05
Sex (M/F ratio)	28/2	28/2	26/4	0.05
Duration of Surgery(min) (Mean ±SD)	150±20.59	145±21.09	153.33±20.05	0.05
Total Urine output(ml) Mean ±SD	1453.33±376.68	823.33±238.43	1313.33±156.96	**0.001***
Total Fluid intake (ml) Mean ±SD	2530±419.28	2440±232.08	2612.67±257.38	0.05
Total Blood Loss (ml) Mean ±SD	576.67±238.43	746.67±348.13	563.33±171.92	**0.05***
Rescue dose of mannitol required (number of patients)	12	8	10	0.05
Brain relaxation (number of patients) excellent/satisfactory/firm/bulging	4/14/10/2	4/16/6/4	8/12/6/4	0.05
ICU Stay (Days) Mean ±SD	5.73±2.18	5.46±1.89	5.00±2.10	0.05

*significant

Table 2: Comparison of preoperative GCS, after 24 hr, at discharge

	GCS score			P value
	Pre-operative	After 24 hr	At discharge	
Group M (n=30)	9.8±3.41	9.87±3.19	10.60±3.08	0.05
Group S (n=30)	9.53±3.15	9.53±2.50	11.13±2.03	**0.05***
Group M+S (n=30)	10.07±2.24	10.27±1.98	11.27±1.91	0.05

*significant

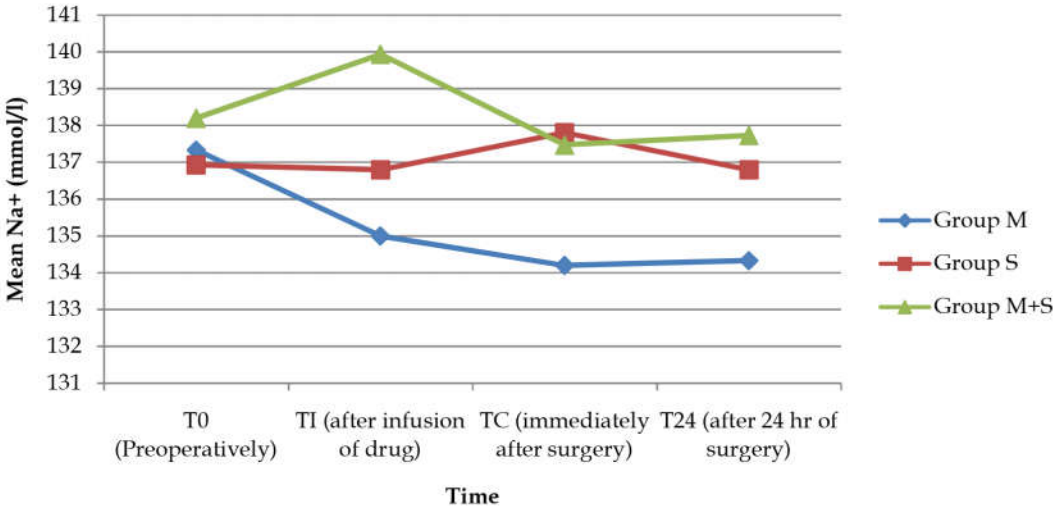

Fig. 1: Mean Na+ level in all the three groups

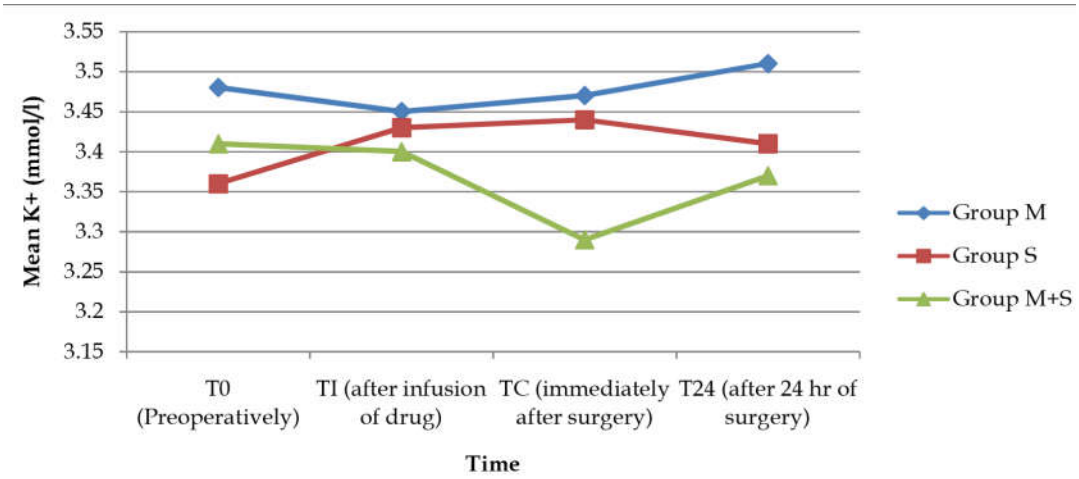

Fig. 2: Mean K+ level in all the three groups

Discussion

Mannitol has been used since long for brain relaxation as a standard hyperosmotic agent.[16] Equiosmolar dose of both mannitol and hypertonic saline were found effective in providing brain relaxation in many studies. Osmotic gradient induced shift of extravascular to intravascular water across the blood brain barrier is the main mechanism of action of both the solutions [17]. Mannitol has more prominent effect on urine output as diuretic action and hypertonic saline has more action on electrolyte. In view of that present study has compared combination of equiosmolar and equivolumic solutions (mannitol + HS) with either of that for brain relaxation.

In present study there was no significance difference between all the groups for intraoperative brain relaxation. These results were similar to other studies which have also compared equiosmolar and equivolemic solutions 20% mannitol versus 3% HS for intraoperative brain relaxation during aneurysm surgery and found no significant difference in brain relaxation between both the groups [3,12]. Various other studies have reported hypertonic saline group more effective than mannitol group [13-15]. This difference could be due that these studies had used non-equiosmolar and unequal volume of hyperosmotic solutions.

Numbers of patients requiring rescue doses of mannitol were similar in all the groups. Other studies have also found similar results with no significance difference of rescue dose of mannitol [3,12]. This could be due to equiosmolar concentrations of hyperosmolar solutions.

Mannitol has been reported hypokalemia and HS has reported hypernatremia in various studies [3,12].

But present study found non-significant rise and fall of electrolyte (Na+ and K+) level amongst the groups. Total urine out was found significantly more in mannitol group. This could be due to the more diuretic action of mannitol as compared to hypertonic saline [17].

There was no death in present study in any of the group and difference between duration of ICU stay was also non-significant amongst all the groups. Mean GCS was improved from the base line value in all the three groups but it was significantly improved in group S only at the time of discharge. Wu et al also found non-significant difference in duration of ICU stay among the groups [13]. This could be due that HS causes more decrease in intracranial pressure and with more hemodynamic stability which improve brain swelling and cerebral perfusion and attenuate the progression of secondary brain injury [18]. This is the first type of randomized study which has compared the effect of equiosmolar and equivolemic solutions of HS, mannitol and mannitol+HS on intraoperative brain relaxation.

Conclusion

The present study concludes that all the three hyperosmolar solutions are equally effective in providing adequate intraoperative brain relaxation during decompressive craniotomy in traumatic brain injury because there was no significant difference when equivolemic and equiosmolar solution of either mannitol or HS or when used in combination.

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Original Research Article

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Comparison of Postoperative Analgesic Effect of Ropivacaine Hydrochloride with Bupivacaine Hydrochloride in Transversus Abdominis Plane Block after Total Abdominal Hysterectomy

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Abstract

Background and Aims: Total abdominal hysterectomy (TAH) is one of the commonly performed major surgical procedures resulting in substantial postoperative pain and discomfort. Hence, the study was carried out to compare the postoperative analgesic effect of Ropivacaine hydrochloride with Bupivacaine hydrochloride in transversus abdominis plane (TAP) block after total abdominal hysterectomy (TAH). The primary objective was to compare the post operative analgesic duration and secondary objective was comparing the hemodynamic parameters, nausea and sedation score. *Methods:* The Prospective, double blind and randomized comparative trial was conducted in 60 ASA physical status I and II patients scheduled for elective total abdominal hysterectomy. Patients were randomly divided into two group R and group B and they were given TAP block by 'double pop off ' technique with Ropivacaine and Bupivacaine respectively. Heart rate, systolic and diastolic blood pressure, NRS NRS nausea and sedation score were measured. Data was analysed with Mann Whitney U Test and Chi square test. *Results:* Haemodynamic variables like heart rate, systolic and diastolic blood pressure does not show significant difference with p value > 0.05. Time for rescue analgesia was significantly higher in patients with group B when compared with group R with p value of < 0.001. Nausea and Sedation score also remains normal without any significant changes with p value > 0.05. *Conclusion:* Bupivacaine hydrochloride gave longer duration of postoperative analgesia compared with Ropivacaine hydrochloride and there is no significant differences in hemodynamic variables, nausea and sedation score.

Keywords: Ropivacaine; Bupivacaine; Transversus Plane Block; Total Abdominal Hysterectomy.

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Introduction

Total abdominal hysterectomy (TAH) is one of the commonly performed major surgical procedures resulting in substantial postoperative pain and discomfort. The abdominal wall sensory afferents course through the transversus abdominis (neuro fascial) plane superficial to the transversus abdominis muscle. Drugs administered through epidural catheter have been used for postoperative pain relief in TAH. Behar and his colleagues published the first report on the epidural use of morphine for the treatment of pain in 1979 [1]. Use of epidural opioids for postoperative pain relief has the disadvantage of hemodynamic instability, motor blockade and respiratory depression [2].

Alternative approaches to control postoperative pain like TAP block have been tried in recent years [3]. These simple but often overlooked blocks can offer several advantages like excellent postoperative

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analgesia, decrease opioid requirements, allow patients to breathe and cough more comfortably. They also facilitate early mobilization and discharge, significantly improving the patient's quality of life postoperatively [4].

TAP block involves deposition of local anesthetic agent into the fascial plane superficial to the transversus abdominis muscle with achieving a block from T7 to L1 blocking anterior intercostal nerve T7 to T11, subcostal nerve, ilioinguinal nerve, iliohypogastric nerve. Hence the block was found to be suitable for use in midline laparotomy surgeries like TAH [4,5]. Ropivacaine HCl [4] and Bupivacaine HCl [5] are amide group of local anesthetics and ropivacaine was introduced into clinical anesthesia as an alternative to bupivacaine because of latter's association with cardiac toxicity.

Though the usage of both ropivacaine HCl and bupivacaine HCl in TAP block has been studied separately for postoperative analgesia, till now no literature compared the effect of above two local anesthetics in TAH. Hence, this study was carried out to compare the postoperative analgesic effect of ropivacaine hydrochloride with bupivacaine hydrochloride in TAP block after TAH.

Material and Methods

This Prospective, double blind and randomized comparative trial was conducted after obtaining approval from the Institutional Ethics Committee and written informed consent from patients. 60 ASA physical status I and II patients scheduled for elective total abdominal hysterectomy were enrolled for the study.

Inclusion Criteria

Patients of ASA status I and II

Patients posted for elective total abdominal hysterectomy.

Exclusion Criteria

1. Pre-existing coagulation disorders.
2. Morbid obesity
3. Local infection at the site of block
4. Allergy to Ropivacaine HCl or Bupivacaine HCl.

After a thorough pre-operative evaluation, patients were randomly divided into two groups,

Group R: TAP block with Ropivacaine HCl.

Group B: TAP block with Bupivacaine HCl.

The allocation sequence was generated by a random number table and group allocation was concealed in sealed opaque envelope. The patient, the anesthesiologist administering the block and the one involved in postoperative observation of the patient were blinded to the drug being administered. All the patients received standardized general anesthesia as per the institute protocols. Standard monitoring includes non-invasive blood pressure monitoring, oxygen saturation, electrocardiogram and end tidal carbon dioxide. Baseline parameters (heart rate, systolic and diastolic blood pressure, SpO_2) were recorded. After premedication with inj. Midazolam 1 mg, anesthesia was induced with Propofol 2mg/kg and inj. Fentanyl 2 µg/kg. Neuromuscular blockade was achieved with inj. Vecuronium 0.1 mg/kg and trachea was intubated using appropriate sized cuffed endotracheal tube. Anesthesia was maintained with Isoflurane as inhalational agent and intermittent boluses of inj. Vecuronium. Intraoperative analgesia was provided with inj. Fentanyl 0.5 µg/kg repeated every hourly. Intravenous Paracetamol 1 gm was given 30 minutes prior to the reversal of neuromuscular blockade. The TAP block was performed bilaterally after conclusion of surgery using 'double pop off ' technique. The Triangle of Petit was identified above the pelvic rim in the midaxillary line. The puncture site was just above the iliac crest and just posterior to the midaxillary line within the triangle of petit. A needle was inserted perpendicular to the skin and a give or pop to the skin is felt when the needle passes through the fascial extensions of the internal oblique muscle. Further advancement with the second pop indicates that the needle has advanced into the fascial plane above transversus abdominis muscle. After aspiration, the test drug was injected bilaterally. Patients in group B received 0.8 ml/kg body weight of 0.25% Bupivacaine HCl divided equally on each side (total dose less than 2mg/kg) and group R received 0.8 ml/kg body weight of 0.25% Ropivacaine HCl divided equally on each side (total dose less than 2 mg/kg). After performing the block, trachea was extubated after administering neuromuscular block reversal and the patients were shifted to PACU. All the patients received inj. Paracetamol 1 gm every 6 hours. Pain intensity was assessed by the numerical rating scale (NRS: 0, no pain; 10, worst pain imaginable) at arrival in the recovery room (time 0) and 1, 2, 3, 6, 12 and 24 hours post operatively. Every assessment of NRS was performed by a blinded interviewer, and pain was scored under two

conditions: at rest (NRSr) and at movement knee flexion (NRSm).

Nausea was measured using a categorical scoring system (none = 0; mild = 1; moderate = 2; severe = 3). Sedation scores was assigned by the investigator using University of Michigan Sedation Scale (UMSS)

0- Awake and Alert

1- Minimally sedated: tired/sleepy, appropriate response to verbal conversation and/or sound,

2- Moderately sedated: somnolent/sleeping, easily aroused with light tactile stimulation or a simple verbal command

3- Deeply sedated: deep sleep, arousable only with significant physical stimulation,

4- Unarousable.

Primary outcome was the time for first rescue analgesia. Secondary outcome was the postoperative pain at rest and movement (knee flexion) as evaluated by Numeral Rating Scale (NRS), variation in hemodynamics in relation to HR, SBP and DBP, postoperative nausea and sedation score. Rescue analgesia with Inj. Tramadol 1mg/kg was given when the NRS score is > 4. The patient was deemed to have nauseated or sedated if they had a nausea or sedation score>0. Antiemetics in the form of Ondansetron 4 mg was given if patient has nausea score > 0. Pulse, blood pressure were recorded at each study interval. Any complications in terms of local anesthetic toxicity were also noted. The result was analysed with SPSS16. A p value < 0.05 was considered significant. Duration of analgesia was analysed by Student´s T test. NRS scores, with paired comparisons at each time interval, was performed using the T test or Mann Whitney U test, as appropriate. Categorical test was assessed using Chi square or Fischer´s exact test.

Results

After obtaining approval from institutional ethics committee, 60 ASA physical status I and II patients who were posted for elective total abdominal hysterectomy were selected and randomly divided into two groups B and R. both the groups were comparable according to age and weight (Table 1 and 2) On comparing the postoperative analgesic duration, patients in group B showed mean analgesic duration of 4.52 hours with maximum duration of 8.15 hours and minimum duration of 3.45 hours while patients in R group showed mean analgesic duration of 3.2 hours with maximum and minimum duration of 6 hours and 2.3 hours respectively and their differences are statistically significant with P value of 0.001 as shown in TABLE 3. On comparing the numeral rating scale at rest (Figure 1) and movement (Figure 2), there was no significant difference noted in both the groups at 1st, 2nd, 3rd and 6th hours with p value of > 0.05. Comparison

Table 1: Comparison of age in both groups

Age Groups	Broup B		Group R		Pvalue
	Frequency	%	Frequency	%	
21-30yrs	2	6.7%	2	6.7%	0.381
31-40yrs	15	50.0%	9	30.0%	
41-50yrs	12	40.0%	16	53.3%	
>50yrs	1	3.3%	3	10.0%	
Total	30	100%	30	100%	
Mean±SD	40.93±6.34		43.60±7.38		0.139

Table 2: Comparison of weight in Both Groups

Weight(kg)	Mean ± SD	P Value
GroupB	59.63±7.61	0.839
GroupR	59.27±6.26	

Table 3: Postoperative analgesic duration

	GroupB Mean±SD	GroupR Mean±SD	P value
Duration(Hrs)	4.52±1.74	3.20±0.87	0.001

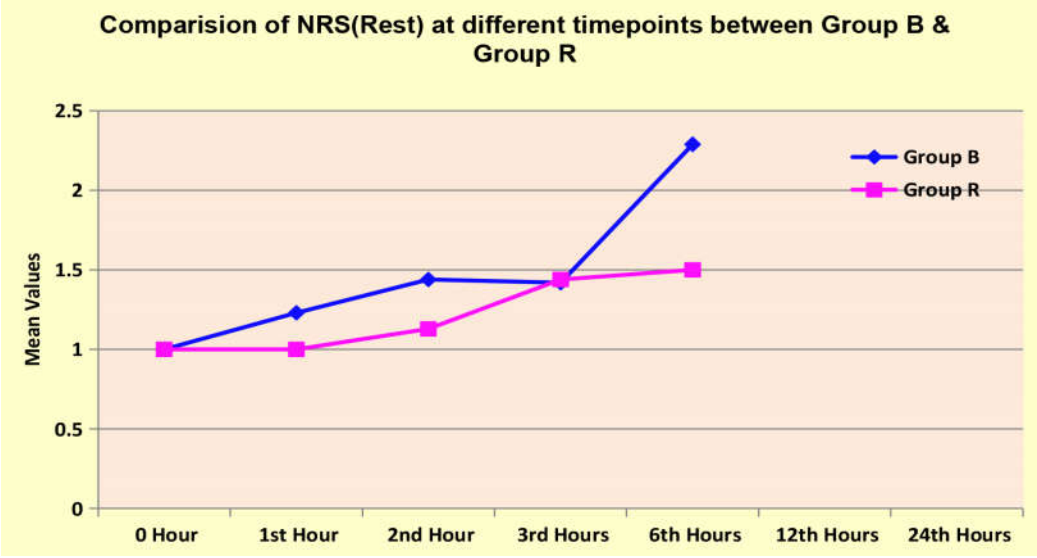


Fig. 1:

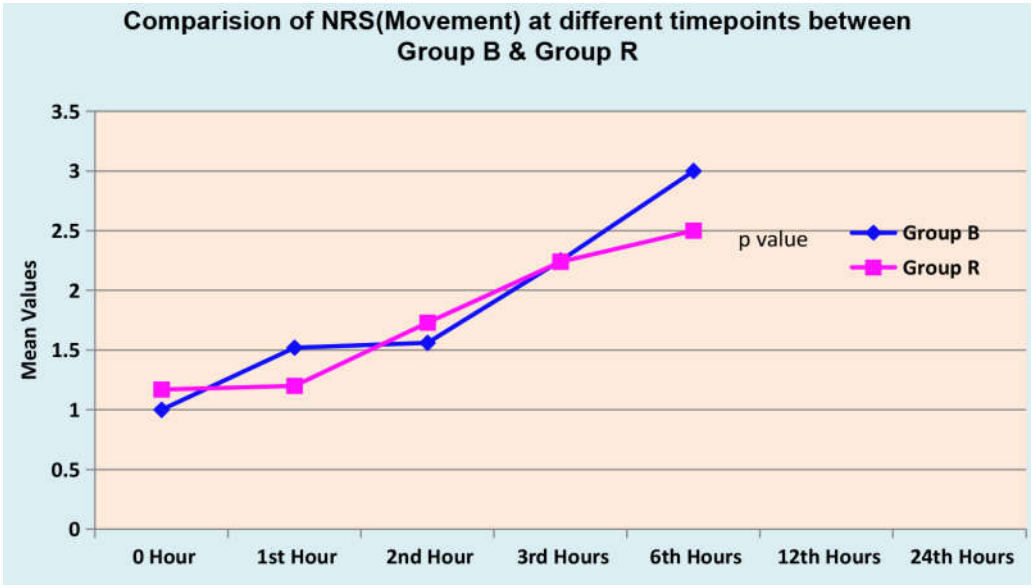


Fig. 2:

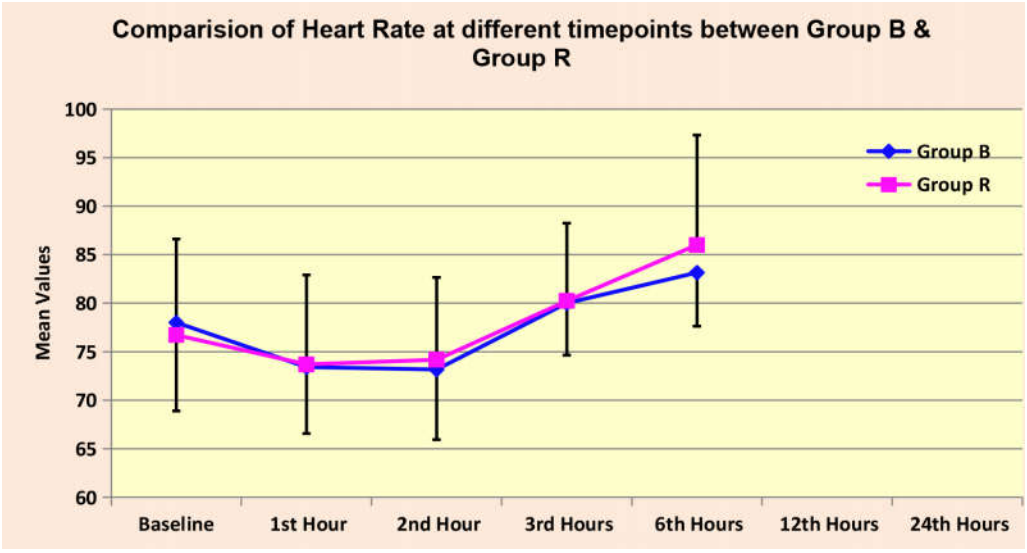


Fig. 3:

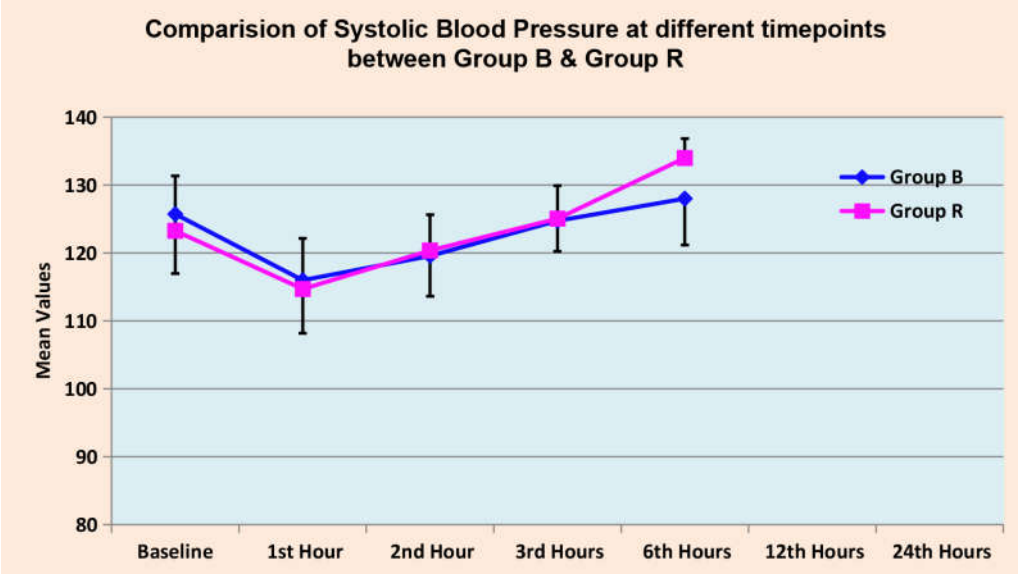
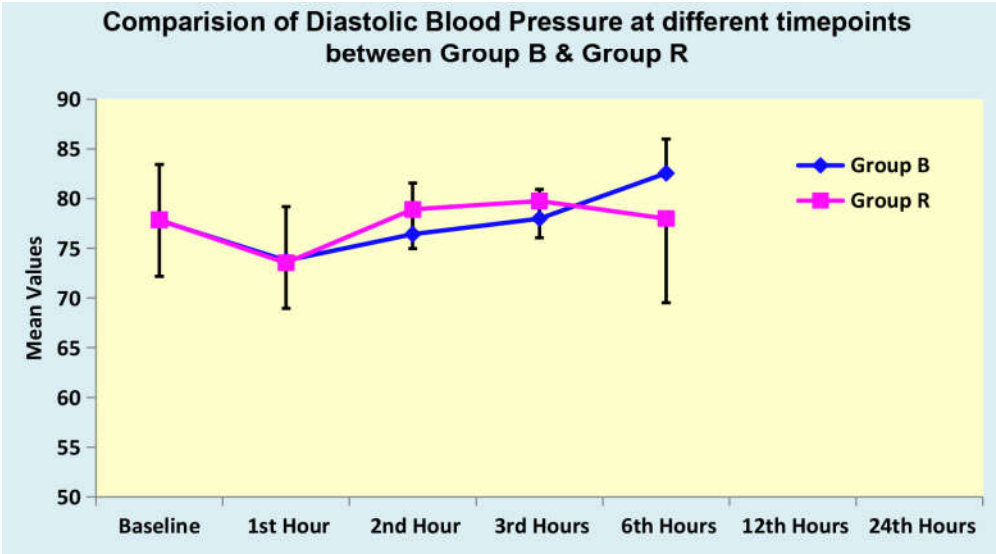


Fig. 4:



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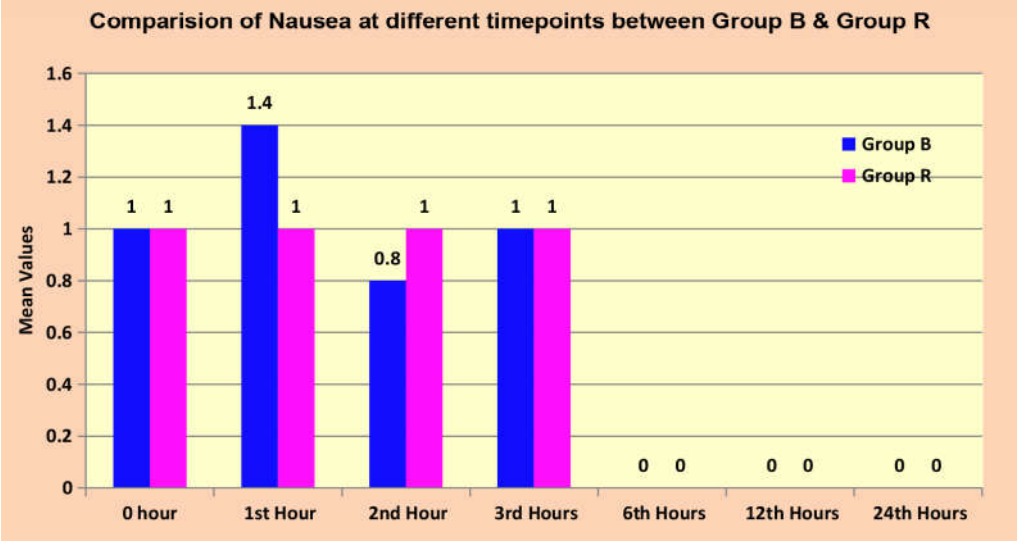

Fig. 6:

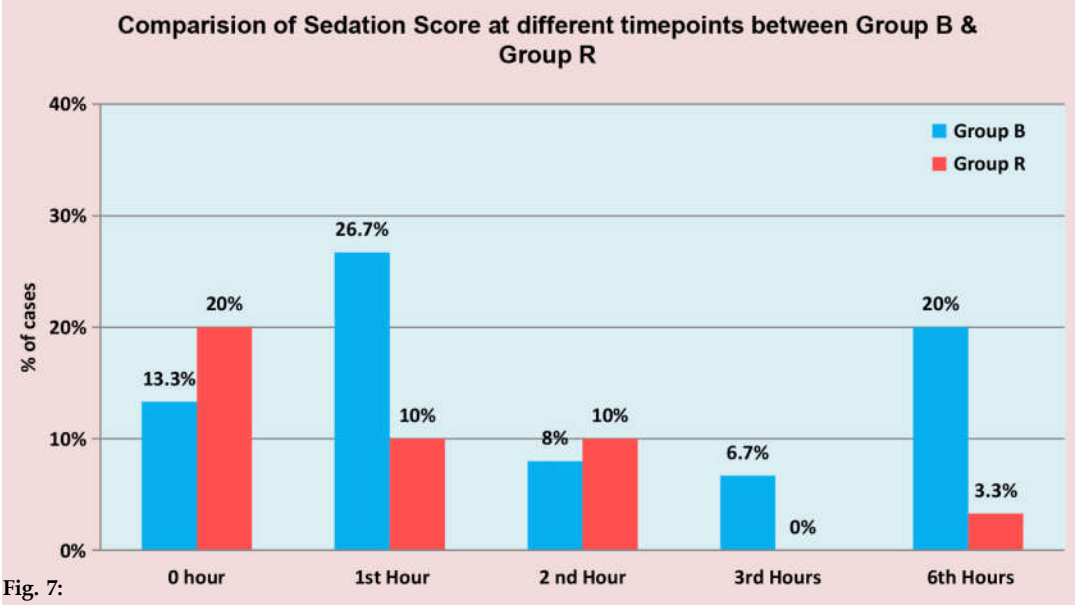

Fig. 7:

of heart rate, systolic blood pressure, diastolic blood pressure, nausea score and sedation score has been shown in Figure 3,4,5,6,7 respectively.

Discussion

Management of postoperative pain relieve suffering and leads to earlier mobilization, shortened hospital stay, reduced hospital costs, and increased patient satisfaction. Pain control regimens should not be standardized; rather, they should be tailored to the needs of the individual patient, taking into account medical, psychological, and physical condition; age; level of fear or anxiety; surgical procedure; personal preference; and response to agents given. The major goal in the management of postoperative pain is minimizing the dose of medications to lessen side effects while still providing adequate analgesia. Various analgesic modalities have been tried for total abdominal hysterectomy like administering narcotics [1] nonsteroidal anti-inflammatory drugs [6] local anesthetics injected through epidural catheter [7] patient controlled anesthesia with opioids and blocks of anterior abdominal wall like transversus abdominis plane block [3,4,5].

Anti-inflammatory agents [5] (nonsteroidal anti-inflammatory agents) can reduce inflammatory response to tissue injury, thus indirectly decreasing pain receptor activation however it has its own side effects like bleeding, gastric ulcers. Postoperative pain therapy has traditionally used a single-agent narcotic to bind Mu-binding sites in the central nervous system such as in the posterior amygdala, hypothalamus, thalamus, caudate nucleus, putamen, and certain cortical areas. Analgesic effectiveness of several opioids administered via PCA has been evaluated. Morphine and Pethidine administered via PCA for postoperative pain have been shown to provide effective analgesia. However opioids has some disadvantages like respiratory depression [2] hemodynamic instability. Local anesthetic via epidural [7] has been shown to be effective in pain relief and may offer an advantage in improved gastrointestinal motility compared with opioid-based analgesia. However epidural anesthetic fails to control abdominal hysterectomy pain because the postoperative pain impulses are transmitted in multiple pathways of which not all are effectively blocked by epidural anesthesia. Hence current practice is moving toward an approach that uses multiple agents acting at various sites of the pain. This approach synergizes different pain medications, augmenting pain control properties and reducing potential adverse effects. In our study, in patients undergoing total abdominal hysterectomy, multimodal analgesia isgiven to block nociceptive pain transmission from skin incision and abdominal and pelvic viscera. Somatic pain from abdominal wall incision was proposed to be taken care by TAP block and visceral pain was relieved with inj. Paracetamol given 6 hourly. Transversus Abdominis Plane Block has been demonstrated to provide excellent analgesia to the skin and musculature of the anterior abdominal wall in patients undergoing colonic resection

surgery [8] involving a midline abdominal wall incision, patients undergoing cesarean delivery [9] and patients undergoing radical prostatectomy [10]. There are two methods of localizing the transversus abdominis plane with a needle: the 'double pop off' technique and the USG technique. In the double-pop technique, an anatomical area called the Triangle of Petit [3] is located by palpation. This triangle lies adjacent to the iliac crest in the flank. A needle introduced perpendicular to the skin, into the triangle will provide a sensation of 'pops' or alterations in resistance as it passes through the layers of tissue, and by deduction the needle tip will be appropriately sited in the correct plane. Local anesthetics is then injected via the needle in this plane [4,5]. Theusefulness of TAP block has been well established when used as a part of multimodalanalgesia in total abdominal hysterectomy. Bupivacaine HCl and Ropivacaine HCl, both amide group of local anesthetics produce anesthesia by inhibiting excitation of nerve endings or by blocking conduction in peripheral nerves.

Various drugs like bupivacaine [5] ropivacaine [4] levobupivacaine [11] have been used during TAP block. In current clinical practice there is a need for local anesthetics whose action is long lasting and which present low systemic uptake to minimize any toxic side effects. Intoxication with local anesthetics may induce cardiac arrhythmias by interaction with ion channels Ropivacaine is an amide local anaesthetic agent and first produced as a pure enantiomer and has been introduced into clinical anesthesia as a safer alternative to bupivacaine, which is associated with a relatively high risk of cardiac arrhythmias. Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres, resulting in a relatively reduced motor blockade. Thus, ropivacaine has a greater degree of motor sensory differentiation, which could be useful when motor blockade is undesirable. Though ropivacaine was found to have faster onset of action, it has major disadvantage of having shorter duration of action. The reduced lipophilicity is also associated with decreased potential for central nervous system toxicity and cardiotoxicity [12].

Hence it may be a preferred option because of its reduced central nervous system and cardiotoxic potential and its lower propensity for motor block. In our study, the mean duration of analgesia with ropivacaine was 3.2 hours with maximum duration of 6 hours and minimum duration of 2.3 hours while in bupivacaine group, mean duration of analgesia was 4.52 hours with maximum duration of 8.15 hours and minimum duration of 3.45 hours. The difference is statistically significant. Cuvillon et al. [13] compared the efficacy of bupivacaine and ropivacaine in femoral and sciatic nerve blocks and they concluded that ropivacaine tends to have a quicker onset time than bupivacaine (by 2 to 15 minutes), but bupivacaine exerts a longer duration of anaesthesia (approximately 4 hours).

Junca et al,[14] compared the effectiveness of cervical plexus block for carotid surgery using bupivacaine or ropivacaine. Despite the administration of a larger dose of the ropivacaine (150 mg of bupivacaine vs 225 mg of ropivacaine), the duration of analgesia provided by the cervical plexus block was longer for bupivacaine than for ropivacaine as evaluated by visual analogue scale which was higher in ropivacaine group at 2nd and 3rd hours.

Petterrson et al. [15] compared 100 milligrams of bupivacaine and 300 milligrams of ropivacaine for local infiltration after inguinal hernia repair and they suggested that no statistically significant differences noted in both the groups with respect to pain scores and consumption of supplementary analgesics. The patients in ropivacaine group had faster motor recovery as suggested by early ability to walk with little or no problems compared to the patients who received bupivacaine.

Griffin RP et al. [16] compared 0.5% bupivacaine and 0.5% ropivacaine for epidural anesthesia in caesarean section patients and they concluded that sensory blockade was comparable but motor blockade was weaker with ropivacaine as suggested by more rapid recovery of leg mobility. Though there are studies which advocate that there is less of motor blockade with ropivacaine as compared to bupivacaine, this carries little significance in our study where single shot of local anesthetics was given. Bupivacaine in some cases causes fall in arterial blood pressure, cardiac index, ventricular systolic work index mainly and no important changes in vascular resistances as explained by Udelsmann A et al. [17].

In our study, there was no significant difference in systolic and diastolic pressure after administering TAP block. Sivapurapu et al. [18] in 2013 has compared the incidence of postoperative nausea and vomiting based on total requirements of opioids in postoperative period in patients who received TAP block, since we did not administer any opioids in the postoperative period, there is no increase in the incidence of postoperative nausea and vomiting in both the groups and the patients are not sedated in both the groups.

Hence from our study it was found that both the drugs were effective for TAP block and bupivacaine showed long duration of postoperative analgesia with mean duration of 4.52 hours as compared to ropivacaine which showed mean duration of 3.2 hours with no adverse effects in relation to hemodynamic variables like heart rate, SBP, DBP, nausea and sedation score noted in both the groups.

Conclusion

Bupivacaine hydrochloride provides statistically significant longer duration of postoperative analgesia compared with ropivacaine hydrochloride and there is no Significant differeces in hemodynamic variables (HR, SBP, DBP), nausea and sedation score. There are no adverse effects noted with respect to drugs or procedure.

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Original Research Article

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Comparison of Dexmedetomidine and Fentanyl as Adjuvants to Ropivacaine in Epidural Anaesthesia for infraumbilical Surgeries: An Observational Study

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Abstract

Aims: To assess the efficacy and compare the duration of analgesia, level of sedation and side effects of 0.75% ropivacaine with 50 mcg dexmedetomidine to 0.75% ropivacaine with 50 mcg fentanyl given epidurally. *Study setting*: Department of Anaesthesiology, MOSC Medical College, Kolenchery. *Study period*: An observational descriptive study on 66 patients over a period of one year. *Methods and Material*: 66 patients of ASA physical status I and II of either sex in the age group of 18-65 years undergoing abdominal hysterectomy or inguinal hernioplasty were observed in the study under two groups of 33 patients in each. Epidural anaesthesia was given after a test dose of 3ml 2% lignocaine with adrenaline followed by 15 ml 0.75% ropivacaine with Group I receiving 50 mcg fentanyl as adjuvant and Group II receiving 50 mcg dexmedetomidine. Two groups were compared with respect to sensory and motor block characteristics, hemodynamic changes, level of sedation and side effects. *Statistical analysis used:* The data was analyzed using Chi-square test, Fisher's exact test and Student *t*-test. $p < 0.05$ was considered to be significant and $p < 0.001$ as highly significant. *Results:* Significant prolongation of analgesia, motor blockade and two point regression time was observed in Group II as compared to group 1. A maximum sedation score of 4 was attained in 78.8% patients in Group II vs 3% in Group I, which was highly significant. *Conclusions:* Dexmedetomidine is a very good epidural adjuvant to ropivacaine providing prolonged duration of analgesia, excellent sedation with minimal side effects as compared to fentanyl.

Keywords: Dexmedetomidine; Fentanyl; Epidural Anaesthesia; Lower Abdominal Surgeries; Ropivacaine.

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Introduction

Adjuvants are used in epidural anaesthesia which potentiates the effects of the local anaesthetic thereby reducing the anaesthetic and analgesic requirement to a huge extent. Opioids synergistically enhance the analgesic effects of epidural local anaesthetics, without prolonging motor block while at the same time allowing a reduction in the dose and side effects of both. Epidural opioids cross the dura and arachnoid membrane to reach the CSF and exert their spinal analgesic effects at the level of the spinal cord dorsal horn [1]. The onset of blockade is hastened with opioid additives [2]. However, the incidence of side effects following the use of epidural opioids tends to increase in parallel with the dose used which include nausea and vomiting, pruritus, urinary retention and hypoventilation [3].

Dexmedetomidine, is a highly selective alpha 2 agonist drug, introduced into clinical practice in the 1990's as an adjunct to regional, local and general anaesthesia. Epidural dexmedetomidine has been

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shown to reduce intraoperative anaesthetic requirements, improve postoperative analgesia, and prolong both sensory and motor block, without side effects of opioid additives [4,5].

Here, an attempt is made to evaluate the potentiating effects of analgesia and side effects of dexmedetomidine in comparison to fentanyl, when used as an adjuvant to ropivacaine in epidural anaesthesia for lower abdominal surgeries.

Subjects and Methods

Study Design

An observational descriptive study was conducted after obtaining written informed consent from the patients and approval from the Institutional Ethics Committee. Patients with ASA physical status I and II, aged 18-65 years and posted for inguinal hernioplasty or total abdominal hysterectomy were included in the study Those with contraindications to epidural anaesthesia – uncooperative patients, previous spinal surgeries, spine abnormalities, allergy to amide local anaesthetics, local site infection and coagulation abnormalities, Body mass index (BMI > 30), patients on any antipsychotic drugs, anti-arrhythmic agents, betablockers or anticoagulants were excluded from the study.

Study was conducted at the Department of Anaesthesiology, MOSC Medical College, Kolenchery over a period of one year.

Sample Size

Considering duration of analgesia as the primary outcome, a superiority margin of 41 minutes for dexmedetomidine was taken, with regard to a previous similar study [6]. The number of cases required were 66 with an alpha error of 5% and power of study 90%. The Sample size was calculated using nMaster computer software.

The patients were observed under two groups of 33 in each. Both the groups received a test dose of 2% lignocaine 3ml along with a bolus 0.75% Ropivacaine 15 ml. Group I received 50 mcg fentanyl and Group II 50 mcg dexmedetomidine.

Data collection

Data was collected over a period of one year and recorded as mentioned in the proforma

Statistical Analysis

Statistical analysis was done using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 20.0. The qualitative data were presented as percentage and quantitative data as mean and standard deviation. For the comparison of quantitative data, independent sample t-test was used. Chi square test / Fisher's exact test was used for the comparison of qualitative variables.

Methodology

Pre-anaesthetic evaluation of the patients was performed by the investigator, the day before the surgery and a written informed consent was obtained. The selected patients were premedicated with ondansetron 4 mg and ranitidine 150 mg tablets orally the night before and in the morning of surgery. Tablet Alprazolam 0.5 mg was also given on the night before the surgery.

In the operating room peripheral intravenous access was secured using 18 gauge cannula and monitors were placed. Baseline noninvasive blood pressure, pulse rate, electrocardiograph and pulse oximetry were recorded. Oxygen was administered through simple face mask. All patients were preloaded with ringer's lactate solution 10 ml/kg 30 minutes before the block. Maintenance fluid was given as per body weight and operative loss requirements. The drug to be given was decided by the concerned anaesthesiologist. After positioning the patients in the left lateral position with the skin over the desired site infiltrated with 2% lignocaine, epidural was attempted at L3-L4/L2-L3 spaces using 18G Tuohy needle by loss of resistance to air technique. The epidural catheter was placed 4 cm within the space. After exclusion of blood and cerebrospinal fluid in the needle with negative aspiration, 3ml of 2% lignocaine with adrenaline 1:200000 was administered as test dose to exclude intrathecal or intravascular placement of the needle. Five minutes later either 0.75% ropivacaine 15 ml with 50 mcg fentanyl (Group I) or 0.75% ropivacaine 15ml with dexmedetomidine 50 mcg (Group II) was administered. Cardiorespiratory parameters were monitored continuously and recordings made every 5 minutes until 30 minutes and at 10 minutes interval, thereafter upto 60 minutes and then at 15 minutes interval for the rest of the surgery. Heart rate less than 50 beats per minute was treated with intravenous injection atropine 0.6 mg and systolic blood pressure less than 20% of baseline was treated with intravenous injection of ephedrine in 3-6 mg bolus doses.

After epidural administration of the anaesthetic, the onset of sensory block at T10 and T8 dermatome was evaluated in midclavicular line bilaterally by pin prick using sterile 26G needle every two minutes. At complete loss of cutaneous sensation at T8, surgery was allowed to proceed. Maximum sensory level attained was noted.

Degree of motor block was assessed every 5 minutes after giving the drug, using Bromage scale. Time of onset of motor block and time taken to reach complete motor blockade were noted. Duration of motor blockade was taken as the time from maximum degree of motor blockade to full recovery of motor power (Bromage scale 0).

Table 1: Bromage Scale

Score	Bromage Scale
0	Able to move the hip, knee and ankle
1 and	Unable to move the hip but is able to move the knee ankle
2 the	Unable to move the hip and knee but is able to move ankle
3	Unable to move the hip, knee and ankle

Duration of analgesia was recorded as the time interval from the completion of anaesthesia to the time when the patient first complained of pain. During surgical procedure, adverse effects like respiratory depression, anxiety, nausea, vomiting, dizziness, headache and pruritus were recorded. Postoperatively patients were assessed at 15 minutes, 30 minutes, 45minutes, 1hour and thereafter every hour. Intensity of postoperative pain is assessed using visual analogue scale, 0=no pain to 10=maximum pain [7]. Rescue analgesia was provided postoperatively by epidural bolus of 5ml 0.2% ropivacaine followed by infusion, when patients complain of pain or with a visual analogue score of more than 4.

Sedation score was recorded just before the initiation of surgery and at 5, 20 and 30 minutes and thereafter every 15 minutes upto 2 hours and then hourly until the end of surgery. Level of sedation was assessed using Ramsay Sedation Score.

Table 2: Ramsay Sedation Score

Patient anxious or agitated or both	1	
Patient cooperative and tranquil	2	
Patient responds to verbal command only	3	
A brisk response to a light glabellar tap		4
A sluggish response to a light glabellar tap	5	
No response	6	

Results

66 ASA I / II patients of age group 18-65yrs undergoing elective bilateral inguinal hernioplasty and total abdominal hysterectomy were studied. They were observed under two groups of 33 in each who received 0.75% Ropivacaine 15 ml+ 2% lignocaine with adrenaline +50 mcg fentanyl in Group I or 0.75% Ropivacaine 15 ml + 2%lignocaine with adrenaline + 50 mcg dexmedetomidine in Group II. The groups studied were similar in terms of age, height, weight and duration of surgery (Table 1).

Time of onset of sensory blockade was taken as the time interval from the conduct of epidural block to attaining a sensory level of T10. Time of onset of sensory blockade was similar between the groups - 6.7±2.39 minutes in Group I and 7.4±2.03 minutes in Group II (p = 0.226).

Time to reach maximum sensory level was 16.9± 2.73 minutes in Group I and 18.1±2.64 minutes in Group II (p = 0.065) . Median maximum sensory

Table 1: Distribution of age, height, weight and duration of surgery

Parameters	Group I [n=33] Mean ± SD	Group II [n=33] Mean ± SD	P-value*
Age (yrs)	49.2 ± 9.98	45.0 ± 6.74	0.051
Weight (Kg)	55.6 ± 9.47	59.9 ± 9.29	0.065
Height (cms)	159.2 ± 8.84	157.4 ± 5.55	0.313
Duration of surgery (mins)	144.8 ± 45.1	159.2 ± 53.43	0.241

*P value < 0.05 is considered significant

Table 2: Sensory characteristics

Parameters	Group I Mean ±SD	Group II Mean ±SD	P - value
Time of onset of sensory blockade at T10 (mins)	6.7 ± 2.39	7.4 ± 2.03	0.226
Time to reach maximum level (mins)	16.9± 2.73	18.1 ± 2.64	0.065
Median maximum sensory level	T5	T5	0.124
Time for 2 dermatome regression (mins)	261.7± 55.73	291.7 ± 61.98	**0.042**
Duration of analgesia (mins)	328 ± 58.38	381.1 ± 75.86	**0.002**

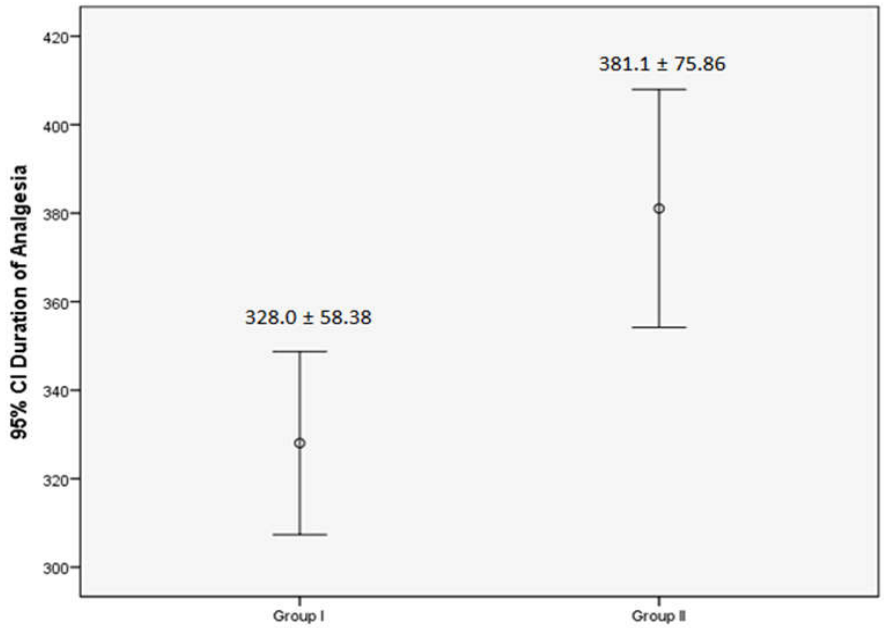
level attained was at T5 in both groups - 15 (45.5%) in Group I and 22 (66.7%) in Group II. The time taken for two point regression is the time interval between time to reach maximum sensory level and the time of achieving sensory regression by two dermatomal segments. Time taken for two point regression was significantly prolonged in Group II compared to Group I (291.7±61.98 mins vs 261.7± 55.73 mins, P = 0.042). Duration of analgesia is the time interval between the time of administration of study drug to the time till the patient complains of pain. Duration of analgesia is taken as the primary endpoint of this study (Table 2).

There was significant difference between the two groups. The duration of analgesia in Group II was prolonged in comparison to Group I (381.1±75.86 mins versus 328±58.38 mins) which was highly significant (p = 0.002) (Graph 1).

Motor block was assessed using Bromage scale. Time of onset of motor block was the time to achieve Bromage scale 1 which was 8.2±3.26 mins in Group I and 8.9±3.48 mins in Group II respectively (p = 0.365). Time to attain complete motor block is from the time of administering epidural block to the time to attain a Bromage scale of 3. Time to reach complete motor block was comparable with no statistical significance, 25.5±5.06 minutes and 27.8±5.73 minutes in Group I and Group II respectively (p = 0.073). Duration of motor block is the time interval between time of maximum degree of motor blockade to full recovery of motor power (Bromage 0). The duration of motor block varied significantly between both the groups. Prolongation of motor block was highly significant in Group II, in comparison to Group I. (267.7±72.4 minutes vs 230.5±48.9 minutes, p = 0.017) (Table 3).

Heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), Mean blood pressure (MBP) respiratory rate and oxygen saturation were continuously monitored intraoperatively as well as post operatively and compared with the preoperative values. Cardiorespiratory parameters were comparable between both groups with no statistical significance. (Graph 2,3). Any hypotension and bradycardia was observed within the first 60 minutes intraoperatively and responded to treatment with intravenous ephedrine and atropine.

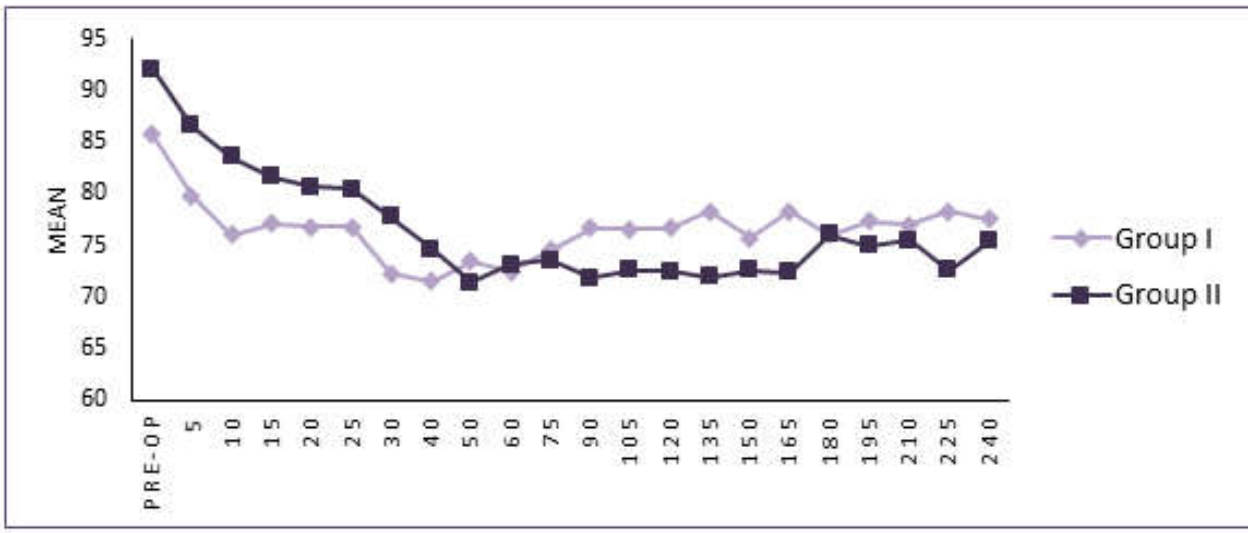
Level of sedation was assessed using a six point sedation score (Ramsay Sedation Score). 26 (78.8%) patients in Group II attained a sedation score of 4 intraoperatively while only 1 (3%) patient in Group I attained a sedation score of 4. This was a highly



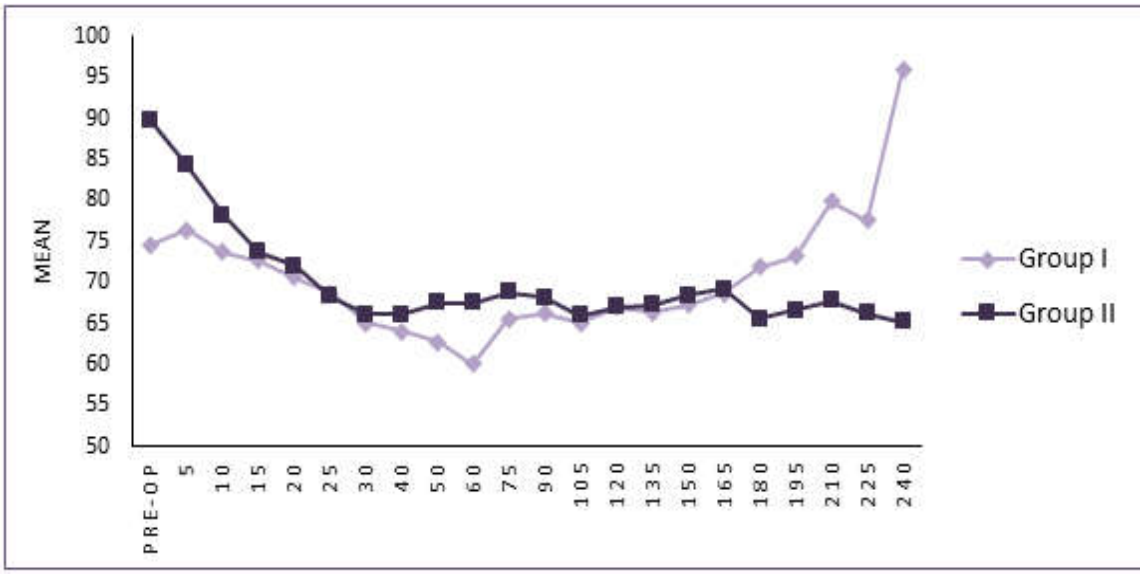
Graph 1: Duration of analgesia

Table 3: Motor characteristics

Parameters	Group I Mean ±SD	Group II Mean ±SD	P - value
Time of onset of motor block (mins)	8.2 ± 3.26	8.9 ± 3.48	0.365
Time for complete motor block(mins)	25.5 ± 5.06	27.8 ± 5.73	0.073
Duration of motor block(mins)	230.5 ±48.9	267.7±72.4	**0.017**



Graph 2: Comparison of Mean blood pressure



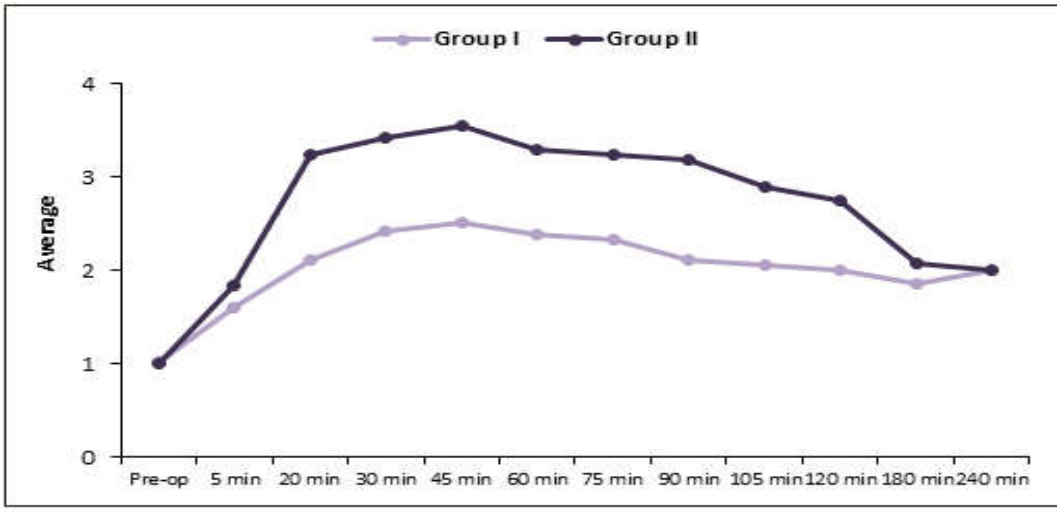
Graph 3: Comparison of heart rate

significant finding (p = 0.000). The level of intraoperative sedation was excellent in Group II. Postoperative pain was assessed using visual analogue scale (VAS). The mean VAS score reached 3.95 in Group I within four hours postoperatively as compared to 2.01 in patients in Group II which was statistically significant (p =0.032). (Graph. 4)

The incidence of hypotension and bradycardia seemed to be more in Group II. The incidence of pruritus, nausea and vomiting were observed more in Group I as compared to Group II, but this observation was of statistical significance (Table 4).

Table 4: Complications

Parameters	Group I	Group II	P – value
Hypotension	14m (42.4%)	16 (48.5%)	0.621
Bradycardia	9 (27.3%)	10 (30.3%)	0.786
Nausea and Vomiting	7 (21.2%)	1 (3.0%)	0.054
Pruritus	7 (21.2%)	0 (0.0%)	**0.011**



Graph 4: Level of sedation

Discussion

The patient characteristics in this study were comparable with respect to the ASA grading, mean age, sex, height, weight, type of surgery and duration of surgery. The primary objective of this study was assessment of duration of analgesia which determined the efficacy of the adjuvant. The results of this study show that the duration of analgesia was significantly prolonged in the group of patients who underwent lower abdominal surgeries and received 50 mcg dexmedetomidine along with 0.75% Ropivacaine 15 ml for epidural anaesthesia as compared to the patients who received 50 mcg fentanyl with 0.75% Ropivacaine 15 ml (381.1 ± 75.86 mins vs 328 ± 58.38 mins). This finding was consistent with that of Bajwa et al. and Gupta et al. [6,9]. This along with prolonged two dermatomal regression clearly indicates the effectiveness of epidural dexmedetomidine over fentanyl. Dexmedetomidine acts by binding to G-protein coupled α-2 adrenergic receptors, which are found in central, peripheral, and autonomic nervous systems and also in various vital organs and blood vessels throughout the body. Similar findings were reported by Salgado et al., while comparing epidural dexmedetomidine with ropivacaine and ropivacaine alone but observed no change in the onset of sensory blockade and time to reach maximal sensory level between groups [5].

The hemodynamic parameters as well as respiratory rate and oxygen saturation were comparable between both the groups. Fall in mean blood pressure occurred around 30 to 40 minutes and around 50 to 60 minutes after epidural administration of fentanyl and dexmedetomidine respectively. Bradycardia, a known side effect of both opioids and α2 agonists, was seen in a few patients of both groups. Postsynaptic activation of central α2-A receptors results in sympatholytic effect leading to hypotension and bradycardia, an effect judiciously used to attenuate the stress response of surgery [8].

As premedication, only a night dose of 0.5 mg alprazolam was given orally to both groups of patients, avoiding the morning dose of anxiolytic agent so that the level of sedation is not affected by the premedicants. Dexmedetomidine provided excellent sedation making it an ideal adjuvant, alleviating the anxiety and discomfort of lying awake for a long time with the inability to move the body in an unfamiliar environment [9].

Nausea and vomiting was significantly high among the fentanyl group as compared to dexmedetomidine. The antiemetic property is attributed to the decrease of noradrenergic activity as a result of binding to α2 presynaptic inhibitory adrenoreceptor in the locus coeruleus, as high level of catecholamine concentrations can induce vomiting [10].

The incidence of pruritus in the fentanyl group was higher than the dexmedetomidine group as was shown in a previous study [11].

Limitations of our Study

Our study involved two types of surgeries. Hence the onset of postoperative pain at the incision site for bilateral hernioplasty and total abdominal hysterectomy might be slightly varied which may have slightly affected the duration of analgesia.

Conclusion

- Dexmedetomidine as an excellent adjuvant to ropivacaine for epidural anaesthesia provides prolonged duration of analgesia.
- Epidural Dexmedetomidine has good hemodynamic stability with minimal side effects as compared to fentanyl

Key Messages

Dexmedetomidine is a very good epidural adjuvant to ropivacaine as it provides superior analgesia and sedation than fentanyl and associated with minimal side effects.

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Original Research Article

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A Comparative Study of Intrathecal Isobaric 0.5% Ropivacaine with Isobaric 0.5% Bupivacaine in Elective Lower Abdominal and Lower Limb Surgeries

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Abstract

Ropivacaine has a lower and different toxicity profile compared to Bupivacaine. It is a new long-acting, enantiomerically pure (S-enantiomers), amide local anaesthetic with a high pKa and low lipid solubility. T. Ropivacaine has a greater degree of motor sensory differentiation, which could be useful when motor blockade is undesirable. The reduced lipophilicity is also associated with decreased potential for central nervous system toxicity and cardio toxicity. Ropivacaine should be a favorable local anesthetic for day-case surgery and could be associated with earlier postoperative mobilization than Bupivacaine. *Objective of Study*: To compare the effects of intrathecal hyperbaric 4 ml of 0.5% Ropivacaine with 4 ml of hyperbaric 0.5% Bupivacaine in a ratio of 1:1 by volume (Ropivacaine 16.5 mg and Bupivacaine 11 mg) for lower abdominal/lower limb orthopedic surgeries with regard to: Onset and duration of sensory block, motor block. Maximum height of sensory block. Quality of anesthesia and Adverse reactions if any after taking written informed consent. *Observations:* Onset of motor blockade was slower and duration of motor blockade was shorter with Ropivacaine compared to Bupivacaine. However, all the patients in either groups attained complete motor blockade. With respect to hemodynamic parameters intrathecal Ropivacaine provided a higher Degree of cardiovascular stability with a lesser incidence of hypotension and bradycardia was observed. *Result:* There is delayed onset of motor block and shorter duration of motor block with Ropivacaine compared to Bupivacaine. Cardiovascular stability is better than Bupivacaine. Hence, Ropivacaine can be used successfully for lower limb/abdominal surgeries where early recovery is well appreciated by the patients

Keywords: Ropivacaine; Buphivacaine; Lower Limb Surgeries.

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Introduction

Bupivacaine rapidly gained popularity for surgeries of longer duration. Although it has slow onset of action, it produces good muscle relaxation, prolonged sensory and motor blockade. Duration and quality of motor and sensory blockade is dose dependant [1]. But increasing the doses of this hyperbaric Bupivacaine leads to increased cephalad spread of drug which accounts for more incidences of hypotension, bradycardia and in some cases, respiratory difficulty and cardio-respiratory arrest. Prolonged motor weakness associated with use of Bupivacaine is also a limiting factor for its use especially when used for surgeries of short duration as it delays the ambulation. It is also associated with side effects including cardiovascular and central nervous system toxicity. In cases of inadvertent intravascular injection of Bupivacaine, it was often

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fatal and responded poorly to conventional resuscitation methods [2]. The selective cardio toxicity of Bupivacaine is attributed to the "R enantiomers in its racemic mixture. This triggered pharmacological research that emphasized the selective behavior of the two enantiomers of racemic Bupivacaine, i.e. S-Bupivacaine and R Bupivacaine. Levo-enantiomer appeared to have a safer pharmacological profile than its dextro-partner [15].

Ropivacaine, a pure S-enantiomers, synthesized in the 1950s, but not introduced clinically until 1996 [3], was the 3rd in the Mepivacaine, Bupivacaine series. It has a similar onset of action as Bupivacaine, but is less potent requiring concentrations of up to 1%. As it is less liphophilic, the preservation of motor function is appealing in areas where early ambulation is desirable, such as in the labour ward or following ambulatory surgery. Ropivacaine being comparatively less cardio toxic also produces minimal motor blockade of shorter duration [17] which also relieves the psychological distress of being immobile for a longer period of time after surgery compared to intrathecal Bupivacaine during lower abdomen and lower limb surgeries [4]. Extensive clinical data have shown that ropivacaine is effective and safe for regional anaesthetic techniques such as epidural and brachial plexus block. However, experience of intrathecal anaesthesia with ropivacaine is not as well documented [5].

Aims and Objectives

To compare the effects of intrathecal isobaric 0.5% Ropivacaine with isobaric 0.5%. Bupivacaine in a ratio of 1:1 by volume (Ropivacaine 20 mg and Bupivacaine 20 mg) for lower abdominal and lower limb surgeries with regard to:

1. Onset and duration of sensory block
2. Onset and duration of motor block.
3. Maximum height of sensory block.
4. Post operative spinal level regression
5. Haemodynamic effect
6. Quality of anesthesia
7. Adverse reactions if any.

Materials and Methods

Source of Data

A prospective randomized comparative study was conducted on 80 patients undergoing elective lower abdominal/limb surgery under subarachnoid block at a tertiary care centre during the period from November 2014 to October 2016.

Inclusion Criteria

All patients of ASA grade I and II., undergoing elective surgeries.

Exclusion Criteria

Patients having deformities of spine and infection at the site of insertion of spinal needle. Patients having bleeding disorders/coagulation abnormalities/ raised intra cranial pressure. Patients who fail to achieve desired sensory and motor blockade were excluded from the study.

The study protocol was approved by Hospital Ethics committee and Ethical Clearance was obtained from the institution for the study. Written informed consent was obtained. Preoperative preparation and optimization of the patients were done as per protocol.

Method

Eighty patients were randomly divided into two groups of forty each.

Group B - Forty patients receiving 4 ml of injection 0.5% isobaric Bupivacaine intrathecally.

Group R - Forty patients receiving 4 ml of 0.5% isobaric Ropivacaine intrathecally.

After shifting the patient to operation theatre, IV access was obtained on the forearm with 18 Gauge IV canula and IV infusion started with Ringer Lactate. Patients were monitored for heart rate (HR), non invasive blood pressure (NIBP), percentage oxygen saturation (SpO_2). Under all aseptic precautions spinal anesthesia was performed with the patient in the lateral position using a 25 gauge Quincke's needle at the L_{3-4} interspaces. The study solution (4ml) was administered over 30 sec. Patient was turned gently and placed supine without elevation of extremities and tested every 5 minutes until maximal spread of sensory blockade, then every 15 and 30 minutes thereafter during the operation.

Parameters Evaluated

1. Sensory Block: Assessed using pin-prick test on each side and patients asked about the sensation. Onset time and duration of Sensory block was noted

2. Motor block: Motor block was assessed using "Modified Bromage Scale. This was performed

every minute until complete motor blockade and then every fifteen minute until return of normal motor function.

3. Vital Parameters: were recorded every 5 minute for the first fifteen minutes and then every 15 mins throughout the surgery.

Hypotension and Bradycardia

Patients were considered hypotensive when their mean arterial pressure decreased to less than 25% from baseline and were treated with injection mephenteramine 6 mg intravenously, dose titrated according to response. A decrease in the heart rate to less than 50 beats per minute was considered as bradycardia and treated with injection atropine 0.02 mg/kg intravenously.

4. Highest level of sensory and motor block with the Onset and offset time for both blockades was recorded during perioperative period.

Complications such as nausea, vomiting and shivering as well as the treatment given were noted down. At the end of surgery the quality of analgesia was judged according to patient's description, as follows: Excellent- No discomfort or pain

Good -Mild pain / discomfort, no need for additional analgesics.

Poor -Moderate to severe pain that required additional analgesics. All the patients were observed during the post operative period for 2 hours and later 6th hourly to know the duration, quality and intensity of pain. The patients were also observed for the development of PDPH and were followed up for 3-4 days.

Observations and Results

A total of 80 patients aged 18 to 60 years belonging to ASA–I and II posted for Elective lower abdomen and lower limbs surgeries were randomly selected. 40 of them belonging to Group B received 4.0 ml of 0.5% isobaric injection. Bupivacaine (20 mg) intrathecally and other 40 patients belonging to Group R received 4.0 ml of 0.5% isobaric injection Ropivacaine (20 mg) intrathecally.

After data collection, data entry was done in Excel. Data analysis was done with the help of SPSS Software Ver. 15 and Sigma - plot Ver. 11. Quantitative data is presented with the help of Mean, Standard deviation, Median and IQR.

Comparison between groups was done with the help of Unpaired T test or Mann–Whitney test as per results of Normality test. *Qualitative data* is presented with the help of Frequency and Percentage table. Association among study and control group is assessed with the help of Chi–Square test.

p value less than 0.05 is taken as significant level. Data is expressed as Mean±Std. Dev.

Age of the patients in both the groups studied varies in between 28 to 60 years of age. Both the study groups B and R are comparable in terms of age with mean age 41.30±9.45 and 40.10±10.67 years respectively. This was statistically insignificant as $p > 0.05$.

Both the study groups are comparable in terms of gender with male gender comprising the whole bulk of the population studied.

Height of the patients in both the study groups varies from 156 to 170 cms. The mean height in group B and R are 164.75±4.50 cms and 165.65±5.66 cms respectively with $p > 0.05$ which was statistically not significant.

Table 1: Comparison of age between the study groups (group B and R)

Study Parameters	Bupivacaine	Ropivacaine	P value
Age (in years)	41.30 ± 9.45	40.10 ± 10.67	0.264

Table 2: Gender distribution amongst the study groups

Gender		Study group		Total
		Bupivacaine	Ropivacaine	
Male	No.	40	40	80
	%	100.0%	100.0%	100.0%
Total	No.	40	40	80
	%	100.0%	100.0%	100.0%

Table 3: Comparison of height (in cm) between the study groups

Study Parameters	Bupivacaine	Ropivacaine	P value
Height (in cm)	164.75 ± 4.50	165.65 ± 5.66	0.141

Table 4: Comparison of weight (in kg) between the study groups

Study Parameters	Bupivacaine	Ropivacaine	P value
Weight (in kg)	76.38 ± 5.36	74.50 ± 5.07	0.087

Weight of the patients in both the groups varies from 60 to 82 kgs. with mean weight in Group B and R respectively as 76.38±5.36 kgs and 74.50±5.07 kgs. Both groups were Comparable in terms of weight of the population studied with statistically insignificant p value > 0.05.

Onset of sensory block at the level of L_1 is comparable in both the groups with mean time of 1.61±0.46 and 1.60±0.50 mins in group B and R respectively. This is statistically not significant with p > 0.05.

Table 6: Onset of sensory block

0nset of sensory block (in mins)	Bupivacaine	Ropivacaine	P value
	1.61 ± 0.46	1.60 ± 0.50	1.000

Table 7: Bromage scale grading amongst the study groups

Modified Bromage Scale in	Bupivacaine	Ropivacaine	P value
5 mins	3.00	2.00	0.000
10 mins	3.00	2.00	0.000
15 mins	3.00	3.00	1.000
30 mins	3.00	3.00	1.000
45 mins	3.00	3.00	1.000
1 hour	3.00	3.00	1.000
1 hour 30 mins	3.00	3.00	1.000
2 hours	3.00	3.00	1.000

Onset for motor blockage was determined with the help of modified Bromage scale, patient was examined every 5 minute till complete onset and thereafter every 15 mins. Time for the Onset of motor block (modified Bromage scale 3) was longer in group R (15 mins) than in group B (5 mins). This was clinically and statistically significant with p < 0.05 in the first 5 and 10 mins duration.

Significant fall in heart rate were observed in both the groups studied after administering of the intrathecal drugs during the 5th to 15th mins. with maximum fall at the 5th min. This fall in heart rate was clinically and statistically significant in both the groups studied.

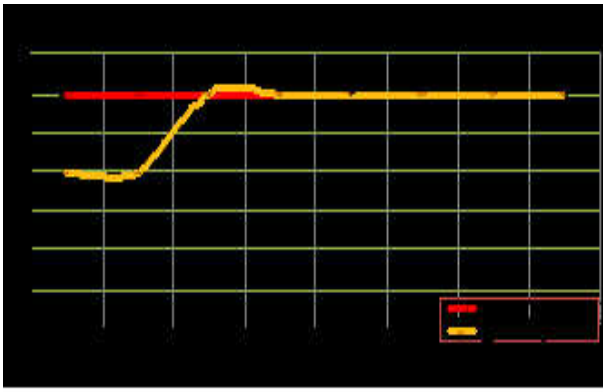

Fig. 7: Graph showing modified Bromage scale grading at various intervals

Table 8: Pulse rate changes at various intervals

Pulse (in mins)	Bupivacaine (mean ± SD)	Ropivacaine (mean ±SD)	P value
Baseline	75.35 ± 6.83	71.35 ± 5.65	0.003
5 mins	73.25 ± 7.56	66.65 ± 5.27	0.000
10 mins	70.45 ± 8.75	65.85 ± 4.72	0.004
15 mins	68.70 ± 8.84	65.65 ± 5.45	0.047
30 mins	67.15 ± 9.40	64.65 ± 4.93	0.140
45 mins	67.40 ± 5.86	64.15 ± 5.52	0.051
1 hour	66.13 ± 7.07	64.15 ± 5.59	0.170
1 hour 30 mins	66.48 ± 6.55	63.90 ± 5.64	0.063
2 hours	65.75 ± 5.86	63.90 ± 5.47	0.148

Table 9: SBP (mm Hg) at various intervals

SBP(mm hg)	Bupivacaine	Ropivacaine	P value
Baseline	126.30 ± 4.83	125.30 ± 4.76	0.385
5 mins	113.25 ± 5.08	116.00 ± 4.98	0.004
10 mins	110.25 ± 5.75	113.50 ± 4.24	0.005
15 mins	108.95 ± 6.81	111.70 ± 4.91	0.052
30 mins	107.85 ± 7.89	110.00 ± 4.10	0.130
45 mins	106.95 ± 7.46	108.75 ± 3.03	0.161
1 hour	108.10 ± 8.44	107.70 ± 3.28	0.781
1 hour 30 mins	107.65 ± 7.64	107.80 ± 3.38	0.910
2 hours	108.30 ± 6.86	106.60 ± 4.67	0.199

Fall in the systolic blood pressure was observed in both the groups after subarachnoid block with more pronounced fall with group B. Significant fall were observed during the 5th to 15th min in both the groups with major changes during the 5 th minute. This fall in the systolic blood pressure was clinically and statistically significant in both the groups studied.

Fall in the diastolic blood pressure was observed in both the groups after subarachnoid block, with more pronounced fall with group B. Significant fall were observed during the 5th to 15th mins in both the groups with major fall during the 5thmin. This fall in diastolic blood pressure was clinically and statistically significant in both the groups studied

In concurrence with the fall in systolic and diastolic blood pressure, the Mean arterial pressure (MAP) also shows corresponding fall in values between the 5th to 15 th mins of duration with maximal fall in the 5th min. This corresponding fall in the mean arterial pressure is clinically and statistically significant in both the groups studied.

Table 12 and its corresponding graph shows comparison of the two study group population in terms of various parameters. The two groups were found comparable in terms of maximum level of sensory block achieved, post operative spinal segment level regression at T_{12} and L_4 level. The two groups were found to be significantly different in respect to duration of motor block where group R has a significantly shorter duration of motor blockage with mean duration of 149.2±7.15 mins compared to 221.3±13.48 mins for those in group B. This was significant clinically and statistically with $p < 0.05$.

Table 10:

DBP(mm hg)	Bupivacaine	Ropivacaine	P value
Baseline	77.05 ± 4.90	77.35 ± 4.04	0.735
5 mins	65.80 ± 5.58	69.55 ± 3.34	0.000
10 mins	65.25 ± 5.58	67.70 ± 3.55	0.022
15 mins	65.90 ± 7.50	67.65 ± 3.21	0.563
30 mins	65.55 ± 4.14	65.55 ± 3.28	1.000
45 mins	65.80 ± 6.54	65.10 ± 3.81	0.561
1 hour	66.65 ± 6.36	64.35 ± 3.97	0.056
1 hour 30 mins	65.20 ± 6.19	63.25 ± 4.12	0.101
2 hours	64.70 ± 5.68	62.65 ± 3.97	0.065

Table 11:

MAP (mm hg)	Bupivacaine	Ropivacaine	P value
Baseline	93.55 ± 4.34	93.40 ± 3.75	0.911
5 mins	81.62 ± 4.76	85.03 ± 3.23	0.000
10 mins	80.25 ± 4.91	82.97 ± 2.96	0.004
15 mins	80.25 ± 6.62	81.67 ± 2.90	0.049
30 mins	79.65 ± 8.22	80.37 ± 2.71	0.602
45 mins	79.52 ± 6.20	79.65 ± 2.75	0.901
1 hour	80.47 ± 6.40	78.80 ± 2.88	0.137
1 hour 30 mins	79.35 ± 6.02	78.10 ± 3.39	0.256
2 hours	79.23 ± 5.50	77.30 ± 3.55	0.066

Table 12:

Study Parameters	Bupivacaine (Mean ± SD)	Ropivacaine (Mean± SD)	P value
Duration of maximum sensory block (min)	190.88 ± 18.18	197.88 ± 10.68	0.148
Duration of motor block (min)	221.25 ± 13.48	149.13 ± 7.15	0.000
Post operative spinal level T 8 (min)	190.88 ± 18.18	197.88 ± 10.68	0.148
Post operative spinal level T 12 (min)	212.38 ± 14.41	214.75 ± 10.56	0.721
Post operative spinal level L 4 (min)	231.38 ± 10.68	230.25 ± 10.50	0.576

Table 13: Comparison of side effects amongst the study groups

Side Effects	Bupivacaine	Ropivacaine	Percentage(%)
Brady/Hypotension	5	0	6.3
Hypotension	1	0	1.3
Bradycardia	0	0	0
Nil	34	40	92.5
Total	40	40	100

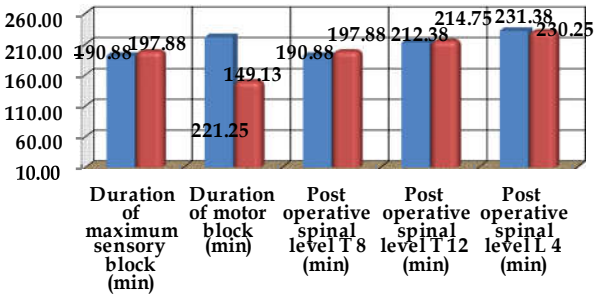

Fig. 2: Graph comparing various parameters between the two study groups

Comparison between Bupivacaine and Ropivacaine

Patients receiving Ropivacaine intrathecally were found to be more haemodynamically stable than those receiving intrathecal Bupivacaine as 5 patients presented with bradycardia and hypotension combined and one with only hypotension. They were managed accordingly with inj.mephentermine in graded doses. No significant haemodynamic changes were observed with patients of group R.

Discussion

Subarachnoid block is a commonly employed anaesthetic technique for performing lower limb/ abdominal surgeries. It is a safe, inexpensive and easy-to- administer technique which also offers a high level of post–anesthesia satisfaction for patients. The technique is simple, has rapid onset and is reliable. The risk of general Anesthesia, including mishaps due to airway management, aspiration and Polypharmacy are avoided by this technique. Bupivacaine is the local anaesthetic used routinely for lower limb/abdominal surgeries because of its high potency and minimal neurological symptoms. Though cardio toxicity is not a concern in subarachnoid block, the quality of sensory blockade, motor blockade, hemodynamic changes and side effect profile are some considerations in selecting drug for spinal anaesthesia. Ropivacaine, s-enantiomers [6] of Bupivacaine is being increasingly used for spinal anaesthesia in caesarean section, lower abdominal and perineal surgeries including lower limb surgeries. Advantages claimed are shorter duration of motor block [7] with similar sensory block properties compared to Bupivacaine (Mc Donnald SB) [8]. Thus it minimizes the psychological discomfort of being immobile for long time. Also its major advantage is lesser cardiotoxic property compared to Bupivacaine hence this study was conducted to assess the sensory and motor characteristics of ropivacaine for spinal anaesthesia in lower limb/abdominal surgeries. A prospective, randomized study was done at a Tertiary care hospital amongst 80 patients belonging to ASA I and II who underwent lower limb/abdominal surgeries under sub arachnoids block. In our study we have used a ratio of 1:1 by volume of Isobaric 0.5% Ropivacaine 20 mg and Isobaric 0.5% Bupivacaine 20 mg was used. Eighty patients were randomly divided into two groups of forty each.

Group B – Forty patients received 4 ml of 0.5% isobaric Bupivacaine intrathecally.

Group R Forty patients receiving 4 ml of 0.5% isobaric Ropivacaine intrathecally. Demographic data were comparable in the two groups. ($p>0.05$) Spinal block characteristics, haemodynamic effects and side effects were observed. Analysis of above mentioned parameters were as follows:

Demographic data: The demographic data with respect to gender, age, weight, height and type and duration of surgery were comparable in two groups. The mean age, weight and height of patients in Group B and Group R were compared and the difference was not statistically significant. The groups are comparable and by applying unpaired T test, the difference was not significant.

Sensory block at L1- All patients receiving either drug achieved adequate level of anaesthesia. We considered a block up to L_1 for onset of sensory block. Mantouvalou et al. [9] did a comparative study of plain Ropivacaine, Bupivacaine and Levobupivacaine for Lower abdominal surgeries and found that the time to achieve surgical analgesia up to T_8 dermatome was 13±2 mins for Bupivacaine group, 12±7 mins for Ropivacaine group. In our study we observe that both Ropivacaine and Bupivacaine takes almost the same time to achieve a surgical anaesthesia at the level of L_1 with mean time of onset at L_1 of 1.61±0.46 mins and 1.60±0.50 mins in Group B and R respectively.

Maximum level of sensory block: M. Mantouvalou et al. [9] noted that the cephalic spread of sensory block was similar in all groups. MC Namee et al. compared 17.5mg of plain Ropivacaine with 17.5mg of plain Bupivacaine in patients undergoing total hip arthroplasty under spinal anaesthesia. There were no significant differences in the upper extent of sensory block. In agreement to the above studies a level of T8 was attained in both the groups in our study.

4. Time for onset of motor block- M. Mantouvalou et al. [9] compared the effects of plain Ropivacaine,

Bupivacaine, LevoBupivacaine for lower abdominal surgeries and found that the mean time for onset of motor block(G3) was significantly faster in the Bupivacaine group (8± 5mins) compared with (12± 5) min in the Ropivacaine group. D.A. Mc Namee and colleagues [10] also found that the median time to achieve the Bromage score of 3 was 10 mins in the Ropivacaine group and 8mins in the Bupivacaine group. In our study, patients receiving Ropivacaine had delayed onset of motor blockade compared to Bupivacaine, this is in agreement with the above mentioned study and also study conducted by Ogun [11] and others. In our study, group B attained complete motor blockade (modified Bromage scale grade 3) within 5 mins whereas in group R it took 15 mins for complete motor blockade.

Duration of motor block- D.A. McNamee et al. [10] found that the median duration of complete motor block. Modified Bromage scale 3 was significantly shorter in the Ropivacaine group compared with Bupivacaine group. M. Mantouvalou et al observed a shorter duration of motor block among the Ropivacaine group when compared with Bupivacaine group. The duration of motor block was 269±20 mins and 278±70 mins respectively for Ropivacaine and Bupivacaine. We observed the same results with mean duration of motor block of 149.13± 7.15 mins and 221.25±13.48 mins, for Ropivacaine and Bupivacaine groups respectively.

Degree of motor blockade- Chan Jong Chung and colleagues[12] observed complete motor block in all patients receiving either Bupivacaine or Ropivacaine for caesarean section. Neval Boztug [13] and others observed complete motor blockade in 88% of patients receiving Ropivacaine and 100% patients receiving Bupivacaine when administered for knee arthroscopy. All patients in our study receiving either Ropivacaine or Bupivacaine developed complete motor block and is in agreement with above mentioned studies.

Regression of sensory block to L4 – In our study mean time taken for the regression of post-operative spinal level to L4 was 231.38±10.68 mins and 230.25±10.50 mins respectively in group B and R.

Request for rescue analgesia – No patients required supplemental analgesia intra operatively. Adequate analgesia achieved in both the groups.

Quality of anaesthesia- The anaesthesia was well accepted by all patients belonging to both groups. Majority of patients opined that the quality of anaesthesia is good to excellent with both the drugs.

Hemodynamic parameters –Neval Boztug and his colleagues [13] observed that 8.8% of patients in Bupivacaine group received inj. Ephedrine for treatment of hypotension, whereas only 2 patients received in Ropivacaine group. One in group B received i.v Atropine for bradycardia but none in group R. D.A. McNamee [19] observed in their study that intra-operative hypotension requiring treatment with inj. Ephedrine occurred in 12% of patients in R group and in 26% of patients in B group. M. Mantouvalou et al found in their study that intra-operative hypotension requiring treatment with.

Inj. Mephenteramine occurred more often in the B group than in R group. Bradycardia was also more common in group B than in group R. In our study 5 patients in group B required treatment for intra-operative Hypotension and bradycardia, 1 patient required treatment or hypotension alone but there was no incidence of intra- operative hypotension or bradycardia requiring treatment in group R.

Summary and Conclusion

Demographic parameters in both the groups were comparable. Onset of sensory block was comparable in both the groups. Level of maximum sensory block and duration of sensory block tested at the level of L4 regression was also comparable.

Onset of motor blockade was slower and duration of motor blockade was shorter with Ropivacaine compared to Bupivacaine. However, all the patients in either groups attained complete motor blockade.

With respect to hemodynamic parameters intrathecal Ropivacaine provided a higher Degree of cardiovascular stability with a lesser incidence of hypotension and bradycardia. There was no incidence of side effects like Nausea, vomiting, Shivering or PDPH in Either groups.

Our study reveals that 20 mg of isobaric Ropivacaine (4 ml of 0.5%) when administered intrathecally provides adequate anesthesia for lower limb/abdominal surgeries. It has the same onset of sensory block at the level of L_1 as well as same level of maximum sensory block attained. The duration of analgesia at L_4, (L_4 regression) was significantly same with Bupivacaine. But there is delayed onset of motor block and shorter duration of motor block with Ropivacaine compared to Bupivacaine. Cardiovascular stability is better than Bupivacaine. Hence, Ropivacaine can be used successfully for

lower limb/abdominal surgeries where early recovery is well appreciated by the patients.

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Compare the Efficacy of Prochlorperazine and Granisetron in Patients Undergoing Total Abdominal Hysterectomy

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Abstract

Aim: To compare the effectiveness of mouth dissolving antiemeticsprochlorperazine and granisetron in the prevention of postoperative nausea and vomiting in patients undergoing abdominal hysterectomy under spinal anaesthesia *Materials and Methods:* A total number of 50 cases of ASA Gr.I and Gr. II were taken into a double blind randomized study and divided into two groups. 25 of them received Granisetron 1mg mouth dissolving tablet and the other 25 patients received Prochlorperazine 5mg mouth dissolving tablet for preventing postoperative nausea and vomiting and observed for a period of 24 hours. *Results:* There were no statistically significant differences between the groups with respect to patient characteristics, type of surgery and duration of anesthesia. Administration of Prochlorperazine and Granisetron 60min before surgery, effectively controlled nausea and vomiting during early postoperative period i.e., within 6 hours after surgery. Postoperative nausea and vomiting in the 6 – 24 hours postoperative period was significantly lower with Granisetron when compared to Prochlorperazine. (p value <0.01) *Conclusion:* Administration of Granisetron 1hr before surgery was superior to Prochlorperazine in long term prevention of postoperative nausea and vomiting following Total abdominal hysterectomy under spinal anesthesia.

Keywords: Prochlorperazine; Granisetron; Abdominal Hysterectomy; Spinal Anesthesia.

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Introduction

Postoperative nausea and vomiting is one of the most common and distressing side effect encountered by patients following anesthetic and surgical procedures. In the present scenario, it is estimated that 22 to 30% of adult patients develop postoperative emesis, which is consistently lower when compared to 75 to 80% reported during the ether era [1,2].

As per the literature, incidence of postoperative nausea and vomiting ranges from 25 to 55% following inpatient surgery and 8 to 47% for outpatient surgery. When questioned before surgery, it was observed that patients were concerned about postoperative nausea and vomiting apart from pain. Severe and persistent postoperative nausea and vomiting can cause tension on suture lines, bleeding at operative sites and wound dehiscence, venous hypertension, oesophageal tears and rupture, rib fractures, gastric herniation and muscular fatigue. In neurosurgical cases, postoperative nausea and vomiting can cause increased intracranial tension. It can also increase the risk of pulmonary aspiration. It may result in dehydration and electrolyte imbalance in pediatric population [3].

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Postoperative nausea and vomiting is a major contributor to burgeoning healthcare costs for both the hospital and the patient [4]. These costs may result from longer recovery, extended stay in the hospital, added attention required from nurses and physicians, additional drug supplies as well as unanticipated admissions following outpatient procedures. Most of the currently used antiemetic drugs like anti-histaminics, anticholinergics and dopamine receptor antagonists possess clinically significant side effects.

Mouth dissolving tablets are novel and advanced oral drug delivery systems used in the management of postoperative nausea and vomiting to achieve better patient compliance. The present study was intended to compare the efficacy of mouth dissolving tablets prochlorperazine and granisetron in prevention of postoperative nausea and vomiting in patients undergoing total abdominal hysterectomy.

Material and Methods

It is a comparative study done in patients undergoing abdominal hysterectomy under spinal anesthesia in Government maternity hospital, Sultan bazar, Government maternity hospital, Petlaburz and Niloufer hospital attached to Osmania medical college Koti, Hyderabad. A total number of 50 patients in the age group of 26 to 52 years belonging to ASA Grade I and ASA Grade II were randomly divided into two groups, Group A and Group B, each consisting of 25 patients. Group A received 1 mg of Granisetron mouth dissolving tablet and group B received 5 mg of prochlorperazine mouth dissolving tablet one hour before starting of surgery. The study was approved by the hospital ethics committee and written informed consent was obtained from patients.

Inclusion Criteria

Patients of ASA Grades I, and II, age group of 26 to 52 years.

Exclusion Criteria

Patients belonging to ASA Grade III, IV and V, below the age of 26years, above the age of 52 years, H/o acid peptic disease, migraine , motion sickness, Patients with clinically significant cardiovascular, pulmonary, renal, hepatic, neurological and endocrinological abnormalities.

Preoperative visit was conducted on the previous day of surgery and a detailed history and present complaints were noted. General and systemic examinations of cardiovascular, respiratory and central nervous system were done. Routine laboratory investigations like complete haemogram, blood urea, serum creatinine, and blood sugar, ECG, bleeding time and clotting time were done. Preoperative data collected included age, weight, heart rate, blood pressure, history of motion sickness, previous surgery and PONV.

After the patient arrived in the operation theatre, ECG pulse-oximeter and NIBP were attached and an intravenous line with 18 G intracath was established. All the women in two groups were hydrated with Ringer's lactate solution 20 ml/kg, before the procedure.

Lumbar Spinal Anaesthesia

After keeping the operating table horizontal, the patient was shifted onto the table. The patient was positioned in left lateral position, with the help of an assistant standing in front of the patient. Strict aseptic precautions were taken. The hands a were scrubbed to elbows with soap and water, after application of spirit the sterile gown and gloves were put on. The patient's back was cleaned with betadine solution (contact time – 3 minutes) followed with surgical spirit from the angle of scapulae the coccyx in a cephalad to caudal direction, from the centre to the periphery. Then the patient's back was draped with sterile spinal hole towel.

A 25 G disposable Quincke's needle was inserted in the middle of the interspace parallel to the table and angled about 100 Cephalad since the inter-laminal space is slightly Cephalad to the interspace. The bevel was positioned laterally so that the longitudinal fibres are separated rather than cut. As the needle pierces the ligamentum flavum and the dura, arachnoid distinct changes in resistance and characteristic loss of resistance will be felt. The stylet was removed and observed for free flow of cerebrospinal fluid (CSF).

After obtaining the clear and free flow of CSF, the bupivacaine 0.5% 3-4 ml was injected intrathecally. The spinal needle was withdrawn and patent was positioned supine. Throughout the procedure the patient received Oxygen (4 liters/ minute) through Hudson's mask continuously. The level of sensory blockade was tested every 2 minutes after intrathecal injection of local anesthetic agent. The level of work was maintained around T4. Monitoring was done continuously.

Bradycardia was treated with atropine and Hypotension with 100% oxygen, Vasopressors and IV fluids promptly. The incidences of PONV were

recorded within the first 24 hours after surgery at intervals of 0-6 hours, and 6-24 hours. Episodes of PONV were identified by spontaneous complaints by the patients or by direct questioning. Incidence of nausea and vomiting occurring in first six hours is considered as early nausea and vomiting and incidence of PONV after six hours was considered as late emetic episode.

"Complete response" was defined as the absence of nausea, retching or vomiting and no need for rescue antiemetic during the 24-hour observation period. Rescue antiemetic was provided with Inj. Metoclopramide 10mg i.v in the event of 1 or more episodes of vomiting depending on the observer's discretion. We made no distinction between vomiting and retching (i.e., retching event was considered a vomiting event). Nausea and vomiting were evaluated on three point ordinal scale. 0=none, 1=nausea, 2=retching or vomiting.

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 on categorical 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 parameters on a categorical scale between two groups.

Results

A total number of 50 cases were taken into study. 25 of them received Granisetron 1mg mouth dissolving tablet, and the other 25 patients received Prochlorperazine 5mg mouth dissolving tablet for preventing postoperative nausea and vomiting through a period of 24 hours.

There were no statistically significant differences between the two groups with respect to patient characteristics age and weight, duration of surgery and anesthesia (Table 1).

The incidence of nausea in first 24 hours of postoperative period was 12% and 48% in Granisetron and Prochlorperazine respectively ($p<0.01$). incidence of vomiting in first 24 hours of postoperative period There were no emetic episodes in Group A. Incidence of emetic episodes in Group B is 32%. Incidence of emetic episodes in 24 hours of postoperative period is significantly high in group B compared to group A ($p <0.01$) (Table 2).

Incidence of early nausea (0-6 hours) in Granisetron and Prochlorperazine were 4% and 20%. Incidence of early nausea (0-6 hours) in Granisetron group and Prochlorperazine groups did not show any statistically significant difference. (p value >0.05). Incidence of late nausea was 12% and 40% in Prochlorperazine and Granisetron groups respectively, which was statistically significant difference (Table 3).

Table 1: Demographic Details

Patient characteristics	Mean±SD Group A	Mean±SD Group B	P value
Age	40.52±8.7	39.84±7.44	0.2968 NS
Weight	50.36±5.81	48.16 ±6.71	1.2379 NS
Duration of anesthesia (min)	100.00±26.61	89.00±23.62	1.5454 NS
Duration of surgery (min)	91.20±17.39	99.20±25.15	1.3079 NS

Table 2: Incidence of postoperative nausea and vomiting in first 24 hours

Postoperative nausea and Vomiting	Group A (Granisetron) (N=25)	Group B (Prochlorperazine) N=25)	Chi Square	P- Value
Nausea in first 24 hours				
Present	3(12%)	12(48%)	7.8095	0.01
Absent	22(88%)	13(52%)		
Vomiting in first 24 hours				
Present	0	8 (32%)	9.6726	0.01*
Absent	25 (100%)	17 (68%)		

Table 3: Incidence of postoperative nausea

Postoperative nausea	Group A (Granisetron) (N=25)	Group B (Prochlorperazine) N=25)	Chi Square	P- Value
Incidence of early nausea (0-6 hours)				
Present	1 (4%)	5 (20%)	3.219	0.05*
Absent	24 (96%)	20 (80%)		
Incidence of late nausea (6 – 24 hours)				
Present	3 (12%)	10 (40%)	5.1975,	0.05*
Absent	22 (88%)	15 (60%)		

Table 4: Incidence of postoperative vomiting

Vomiting	Group A (Granisetron) (N=25)	Group B (Prochlorperazine) N=25)	Chi Square	P- Value
Incidence of early vomiting (0-6 hours)				
Present	0	2 (8%)	**2.**602	0.05
Absent	25(100%)	23 (92%)		
Incidence of late vomiting (6- 24hours)				
Present	0	8 (32%)	**9.**6726	0.05
Absent	25 (100%)	17 (68%)		

Two patients in Prochlorperazine and none in Granisetron had vomiting during first 6 hours of postoperative period. Both Granisetron and Prochlorperazine were equally efficacious in preventing vomiting during early postoperative period after recovering from anesthesia (p value >0.05). There were no emetic episodes during 6–24 hours postoperative period in Granisetron group whereas 32% of patients in Prochlorperazine group developed emesis during this late postoperative period, which showed statistically significant difference. (Table 4).

Discussion

Nausea and vomiting following anaesthesia has been a distressing problem for the patients and is frequently listed among the most important preoperative concerns apart from pain. With the change in emphasis from inpatient to outpatient office based medical/surgical environment, there has been an increasing interest in the big little problem of postoperative nausea and vomiting.

Inspite of so many advances in the management of postoperative nausea and vomiting with the invention of new drugs, multimodal approaches of management like administering multiple different antiemetic medication, less emetogenicanesthetic techniques, adequate intravenous hydration, adequate pain control, etc., the incidence of postoperative nausea and vomiting remains still high ranging from 25%-55% following inpatient surgery and 8%-47% following outpatient surgery.

An effective antiemetic that could be used to treat nausea and vomiting without extending recovery time and that remains effective for 24 hours following treatment would be a significant asset to the anesthesiologists armamentarium, especially in settings like office based anesthesia where the patient is admitted for day care surgery and discharged on the same day. Drugs acting for longer duration also have an advantage in surgeries where the incidence of postoperative nausea and vomiting is very high like laparoscopic surgery, middle ear surgery, tonsillectomy, laparotomy, strabismus surgery, orchipexy, etc.

Unfortunately, commonly used medications like antihistamines, anticholinergics, gastro-prokinetics, butyrophenones, cause undesirable side effects like sedation, dysphoria, restlessness and extrapyramidal symptoms. To overcome these serotonin antagonists like Ondansetron, Tropisetron, Dolasetron, Ramosetron, Palonosetron and Granisetron were introduced for treatment of nausea and vomiting. They were primarily used in treating chemotherapy induced vomiting with minimal and clinically acceptable side effects. The most distressing and intolerable emesis induced by anti-malignant medications was better controlled with these 5HT3 antagonists and they proved to have a promising role in the field of oncology. Abundant research in the field of oncology demonstrates the efficacy of these drugs. However, there were anecdotal reports in the

literature about their role in the prevention of postoperative nausea and vomiting [4,5].

To overcome the difficulties associated with conventional tablets i.e. difficulty in swallowing which leads to poor patient compliance, scientists have developed innovative drug delivery system known as fast dissolving tablets. The benefits in terms of patient compliance, rapid onset of action, increased bioavailability and good stability make these tablets popular as a dosage form of choice in the current market. These tablets disintegrate instantaneously when put on tongue, releasing the drug which dissolves or disperses in the saliva. Some drugs are absorbed in mouth, pharynx and oesophagus as the saliva passes down into the stomach. In such cases, bioavailabilty of the drug significantly greater than those observed from conventional tablet dosage form.

In the present study, the antiemetic efficacy of Prochlorperazine and Granisetron were assessed in postoperative nausea and vomiting for a period of 24 hours. The postoperative period was again divided into two groups of assessment period (0-6 hrs, early postoperative period and 6-24 hours, late postoperative period) to assess the efficacy of both the drugs during different time intervals. We have selected similar groups of patients in respect of age, weight, duration of surgery and duration of anesthesia to compare the efficacy of the drugs. Analgesia for postoperative pain was standardized and patients of both groups were observed for a period of 24 hours postoperatively. Hence we believe that the difference in postoperative nausea and vomiting is attributed exclusively to the study drugs.

The present study was conducted only in elective surgeries in patients with no obvious causes for nausea and vomiting. Patients with risk factors of PONV like motion sickness, migraine, gastro-oesophageal reflux disease etc. were excluded from the present study.

In our study, there were no significant differences in the incidence of PONV between the Granisetron and Prochlorperazine groups during first 6hrs of surgery. 22 out of 25 patients receiving Granisetron had no symptoms of nausea and vomiting, while only 13 out of 25 patients receiving Prochlorperazine had no symptoms of nausea and vomiting.So it was concluded that Granisetron was superior to Prochlorperazine in the long term prevention of PONV (6-24 hrs).

Burris H et al. [6] conducted a double blind randomised parallel group study in 230 adult cancer patients who received moderately emitogenic chemotherapy to compare the efficacy and safety of oral granisetron vs oral prochlorperazine in preventing nausea and emesis. The results were granisetron was significantly more effective than prochlorperazine in achieving the complete response (74% vs 41%) respectively and total control of nausea and vomiting (58% vs 33%) respectively. They concluded that oral granisetron 1mg twice a day was significantly more effective than oral prochlorperazine sustained release capsule 10mg twice a day in complete response and total control of nausea vomiting at 24hrs after chemotherapy.

A G Wilson et al. [7] conducted a randomised double blind placebo controlled dose ranging study compared three doses (0.1mg, 1mg and 3mg) of the 5HT3 receptor antagonist, granisetron as prophylactic therapy for prevention of PONV. The aims were to determine the optimum dose of granisetron. They studied 527 adult patients undergoing elective open abdominal surgery or vaginal hysterectomy during general anaesthesia. They concluded that granisetron was well tolerated and the optimum dose was 1mg.

Lowen P S et al. [8] in 2000 conducted a randomised double blind controlled study to compare efficacy of 5HT3 receptor antagonist (Ondansetron, Granisetron, Dolasetron and Tropisetron) vs traditional agents (Metaclopramide, Prochlorperazine, Cyclizine and Droperidol). Results in the 32 studies examining PONV indicated a 46% reduction in the odds of PONV in the 5HT3 treated group (0.54 [95% Cl 0.42-0.71], $p<0.001$). They concluded that 5HT3 receptor antagonists are superior to traditional antiemetic agents for prevention of PONV.

D Angelo et al. [9] conducted a randomised, double blind, placebo study, pilot study of PONV prevention in patients undergoing elective open abdominal hysterectomy requiring general anaesthesia received a single dose of Granisetron 0.1mg, 0.2mg, 0.3mg or placebo administered approximately 15 minutes prior to end of surgery. The results were the proportion of patients with no vomiting episode in 0-6 hr interval after administration of study medication was higher in each Granisetron treatment group (>90%) than in the placebo group (77%). Proportion of patient with no vomiting episode in 0-24 hr interval were similar across treatment groups. They concluded that Granisetron doses 0.1mg, 0.2mg, 0.3mg administered just prior to end of surgery suggested a trend of improved efficacy compared to placebo in prevention of PONV in first 6hrs after total abdominal hysterectomy.

Dasgupta M et al. [10] in 2012 conducted randomised placebo controlled trial to evaluate the

efficacy and safety of Granisetron on incidence of nausea and vomiting in caesarean deliveries under spinal anaesthesia. 80 parturients received Granisetron 40mcg/kg or placebo (n=40) intravenously immediately after clamping of fetal umbilical cord. Nausea and vomiting and adverse events were observed for 24 hrs after administration of spinal anaesthesia. The results were complete response 0-4 hr after administration of spinal anaesthesia was achieved in 80% patients with Granisetron and in 45% of patients with placebo. The corresponding incidences during (4-24hrs) were 82.5 and 55% (p value <0.05).

Our study agrees with and confirms the various aspects of the above studies. We found that Granisetron has definite advantage over Prochlorperazine in prevention and treatment of PONV in female patients undergoing abdominal hysterectomy under spinal anaesthesia. There was absolutely negligible need for rescue antiemetic medication in granisetron group whereas some patients in prochlorperazine group needed rescue medication in the form of metaclopramide.

Mouth dissolving tablets of Granisetron available freely in India 1mg strength by the trade name Graniforce-MD (Mankind) and Prochlorperazine 5mg tablet by the trade name of Emikind-MD (Mankind).

Conclusion

The administration of Granisetron 1hr before surgery was superior to Prochlorperazine in long term prevention of postoperative nausea and vomiting following total abdominal hysterectomy under spinal anesthesia.

The postoperative sequelae, side effects and behaviour of the patients , though not a part of our study were comparable in both the groups and both the drugs are safe for routine clinical use during Total abdominal hysterectomy under spinal anesthesia.

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Original Research Article

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Sevoflurane with Halothane for Endotracheal Intubation in Paediatric Patients: A Comparative Evaluation

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Abstract

In paediatric patients, smooth induction with rapid endotracheal intubation without morbidity and mortality is of prime importance. Many of the inhalational anaesthetic agents have been tried for this purpose. In the present study, Sevoflurane due to its high potency, rapid induction, excellent intubating conditions with haemodynamic stability was compared with Halothane in paediatric patients. In the present study, 60 paediatric patients of ASA grade I and II of either sex were divided into 2 equal groups of 30 each according to inhalational anaesthetic agent used for induction of anaesthesia. In group S Sevoflurane 8% and group H Halothane 3% were used for induction of anaesthesia with Nitrous oxide/oxygen mixture on Boyles' machine. All patients received Inj. Glycopyrolate 5-8µgm /kg and inj. Midazolam 0.25 µgm /kg as premedication 10 minutes prior to induction of anaesthesia. It was observed that, mean induction time in group S was 210±17 secs and in Group H 262±21 secs. Sevoflurane has low blood/gas coefficient of 0.69 as compared to Halothane 2.5, so quicker induction time with Sevoflurane as compared to Halothane. In group S, 90% of patients had excellent intubating conditions, 7% good and 3% had fair while in group H 84% had excellent intubating conditions, 13% had good and 3% had fair intubating conditions. During intubation, mean pulse rate decreased significantly in both groups and increased after intubation. The decrease in pulse rate was comparatively less in group S than group H and also there was significant increase in pulse rate after intubation in both groups. Similar changes were observed with mean systolic blood pressure and mean arterial pressure in both groups. Thus Sevoflurane provided better cardiovascular stability during and after intubation as compared to Halothane. We conclude that, Sevoflurane due to its cardiovascular stability, smooth induction, and excellent intubating conditions may be preferred over Halothane in paediatric patients for endotracheal intubation.

Keywords: Sevoflurane; Smooth Induction; Rapid Intubation; Paediatric Patients.

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Introduction

Safety in anaesthesia practice is recent satisfactory outcome, secondary to introduction of newer and newer drugs and techniques in the practice. Endotracheal intubation is mandatory for providing safe protected airway and IPPV during general anaesthesia for operative procedures. Smooth endotracheal intubation is necessary to avoid bucking and coughing during laryngoscopy and endotracheal intubations and related complications

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of aspiration of gastric contents resulting morbidity and mortality.

In paediatric patients for smooth induction and rapid endotracheal intubation halogenated hydrocarbons inhalational anaesthetic agents are being tried by so many practicing anaesthesiologists. Halothane was synthesized in 1951 and was introduced for clinical use in 1956. Halothane has tendency for alkaline derivatives to enhance the dysarrhythemoganic effects of epinephrine, led to search of new inhalational agents. In this series Methoxyflurane, Enflurane, Isoflurane were tried but not so popular. Then Sevoflurane was introduced.

Halothane has been used worldwide for many years as it provides smooth induction and good intubating conditions with some drawbacks of myocardial depression and arrhythmias. Sevoflurane is halogenated with fluorine, non-pungent and rapid increase in alveolar concentration, makes it an excellent choice for rapid and smooth induction in paediatric patients. It has rapid onset of action within 1-3 minutes in 4-8% concentration with more rapid emergence.

In view of these properties, the present study was under taken to evaluate the efficacy of Sevoflurane for smooth induction and rapid endotracheal intubation with haemodynamic stability as compared to Halothane in paediatric patients.

Material and Methods

The present study was undertaken in 60 paediatric patients of age range 3 months – 3 years of ASA grade I and II. The weight range was 3 – 12 kg. The paediatric patients with severe systemic diseases of renal, cardiovascular, respiratory, hepatic and central nervous system were excluded from the study. All patients were preanaesthetically evaluated for fitness of anaesthesia and informed valid consent was obtained from parents. These patients were divided into 2 equal groups of 30 patients each according to inhalational induction agent used for endotracheal intubation Group S for Sevoflurane and Group H for Halothane.

Preoperatively baseline pulse rate, blood pressure and O_2 saturation were noted. All patients were premedicated with Inj. Glycopyrolate 5-8 µgm/kg and inj. Midazolam 0.25 µgm/kg IV 10 minutes prior to induction. Induction of anaesthesia was performed with Gas/Oxygen and either Halothane or Sevoflurane on mask with Boyles' machine. Endotracheal intubation was performed under 6-8% Sevoflurane or 2-3% Halothane slowly incremental inhalation.

The quality of endotracheal intubation was assessed as ease of laryngoscopy, vocal cord position, coughing or bucking on laryngoscopy and intubation, jaw relaxation and response of body movements. The scoring system was used as devised by Helbo-Hausen and Trap-Anderson (1998) [1] and revised by Steyn et al. (1998) [2].

Anaesthesia was continued and maintained with Gas, Oxygen, Halothane or Sevoflurane on controlled ventilation. All patients were monitored for changes in pulse rate, blood pressure (systolic, diastolic and mean pressure) Intraoperatively, after premedication, during intubation, after intubation, 1,2,3 minutes after intubation. At the end of operative procedure, inhalational anaesthetic agent was tapered and extubation was done after complete recovery. These patients were also observed in recovery room for any related complications.

Scoring System for Intubating Conditions

Helbo-Hansen [1]

Criteria	Score 1	2	3	4
Laryngoscopy	Easy	Fair	Difficult	Impossible
Vocal cords	Open	Moving	Closing	Closed
Coughing	None	Slight	Moderate	Severe
Jaw relaxation	Complete	Slight	Stiff	Rigid
Limb movement	None	Slight	Moderate	severe

Cooper

Criteria	score 0	1	2	3
Jaw relaxation	Poor	Minimal	Moderate	Good
Vocal cord position	closed	Closing	Moving	Open
Reaction to intubation	Severe Coughing	Mild Coughing	Slight Movements	none

Intubating condition	Total Score
Excellent	8-9
Good	6-7
Fair	3-5
Poor	0-2

Observations

These 60 pediatric patients were divided into 2 groups. The age distribution was as shown in Table 1.

Mean age range in group S was 21±9 months and group H was 18 ± 9 months. There was no significant difference as far as age range was concerned in both groups.

Distribution of patients according to sex was as shown in Table 2.

There were 67% male in group S and 77% in group H while there were 33% female in group S and 23% in group H.

The weight range in both groups was as shown in Table 3.

Mean weight range was 7.68±2.57 in group S and 7.30±2.64 in group H. There was significant difference in age range in both groups.

The distribution of patients according to induction time in seconds was as noted in Table 4.

The induction time was within 180-210 seconds in 53% of patients and 210-240 secs in 47% in Sevoflurane group. In Halothane group induction time was 210-240 secs in 12%, 240-270 secs and 270-300 secs in 39% of patients each. The mean induction time was 210±17 secs in Sevoflurane group and 212±21 secs in Halothane group. Thus induction time was significantly less in Sevoflurane group as compared to Halothane group. Sevoflurane offered quicker induction than Halothane in paediatric patients. The distribution of patients according to intubating conditions observed were as shown in Table 5.

Table 1: Showing Age Distribution

Age in months	Sevoflurane Group S		Halothane Group G	
	No. of patients	Percentage	No. of patients	Percentage
3 – 6	1	3	4	13
7 – 12	9	30	8	27
13 – 18	4	13	4	13
19 – 24	7	24	4	13
25 – 30	3	10	8	27
31 – 36	6	20	2	8
Total	30		30	

Table 2: Showing sex Distribution

Gender	Group S		Group H	
	No. of patients	Percentage	No. of patients	Percentage
Male	20	67	23	77
Female	10	33	07	23
Total	30		30	

Table 3: Showing Weight range in Kg

Weight range in Kg	Sevoflurane Group S		Halothane Group G	
	No. of patients	Percentage	No. of patients	Percentage
1 – 3	1	3	1	3
4 – 6	9	30	12	40
7 – 10	16	54	14	47
11 - 14	4	13	3	10
25 – 30	3	10	8	27
31 – 36	6	20	2	8
Total	30		30	
Mean	7.68 ± 2.57		7.30 ± 2.64	

Table 4: Showing Distribution according to Induction Time

Induction time In seconds	Group S		Group H	
	No. of patients	Percentage	No. of patients	Percentage
180 – 210	16	53	--	--
210 – 240	14	47	4	12
240 – 270	--	--	13	39
270 - 300	--	--	13	39
Total	30		30	
Mean time	210 ± 17 secs		262 ± 21 secs	

In Sevoflurane group, 90% of patients had excellent intubating conditions while in Halothane group 84% of patients had excellent intubating conditions. Good intubating conditions were noted in 7% of patients in group S and 13% patients in group H. Only one patient in each group had fair intubating conditions. Thus intubating conditions were excellent in more number of patients of Sevoflurane group as compared to Halothane group.

The changes in mean pulse rate at various time intervals were noted as shown in Table 6.

After premedication, mean pulse rate was 127.63± 9.91 in group S and 129.86±9.81 in group H. During intubation, mean pulse rate was 118.96 in group S and 113.13±9.56 in group H. It was observed that; mean pulse rate was significantly less in both groups during and after intubation as compared to premedication readings. The mean pulse rate, increased insignificantly in both groups after intubation and 1,2,3 minutes time intervals in both groups as compared to after premedication. The mean pulse rate remained low during intubation in both groups. The changes I mean systolic blood pressure at various time intervals In both groups were as shown in Table 7.

After premedication, mean systolic blood pressure were 90.73±8.19 mm of Hg in group S and 90.08± 7.94 mm of Hg in group H. There was significant fall in mean systolic blood pressure during intubation in both groups as compared to premedication readings. After intubation and at 1,2,3 minutes intervals, again there was insignificant increase in mean systolic blood pressure in both groups as compared to during intubation readings and also during premedication readings. Thus during intubation, mean systolic blood pressure was significantly less as compared to premedication and after intubation readings in both groups.

The changes in mean arterial pressure were noted as shown in Table 8.

After premedication, mean arterial blood pressure was 56.7±4.41 mm of Hg in group S and 60.93±4.77 mm of Hg in group H. There was insignificant decrease in mean arterial pressure after intubation as compared to during intubation readings in both groups. There was no significant difference in mean arterial pressure amongst two groups at various time intervals.

Table 5: Showing Intubating Conditions

Intubating conditions	Group S		Group H	
	No. of patients	Percentage	No. of patients	Percentage
Excellent	27	90	25	84
Good	2	7	4	13
Fair	1	3	1	3
Poor	--	--	--	--
Total	30	--	30	--

Table 6: Showing changes in Mean Pulse rate

Time Interval	Group S	Group H
After Premedication	127. 63 ± 9.91	129.86 ± 9.81
During Intubation	118.96 ± 9.86	113.13± 9.56
After Intubation	133.86 ± 10.74	126.06 ± 8.28
1 minute after intubation	130.86 ± 9.66	127.06 ± 8.71
2 minutes after intubation	128.86 ± 10.97	127.56 ± 9.46
3 minutes after intubation	129.53 ± 11.53	127.73 ± 10.50

Table 7: Showing changes in Mean Systolic Blood Pressure

Time Interval	Mean systolic Blood Pressure in mm of Hg	
	Group S	Group H
After Premedication	90.73 ± 8.19	90.08 ± 7.94
During Intubation	86.36 ± 7.98	80.66 ± 6.65
After Intubation	99.80 ± 7.66	96.0 ± 6.38
1 minute after intubation	94.76 ± 7.19	92.6 ± 5.99
2 minutes after intubation	93.73 ± 7.14	92.4 ± 5.97
3 minutes after intubation	93.13 ± 6.78	91.86 ± 5.27

Table 8: Showing Mean Arterial Blood Pressure

Time Interval	Mean Arterial Blood Pressure in mm of Hg	
	Group S	Group H
After Premedication	56.7 ± 4.41	60.93 ± 4.77
During Intubation	56.42 ± 4.13	57.99 ± 3.98
After Intubation	66.58 ± 5.52	63.46 ± 3.72
1 minute after intubation	61.58 ± 4.90	61.21 ± 3.35
2 minutes after intubation	60.70 ± 4.50	61.15 ± 3.15
3 minutes after intubation	60.01 ± 4.50	60.57 ± 2.71

Discussion

Newer inhalational anaesthetic agents since their introduction have provided safe anaesthesia practice. These contribute for advanced medical and health care for human population. General anaesthesia constitutes smooth induction, rapid endotracheal intubation, uneventful intra and postoperative outcome after operative procedures. Aspiration of gastric contents during laryngoscopy and intubation is a major contributing factor for anaesthetic morbidity and mortality. So smooth induction and rapid endotracheal intubation is mandatory particularly in paediatric patients to avoid these complications.

Inhalational anaesthetic agents with potent action and smooth induction simplified technique of general anaesthesia. Halothane due to its high potency and smooth induction, easy passage into deep levels of anaesthesia by increasing concentration, sweet smell and easily accepted by paediatric patients remained agent of choice for many years. There is tendency for alkaline derivatives of Halothane to enhance dysarrhythamogenic effects of epinephrine led to search of new inhalational agents particularly derived from esters. The introduction of fluorinated methyl isopropyl ester Sevoflurane, having low solubility in blood facilitates rapid and smooth induction and smooth recovery.

Meretoja O A et al. (1996) [3], Paris S T et al. (1997) [4], Brain K O et al. (1998) [5], Sigston P E et al. (1997) [6] Black A et al. (1996) [7], Vernoque et al. (1994) [8] have used Sevoflurane and Halothane in paediatric patients for endotracheal intubation. In the present study, the age range was 3 months to 3 years and the age range of above authors was corresponding to our study. Mean weight range was 7.68± 2.64 kg in Group S and 7.30±2.64 in group H. There was no statistical difference in both groups.

Induction Time

Meretoja O A et al. (1996) [3], Paris S T et al. (1997) [4] Brien K O et al. (1998) [5], Massakki et al. (1993) [9], Veronique et al. (1994) [8], Matsuyki et al. (1993) [10], Joel B et al. (1995) [11], Sigston et al. (1997) [6], Bkack A et al. (1996) [7] and many others have used various inhalational anaesthetic agents as Sevoflurane, Halothane, Enflurane or Isoflurane for induction of anaesthesia in their paediatric patients. Many of them have noted that, induction time within 120-160 seconds for Sevoflurane and 180-240 secs for Halothane. In the present study, mean induction time was 210±8 secs for Sevoflurane and 262±21 secs for Halothane. Induction time was significantly less with Sevoflurane as compared to Halothane. The induction time was comparatively prolonged in the present study as the inspired concentration was low during the starting of induction in both groups as compared to other studies. Most of above authors have observed quicker induction time with Sevoflurane as compared to Halothane in their studies. Our observations coincides with above observations.

The slow induction of anaesthesia is mainly due to its high blood/gas coefficient (Krien K O et al., 1998) [8]. The induction of anaesthesia with inhalational anaesthetic agents depend on alveolar ventilation, cardiac output and regional distribution as tissue/ blood and blood/gas solubility coefficient (Veronique et al. 1994) [8]. Sevoflurane has a low blood/gas solubility than Halothane, hence rapid induction rapid recovery. Thus Sevoflurane is more potent than Halothane, hence induction is quicker with Sevoflurane as compared to Halothane and our observations can be explained on above grounds.

Intubating Conditions

Brien K O et al. (1998) [5] used Helbo-Henson, Ralvo and Trap Andrson [1] scoring system to assess the intubating conditions in their study. In the present study we have also assessed the intubating conditions with above system in our study. We have observed equivalent intubating conditions either with Sevoflurane and Halothane. We have noted 27 (90%) out of 30 in Group s and 25 (84%) out of 30 in group H had excellent intubating conditions Masaki et al. (1993) [12], P E Sigston et al. (1998) [6], Black J E et

al. (1996) [7], R C Agnor et al. (1998) [12] have also observed excellent intubating conditions in more number of patients with Sevoflurane as compared to Halothane induction. Sevoflurane has less airway irritation, more pleasant smell than Halothane so more acceptance with rapid induction and deep level of anaesthesia than Halothane. So more patients with excellent intubating conditions with Sevoflurane than Halothane.

Heart Rate

O A Meretoja etal (1996) [3] observed cardiac arrhythmias more common in Halothane induction as compared to Sevoflurane anaesthesia. In our study, mean pulse rate decreased in Group S during intubation and increased after intubation. In Group H, mean pulse rate there was more decrease during intubation and increased after intubation. We observed Sevoflurane to be more cardiostable as compared to Halothane as far as mean pulse rate was concerned. Paris S T et al. (1993) [4], Brien K O, et al. (1998) [5], Friesen R H et al. (1982) [13], Veronique et al. (1994) [8], Sorner J B et al.(1995) [11] have also noted Sevoflurane to be cardiostable during intubation as compared to Halothane. Our observations correlate with these authors. Cardio stability offered with Sevoflurane might be due to its non-myocardial depressant action which is there with Halothane.

Mean Arterial Pressure

Friesen R H et al. (1982) [13], Epstein R H et al. (1995) [14], Sarner J B et al. (1995) [11], Shin Kawana et al. (1995) [15], Black A et al. (1996) [7] Brien K O et al. (1998) [5], H Vitanen (1999) [16] have studied mean arterial pressure during induction and after intubation under Sevoflurane and Halothane anaesthesia. In the present study, in group H mean systolic blood pressure and mean arterial pressure decreased during intubation by 10 mm of Hg and increased after intubation There are many variations as far as mean systolic and mean arterial pressure in different studies. These might be due to differences in age group of patients, MAC values and concentrations of Sevoflurane and Halothane used for induction of anaesthesia. Overall, Sevoflurane offers more cardio stability due to less myocardial depressant action as compared to Halothane in paediatric patients.

Conclusions

From the present study, it was concluded that inhalational anaesthetic agents Sevoflurane and Halothane can be used for smooth induction and rapid endotracheal intubation. Sevoflurane has sweet smell, less airway irritation and greater acceptance particularly by paediatric patients so it is preferred over Halothane. Sevoflurane is more potent than Halothane provides excellent intubating conditions with cardiovascular stability in paediatric patients as compared to Halothane. So it is better choice in paediatric patients for endotracheal intubation than Halothane.

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Original Research Article

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The Efficacy of Transversus Abdominis Plane Block in Laparoscopic Tubal Sterilisation Surgeries: A Randomised Control Study

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Abstract

Background: Transversus abdominis plane block is a safe, simple and effective technique, widely used to provide postoperative analgesia for various abdominal surgeries. We evaluated the efficacy of Transversus abdominis plane block in laparoscopic tubal sterilisation surgeries in providing intraoperative and postoperative pain relief. *Materials and Methods:* 40 ASA I and II adult female patients undergoing laparoscopic sterilisation surgeries were randomised into two groups. Group T (n=20) received TAP block with 20 ml of 0.375% Ropivacaine and Group C (n=20) received general anaesthesia with local infiltration with 10 ml of 0.375% Ropivacaine. Intraoperatively, hemodynamic parameters, Pulse oximetry, end tidal Carbon dioxide concentration and total Propofol requirement were noted. Postoperatively, the recovery profile (Modified Aldrete Score) and Visual analog scale scores were noted at emergence and at 1st, 2nd, 6th, 12th and 24 hours. *Results:* Patients who underwent surgery under TAP block had a longer time to request for rescue analgesic (Group T 313±77.61 minutes; Group C 34.77±6.72; p<0.001) with a reduced VAS at Trescue (Group T=4.00±0.00; Group C=4.32±0.89; p<0.001).The mean VAS scores of the patients in Group T were lower when compared to Group C at all time intervals. The Propofol requirement was lower in Group T (Group T =18.88±17.85 mg and Group C =119.54±9.5 p<0.001) and recovery profile better in patients in Group T. Incidence of postoperative nausea and vomiting was the same in both groups. *Conclusion:* TAP block with sedation can be considered as a suitable alternative to general anaesthesia with local infiltration in laparoscopic sterilisation surgeries.

Keywords: Laparoscopic Sterilisation; Transversus Abdominis Plane Block; Ropivacaine.

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Introduction

Laparoscopic tubal ligation is one of the most commonly performed ambulatory surgeries, but the appropriate anaesthetic technique has not been defined [1]. General anaesthesia with endotracheal intubation or laryngeal mask airway has its set of side effects; whereas local infiltration with sedation is often inadequate due to patient discomfort [1,2].

Transversus abdominis plane block introduced by Rafi in 2001 [3], acts by blocking the somatic nerves supplying the anterior abdominal wall. It is done by depositing local anaesthetic in the neurovascular plane between internal oblique and transversus abdominis muscles. It has been used as a component of multimodal analgesia for postoperative pain relief following various surgical procedures such as large bowel resection, appendectomy, hysterectomy, caesarean section etc [4,5,6].

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However few studies have evaluated its efficacy in providing intraoperative analgesia .We hypothesised that TAP block would provide longer and better quality of analgesia in patients undergoing laparoscopic tubal sterilisation surgeries, and also reduce the requirement of intravenous sedatives and anaesthetics, enabling the mother to be conscious and pain free.

Materials and Methods

After obtaining approval from the institutional ethical committee and written informed consent, two groups of 20 adult female patients of ASA I and II; scheduled for laparoscopic tubal ligation surgeries were studied. Patients with BMI more than 30, drug allergy, opioid tolerance, severe systemic diseases and history of abdominal surgeries were excluded. Primary outcome of our study was the duration of postoperative analgesia and VAS scores in the immediate postoperative period and at 1st, 2nd, 6th, 12th and 24th hours .Secondary outcomes were the total Propofol requirement and recovery profile at the end of the surgery.

Patients were randomised by sealed envelope technique into two groups to either TAP block (Group T, n=20) or to receive general anaesthesia with local infiltration (Group C, n=20). A single investigator experienced in performing the blocks performed both the blocks. All patients received premedication with intravenous Midazolam 0.02 mg/kg, Glycopyrrolate 0.004mg/kg and Fentanyl 2 mcg/kg. All standard monitoring like pulse oximetry, electrocardiogram, non invasive blood pressure and end tidal carbon dioxide were monitored. Patients were familiarised with the VAS scoring scale before surgery.

For patients in Group T, bilateral TAP block was performed with 18 G blunted needle, as advocated by McDonnell et al. [5]; 20 minutes prior to skin incision using the 'double pop' technique. The lumbar triangle of Petit, located just anterior to the latissimus dorsi muscle was identified. The iliac crest was palpated and skin was pierced two inches cephalad to it in the mid axillary line. The first resistance indicated that the needle tip is traversing the external oblique muscle. On advancing the needle, a loss of resistance or pop sensation was obtained as the needle entered the fascial plane between external oblique and internal oblique. Further gentle advancement resulted in a second resistance which is the fascial extension of the internal oblique muscle. A second 'pop' indicated entry into the transversus abdominis plane. After negative aspiration to exclude vascular puncture, a test dose of 1ml of Ropivacaine 0.375% was injected .In case of any resistance, the needle was repositioned and test repeated. 20 ml of Ropivacaine 0.375% was given (not exceeding a maximum dose of 2.5 mg/kg). TAP block was then performed on the other side. A sedative dose of Propofol 0.5mg/kg was given if the patient had any discomfort or pain. The total Propofol requirement was then calculated.

In Group C, skin was infiltrated with 10 ml of Ropivacaine 0.375%; 20 minutes prior to skin incision. Following which general anaesthesia was administered with Propofol 2mg/kg, and size 3 or 4 Laryngeal mask airway(LMA) was inserted. Anaesthesia was maintained with oxygen and nitrous oxide in the ratio of 40:60, and Propofol 0.5 mg/kg was given as required; as a supplement. Nitrous oxide was discontinued after ligation of fallopian tubes and LMA removed after skin closure.

Intraoperatively heart rate, blood pressure, pulse oximetry was monitored every 5 minutes up to 10 minutes after surgery. The total Propofol required and the recovery profiles (Modified aldrete score)[15] were assessed at immediate postoperative period and 5 and 10 minutes thereafter. A score of 9 or more was considered as complete recovery. Visual analogue scores (0= no pain and 10 = worst possible pain)at the immediate post operative period, 1st , 2nd , 6th , 12th and 24th hours were noted .The time to request of rescue analgesic(when VAS score ≥ 4) in the form of Injection Tramadol 1 mg/kg was noted. Any intraoperative or postoperative complications like hypotension, bradycardia, and technique related complications like local site infection, hematoma formation, peritoneal and bowel perforation and local anaesthetic toxicity were sought for. Incidence of postoperative nausea and vomiting was noted in both the groups.

A thorough review of related literature was performed from standard textbooks and related articles. We determined that a study size with a sample size of 18 per group would have an 80% power for a 30% reduction in the mean time for request for rescue analgesic. We included 20 patients in each group. All raw data were entered into a Microsoft Excel spreadsheet and analysed using standard statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver. 2.11.1 Continuous numerical data were expressed as mean and standard deviation. Categorical data were expressed as frequencies and percentages. Normally distributed data between groups were analysed using Students t test. Chi-square/ Fisher Exact test has been used for categorical data. p value ≤ 0.05 was considered statistically significant.

Results

Forty subjects were recruited into the study. Both groups were comparable in terms of baseline demographics, duration of surgery and baseline vital parameters (pulse rate, systolic and diastolic blood pressure. A summary of the baseline characteristics of the patients has been furnished below in Table 1.

Intraoperative hemodynamic changes were comparable in both the groups and have been graphically plotted in Figures 1, 2 and 3.

Patients who underwent TAP block had a longer time to request for rescue analgesic (Group T 313±77.61 minutes; Group C 34.77±6.63; p<0.001) with a reduced VAS at Trescue (Group T = 4.00±0.00; Group C=4.32±0.89; p<0.001) (Table 2) The mean VAS scores of the patients in Group T were lower when compared to Group C at all time periods.

However patients on sole TAP block often had mild discomfort while ligation of tubes for which Propofol 0.5mg/kg was given. Despite this the mean Propofol consumption was lower (Group T =18.88±17.85 mg and Group C =119.54±9.5, p<0.001)and recovery

Table 1: Patient characteristics

Parameters	Group T	Group C	Significance
Age (in years)	27.72±3.64	27.59±3.66	P=0.911
Weight(in kg)	58.54±2.50	59.33±3.85	P=0.47
SBP(mm Hg)	112.61±8.50	115.45±13.49	P=0.44
DBP(mm Hg)	72.33±4.07	75.23±8.26	P=0.183
PR(per min	80.67±12.78	77.86±13.87	P=0.51
Duration of surgery(minutes)	10.33±0.76	10.59±1.25	P=0.45

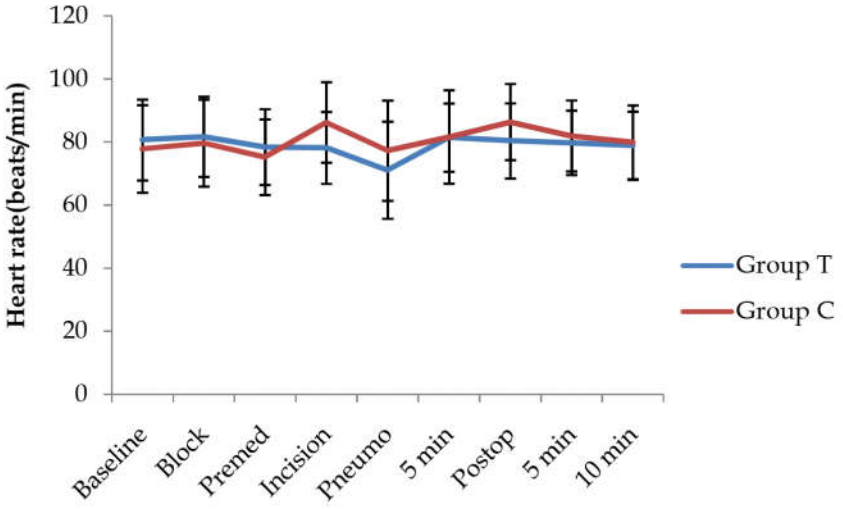

Fig. 1: Heart Rate

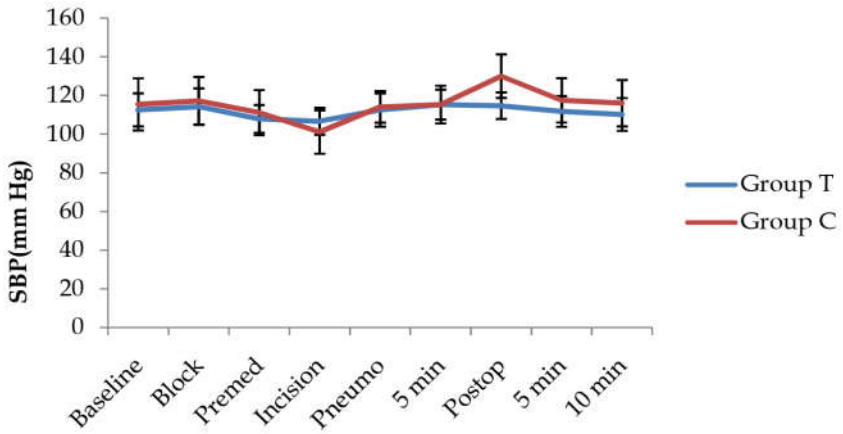

Fig. 2: Systolic blood pressure

profile (assessed by Modified Aldrete Score) better in patients in Group T in the immediate postoperative period (Group T MAS=9.77± 0.42, Group c =7.00±0.67, p<0.001) (Table 3). However, patients in both the groups had a score of 9 or more at the end of 10 minutes. Incidence of postoperative nausea and vomiting was the same in both the groups.

Discussion

The principal finding of our study was that TAP block with Ropivacaine provides effective intraoperative and postoperative analgesia for patients undergoing laparoscopic tubal sterilisation surgeries, but often has to be combined with Propofol 0.5 mg/kg for effective patient comfort.

While laparoscopic tubal ligation surgeries have been done with either general anaesthesia or procedural sedation with analgesia [2], no studies have evaluated the role of TAP block for the same. TAP block provides superior analgesia when compared to local infiltration as evidenced by the longer time to rescue analgesic while at the same time reduces the requirement of drugs like Propofol, ensuring a smooth and early recovery – an awake, pain free mother is most desirable at the end of the procedure.

We have found the superiority of TAP block in providing immediate postoperative analgesia as reflected by a lower VAS score. However, the present studies on TAP block are not unanimous in their opinion of whether TAP block improves postoperative pain score or not [12].

Table 2: Comparison of quality of analgesia

	Group T	Group C	Significance
Immediate postoperative VAS	2.22±1.22	4.32±0.89	P<0.001
Time to rescue analgesic	313±77.61	34.77±6.63	P<0.001
VAS at Trescue	4.00±0.00	4.32±0.89	P<0.001
PONV	6/20	6/20	P=0.66

Table 3: Mean Propofol requirement and recovery characteristics'

	Group T	Group C	Significance
Total Propofol used	18.88±17.85	119.54±9.5	P<0.001
Recovery(immediate post op)Modified Aldrete Score	9.77± 0.42	7.00±0.67	P<0.001
MAS at 5 minutes	10.00±0.00	8.89±0.61	P<0.001
MAS at 10 min	10.00±0.00	9.90±0.29	P=0.15

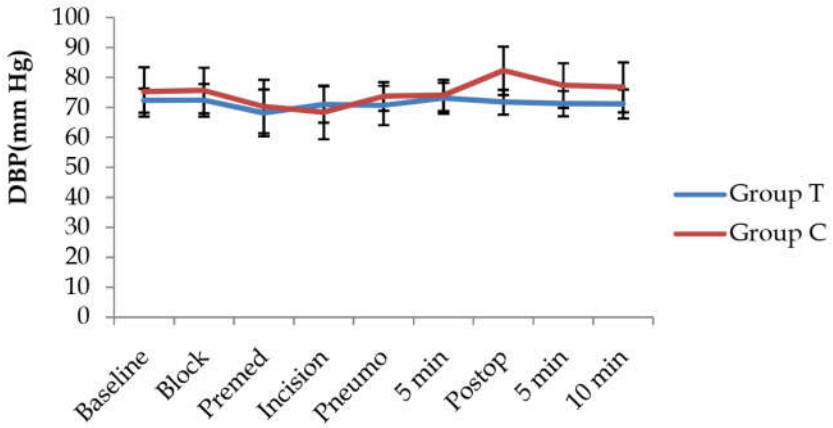

Fig. 3: Diastolic blood pressure

Our finding is consistent with that of the study done by S Bhattacharjee et al. [7] in abdominal hysterectomy and McDonnell et al. in caesarean section [4].

Sivapurapu et al in their study in patients undergoing abdominal hysterectomy under general anaesthesia have noted a significant increase in the time to rescue analgesia with lower VAS scores in the immediate postoperative period and at 1st, 2nd, 6th, 12th and 24th hours. Also the 24 hour morphine requirement was lesser in the TAP block group [8].

Siddiqui et al. in 2011 in a meta analysis have noted that TAP block is comparable to morphine for postoperative analgesia, reduces the time for request for rescue analgesic with reduced postoperative opioids requirement [9].

However, Loane H et al. in 2012 in their study on patients undergoing Caesarean section have found that TAP block provides inferior analgesia when compared to intrathecal morphine, but with lesser opioid related side effects [10]. This was probably due to the effect of intrathecal morphine at both the parietal and visceral component of pain, while TAP block addressed only the parietal component.

In our study, the mean duration of effective analgesia was 313 minutes in the TAP block group which was consistent with S Bhattacharjee et al. [7] in abdominal hysterectomy (Median duration of analgesia was 290 minutes; with 0.25% bupivacaine; 0.5ml/kg bodyweight on either side) and Mc Donnell et al. [16] who demonstrated in their study that TAP block with 0.5% lignocaine may provide effective analgesia up to 4-6 hours. Also the reduced VAS scores for up to 24 hours in patients in TAP block group indicates a continuing analgesic action of the TAP block which may be explained the relative avascularity of the TAP, leading to delayed drug clearance [11].

All local anaesthetic techniques carry an inherent failure rate of 5- 20%, which depends on the operator skill. Inadequate analgesia after TAP block may be due to a technical failure which can be improved by using an ultrasound [6] or it may be due to visceral pain which is not addressed by TAP block.

Our study had few limitations. First use of a ultrasound in TAP block [6] is increasing; whereas we used a landmark based anatomical approach which is less efficacious. Secondly, use of patient controlled analgesia in the postoperative period would have accurately delineated the postoperative analgesic requirement. Thirdly, the response to pain is different in different patients and true blinding of the patients is not possible; which may have influenced the study.

Conclusion

TAP block with sedation can be considered as a suitable alternative to General anaesthesia with local infiltration in laparoscopic sterilisation surgeries; as it provides superior analgesia, better recovery profiles and reduces the requirement of Propofol supplementation.

Conflict of Interest

None

Abbreviations

HR-Heart rate, SBP-Systolic blood pressure, DBP-Diastolic blood pressure, VAS: Visual analog scale, MAS-Modified Aldrete Score, PONV= postoperative nausea and vomiting, Trescue- time of rescue analgesic, LMA-Laryngeal Mask Airway.

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Original Research Article

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Ketamine versus Magnesium Sulphate Gargle in Prevention of Post Operative Sore Throat after Endotracheal Intubation, Randomised Comparative Trial

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Abstract

Background: Postoperative sore throat is one of the most common complications afterendotracheal intubation. Both Ketamine and magnesium can block N-methyl-D-aspartic acid receptors and provide central and local analgesia. *Objectives:* To compare the efficacy of magnesium sulfate and ketamine gargle in preventionof postoperative sore throat. *Methodology:* A total of 90 patients posted for general anaesthesia with endotrachealintubation were enrolled in the study. Patients in ketamine group received ketamine gargle (50 mg) and magnesium group received magnesium sulfate gargle (20 mg/kg up to 30 mL normal saline) 15 minutes before the operation. Patient's complaint of postoperative sore throat, and its severity were measured and recorded at baseline in recovery room, and then 0, 4, 8, 12 and 24 hours after operation. *Results:* To analyse the association of sore throat in two groups Chi square test wasused. $p < 0.05$ was considered statistically significant Number of patients with sore throat were significantly lower in magnesium group compared to ketamine group at 0hr ($p<0.001$), 4^{th} hr ($p <0.001$), 8^{th} hr ($p <0.001$), 12^{th} hr ($p<0.001$) and 24^{th} hr ($p =0.006$) after the operation. *Conclusions:* Magnesium sulphate decreases sore throat and pain severity more effectively compared toketamine gargle.

Keywords: Ketamine; Magnesium; Postoperative Sore Throat; Complications.

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Introduction

Management of airway is central to the practice of anaesthesia & it encompasses the whole range of airway manipulations required during the course of anaesthesia. Endotracheal intubation forms an integral part of airway management. Cuffed endotracheal tubes prevent aspiration and hence are commonly used. However, local irritation, inflammation of the airway is a common sequelae to cuffed endotracheal intubation, which leads to post extubation morbidities like sore throat, cough & hoarseness of voice which is extremely distressing to the patient.

A number of different measures both pharmacological & non pharmacological have been studied to reduce the incidence & the severity of post extubation sore throat. Smaller sized tubes [1], high volume low pressure endotracheal tubes [2], careful instrumentation of the airway, adequate intracuff pressure, lubricating with lignocaine jelly [3], betamethasone gel [3], IV dexamethasone [4],

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beclomethasone inhalation [5], magnesium lozenges [6], Aspirin gargle [7] are some of the strategies used to reduce postoperative sore throat. However, each intervention is associated with side-effects which may not be desirable. Hence there is a need for an intervention which would prevent rather than treat post-operative sore throat which is effective, patient friendly and reliable.

N-methyl D aspartate (NMDA) receptors are present not only in the central nervous system but also in the peripheral nervous system [8]. These receptors contribute in inflammatory pain. Ketamine and Magnesium sulphate are NMDA antagonist with anti-nociceptive and anti-inflammatory properties, which may be the possible mechanism in prevention of post-operative sore throat (POST) [7,8,9].

Though there are several measures available for reduction of post operative sore throat,the problem still remains unresolved. Hence, newer methods to address thiscomplication have to be developed and the effectiveness of ketamine and magnesium sulphate in prevention of POST needs to be studied. Therefore, we undertook a study on the effect of ketamine gargle and compared it with magnesium sulphate gargle in prevention of post-operative sore throat.

Materials and Methods

A prospective randomised, double blind clinical study was approved by our institutional ethical committee for a period of one year. Written informed consent was obtained from patients. 90 (45 in group A and other 45 in group B) patients of physical status American society of anaesthesiologist (ASA) grade 1and 2, aged between 18 to 60 years undergoing elective surgeries under general anaesthesia with endotracheal intubation, Mallampati grade I and II were included in the study. Patients with anticipated difficult intubation,Head and neck surgery, Duration of surgery > 3hrs were excluded from the study.

A total sample size of 90, sample size calculation done by using open episoftware version 2.3.1. at 95% confidence limit and 80% power of the study. According to study conducted by Rudra A [10] 45 patients having sore throat in ketamine group mean is 40% and study conducted by Borazan H [6], on 45 patients having sore throat in magnesium group mean is 14%. So sample size calculated is 45 in each group, hence the total sample size is 90.

Methodology

A total of 90 patients undergoing elective surgeries of a maximum duration of 3 hours under general anaesthesia were included in the study. Patients randomly divided into two groups by using computer generated table.

- Group A received preservative free ketamine 1 ml (50mg) in 29ml Normal saline (NS)
- Group B received 20mg/kg of magnesium sulphate diluted in normal saline making total volume of 30 ml.

Patients were asked to gargle for 30 seconds 5 minutes prior to induction. Standard non-invasive monitoring was done throughout the procedure. Following pre-oxygenation, patient were pre-medicated with Inj.glycopyrrolate 0.005mg/kg iv, Inj.midazolam 0.05mg/kg iv and Inj.fentanyl 2mcg/kg iv.

Induction of anaesthesia was done with 2mg/kg of Inj.propofol iv sufficient to obtund the eye-lash reflex, followed by Inj.vecuronium 0.1 mg/kg iv with an appropriate sized endotracheal tube. Tracheal intubation was performed by an experienced anaesthesiologist having experience of >3 years. The endotracheal tube was lubricated with 2% lignocaine jelly at room temperature. Immediately after intubation, cuff of the endotracheal tube was filled with a volume of room air required to prevent a palpable air leak.

Anaesthesia was maintained with isoflurane, fentanyl, vecuronium and supplemented with oxygen 33% in nitrous oxide. Intracuff pressure was maintained throughout the procedure between 18-22 cm H_2O using handheld pressure gauge. Supplemental analgesia during surgery was maintained with small doses of iv Fentanyl.

Residual neuromuscular relaxation with vecuronium was antagonized with Inj. Neostigmine iv (0.05mg/kg body weight) and Inj. Glycopyrrolate iv (0.01mg/kg body weight) on completion of surgery. Oropharyngeal suction before extubation was done under direct vision to avoid trauma to the tissues, confirming that secretion clearance was complete.

The patients were interviewed regarding post operative complaints. If they did not complain about sore throat then a leading question was asked regarding the same at 0, 4, 8, 12 and 24 hours after the procedure.

POST was graded on a four-point scale (0-3):

0. no sore throat;
1. mild sore throat (complains of sore throat only on asking);
2. moderate sore throat (complains of sore throat on his/her own);
3. Severe sore throat (change of voice or hoarseness, associated with throat pain). Other side-effects, if any, were also noted.

Statistical Analysis

Data were entered in MS-Excel analysed by using SPSS V22. Descriptive statistics like Mean and Standard Deviation were applied for quantitative data. t-test was applied for finding significance in quantitative data. Qualitative data were represented in the form of percentages. Chi-square test was done for finding significance in qualitative data. $p<0.05$ was considered as statistically significant.

Results

The present study was conducted to compare the efficacy of ketamine gargle and magnesium sulphate gargle in prevention of postoperative sore throat following endotracheal intubation in patients receiving general anaesthesia.

90 ASA grade I-II patients between 18-60 years of age, of both the sex were included in the study. 45 patients in Group A (Ketamine gargle) and 45 patients in Group B (Magnesium sulphate gargle).

Demographic data concerning patients age (p-0.61), Weight (p-0.49), Sex (p-0.29) and duration of surgery (p-0.46) were comparable in both the groups Table 1.

Incidence of sore throat was lower in Group B than in Group A at intervals 0 hr, 4th hrs, 8th hrs, 12th hrs, 24th hrs. Statistically significant at all instances with p value of <0.05 Table 4, 5, 6.

Table 1: Demographic Data

Variables	Group A (N=45)	Group B (N=45)
Age (years)	32.11 ± 10.27	33.24 ± 10.42
Weight (Kg.)	61.42 ± 8.73	60.22 ± 7.82
Gender (Male/Female)	23/22	18/27
Duration of surgery (mins)	122.44 ± 18.08	119.67 ± 17.10

Table 2: Shows incidence of sore throat at 0 Hr

Group	Sore Throat at 0th Hr				Chi-Square Value	P-value
	Grade-0	Grade-1	Grade-3	Grade-4		
Group-A	0	7	24	14	26.87	<0.001
	0.0%	15.6%	53.3%	31.1%		
Group-B	2	28	13	2		
	4.4%	62.2%	28.9%	4.4%		

Table 3: Shows incidence of sore throat at 4th Hr

Group	Sore Throat at 4th Hr			Chi-Square Value	P-value
	Grade-0	Grade-1	Grade-2		
Group-A	3	17	25	22.86	<0.001
	6.7%	37.8%	55.6%		
Group-B	15	25	5		
	33.3%	55.6%	11.1%		

Table 4: Shows incidence of sore throat at 8th Hr

Group	Sore Throat at 8th Hr			Chi-Square Value	P-value
	Grade-0	Grade-1	Grade-2		
Group-A	9	27	9	32.17	<0.001
	20.0%	60.0%	20.0%		
Group-B	35	10	0		
	77.8%	22.2%	0.0%		

Table 5: Shows incidence of sore throat at 12th Hr

Group	Sore Throat at 12th Hr		Chi-Square Value	P-value
	Grade-0	Grade-1		
Group-A	24	21		
	53.3%	46.7%		
Group-B	43	2	21.08	<0.001
	95.6%	4.4%		

Table 6: Shows incidence of sore throat at 24th Hr

Group	Sore Throat at 24th Hr		Chi-Square value	P-value
	Grade-0	Grade-1		
Group-A	38	7		
	84.4%	15.6%		
Group-B	45	0	7.59	0.006
	100.0%	0.0%		

Discussion

In modern anaesthetic practice, many of the general anaesthetic procedures are carried out with endotracheal intubation. Postoperative sore throat (POST) is a well-recognized side effect after endotracheal intubation [11]. But the discomfort produced by sore throat makes it one of the most undesirable side effect in the postoperative period [12].

POST(Post-operative sore throat) represents a broad constellation of signs and symptoms of laryngitis, tracheitis, hoarseness, cough or dysphagia with incidence varying from (21-65%) [10] after endotracheal intubation.

Identification of the factors associated with an increased risk of POST will allow anaesthesia providers to avoid combination of controllable factors, decrease the incidence of POST and improve post anaesthetic outcomes. Multi modal approach can be used for attenuation of POST. These consist of non-pharmacological and pharmacological interventions. Smaller sized endotracheal tubes [1], lubricating the endotracheal tube with water soluble jelly [3], careful airway instrumentation, intubation after full relaxation, gentle oropharyngeal suctioning, and minimizing intra-cuff pressure [11] are some of the non-pharmacological measures to reduce the incidence of POST.

Pharmacological interventions include beclomethasone inhalation [5], IV steroids [4], IV preservative free lignocaine, gargling with azulene sulfonate[13] etc. But all such manoeuvres have their own limitations and have not been able to successfully deal with this distressing side-effect.

Ketamine and magnesium both can block N-methyl- D-aspartic acid (NMDA) receptor. Ketamine relaxes the tracheal muscle contraction through a mechanism independent of NMDA receptors [8]. In addition, the decreased bronchomotor tone induced by ketamine is probably due to its interference with Ca2+ (a required step necessary to maintain the contraction). In this sense, magnesium could probably block the Ca entrance into tracheal muscle in a more effective manner. Recent reports of the incidence of postoperative sore throat following anaesthesia have claimed that the incidence of postoperative sore throat does not necessarily reflect damage caused by the tracheal tube cuff but more of increased muscle contracture. By preventing central sensitization, preemptive analgesia along with intensive multimodal analgesic interventions could theoretically reduce postoperative sore throat incidence and severity. Hence, in our study we compared pre-emptive ketamine gargle with mgso4 gargle as a means to prevent post-operative sore throat.

In our study the number of male patients was 23 in ketamine group & 18 in $MgSO_4$ group. The number of female patients was 22 in ketamine group and 27 in $MgSO_4$ group. When compared the difference was not found to be statistically significant (p=0.29).

The incidence of sore throat increases with the duration of procedure. Hence in our study the duration of procedure was defined. Duration was standardized in both the groups. Any patient whose surgery lasted for more than 3 hrs was excluded from our study. The duration of the procedure in ketamine group was 122.44±18.08 minutes while in mgso4

group it was 119.67±17.10 minutes. When compared the difference was not found to be statistically significant (p=0.75).

The use of cuffed tubes, Stout D M. et al. (1987) [1] showed a higher incidence of sore throat by larger size tube compared with smaller size, hence in our study we used 7.5 mm tube for female patients and 8.5mm tube for male patients in both the groups.

Incidence of post operative sore throat has been found to be higher when tubes with high pressure low volume cuffs are used in comparison with tubes with high volume low pressure cuffs. Hence in our study we used portex tubes that have a high volume low pressure cuff in all patients [11]

Previous studies have reported that POST is associated with increase in cuff pressure. Excessive inflation of endotracheal tube cuff produces high pressure on the tracheal wall thereby affecting perfusion of the tracheal mucosa resulting in its ischaemic necrosis. When pressure in the endotracheal tube cuff exceeds 22 mm hg, blood flow in the tracheal mucosa begins decreasing and reduces markedly when the pressure reaches 30 mm hg hence in our study we maintained the intra-cuff pressure between 18-22 mm hg in both the groups.

Trauma during insertion of the endotracheal tube is associated with higher incidence of post operative sorethroat [11], hence in our study all the intubations were done by an anaesthesiologist with a minimum experience of 3 years to avoid unnecessary trauma.

Blind suctioning causes trauma to the pharyngolaryngeal structures that increases the chances of post-operative sore throat. Suctioning was strictly done under vision in our study. High anaesthetic air flow rates cause drying of the mucosa that inturn leads to increased incidence of post-operative sore throat, our study used O_2:N_2O in a ratio of 1:1 with fresh gas flow of 4 liters [14].

The incidence of postoperative sore throat varied with the type of questioning employed. Various investigators have used various techniques to elicit sore throat in postoperative period. Harding C J. et al. [15] conducted a study in 1987 that showed higher incidence of sore throat by direct questioning. Hence in our study we have used a scale in which patient is asked about his complaints in the postoperative period. If the patient does notcomplain of sore throat then a direct question pertaining to sore throat, cough, hoarseness was asked.

Placement of throat pack around the endotracheal tube increases the incidence of POST [16]. However, in our study, throat pack was not inserted in any of the patients.

Our study found that Gargling with 50mg of Ketamine diluted with 29ml of NS 5 minutes before induction successfully reduced the incidence & severity of post-operative sore throat. Immediately after extubation 14/45 patients in ketamine group complained of severe POST as compared to only 2/45 patients in mgso4 group.

At four hours post extubation 25/45 patients in ketamine group complained of moderate sore throat while only 5/45 in $MgSO_4$ group experienced sorethroat. When compared statistically the difference in incidence of POST at 0 and 4 hours post extubation was found to be statistically significant ($p<0.001$).

At 8 hours post extubation 9/45 patients in ketamine group complained of moderate sore throat while no patients experienced sorethroat in mgso4 group. When compared statistically the difference in incidence of POST at 0 , 4 and 8 hours post extubation was found to be statistically significant ($p<0.001$).

At 12 hours post extubation only 2/45 patients in $MgSO_4$ group complained of mild sore throat while none had moderate or severe symptoms. However in ketamine group, although no patients had moderate or severe symptoms, 21/45 patients still experienced mild sore throat. 7/45 patients had mild sore throat even at 24 hours following extubation in saline group while none of the patients in $MgSO_4$ group complained of any sore throat. When compared statistically the difference in incidence of POST at 12 and 24 hours post extubation was found to be statistically significant ($p<0.001$).

This shows that mgso4 gargle just prior to induction of general anaesthesia significantly reduces the incidence and severity of POST compared to ketamine gargle. However it was not found to be effective in prevention of POST as 28/45 patients in $MgSO_4$ group complained of mild sore throat at 0 hours ie., immediate post extubation.

The findings of our study correlate with a study done by Canbay et al. [12] in 2008. In this study the author studied the effects of a ketamine gargle on POST. Forty-six patients undergoing septorhinoplasty were included in the study and divided into two groups, one received ketamine gargle 40mg and other normal saline for thirty seconds prior to induction of general anaesthesia. They found that both the incidence and severity of POST was reduced in the ketamine group. None of the

ketamine patients reported severe POST symptoms at any interval while fifteen of the saline gargle patients reported severe symptoms. Two patients of ketamine group reported moderate symptoms in the immediate postoperative period while thirteen patients in the saline group reported moderate symptoms thus showing that ketamine gargle significantly reduces the incidence and severity of POST.

The findings of our study also correlated with the following studies. In 2009, Rudra et al. [10], conducted a prospective, randomized, placebo-controlled, and single–blinded studyassigning 40 ASA grade I patients undergoing abdominal and pelvic surgery under general anaesthesia to 2 groups, one group received drinking water 30 ml and another received preservative free ketamine 1ml (50mg) in 29ml of drinking water to gargle for 40 seconds. The researchers reported that the number of patients in Control group had significantly more incidence of POST at 4, 8 and 24hours (85%, 75%, and 60%) than in patients having ketamine gargle (40%, 35%and 25%) concluding that gargling with ketamine effectively attenuated POST, with no adverse reactions.

The findings of our study also correlated with the following studies. In 2012, Borazan H [6], conducted a prospective, randomized, placebo-contolled, and single blinded studyassigning 70 ASA grade I and II patients undergoing orthopaedic surgery, randomly allocated into 2 groups to either receive placebo or magnesium lozenzes to be dissolved by sucking 30 mins preoperatively. Patients were assessed for incidence and severity of POST at 0, 2, 4, and 24 h post-operatively. The incidence of POST at 4th hr was higher in control group than in magnesium group. Thus they concluded that administration of magnesium lozenge 30mins preoperatively is effective to reduce both incidence and severity of POST in the immediate postoperative period.

The findings our study correlate also correlated with the following studies. In 2015 Teymourian H et al. [8], conducted a study on 100 patients with American Society ofAnesthesiologist (ASA) class 1, 2 candidate for emergency acute appendicitis surgery and age ranges 25-75 years were enrolled in the study and randomly allocated to ketamine or magnesium groups. Patients in ketamine group received ketamine gargle (0.5mg/kg) and magnesium group received magnesium sulfate gargle (20mg/kg upto 30ml dextrose water 20%) 15 mins before the operation. Patient complaint of POST and its severity measured by VAS were recorded at baseline in recovery room, and then 2, 4, and 24hrs after operation. They concluded that magnesium at low dose decreases sore throat and pain severity more effectively compared to ketamine gargle.

In 2017 Chattopadhyay S et al. [7], conducted a study , comparison between preoperative aspirin and magnesium sulfate gargle- A prospective, randomized, double- blind study. 56 patients ASA grade I and II, aged 25-50 yrs, scheduled for day care surgery, were randomly allocated to group A receiving aspirin gargle (325mg tablet) and group M receiving magnesium sulfate (20mg/kg gargle). Patients were asked to gargle with this mixture for 30s, 15min before induction of anaesthesia. Episodes of POST were measured at 0, 2, 4, 6, 9, 12, and 16h postoperatively with a four- point scale. They concluded that preoperative magnesium sulphate gargle significantly attenuated the incidence and severity of POST, especially in the early postoperative period, with no adverse effects in patients undergoing day care surgery under general anaesthesia.

Conclusion

Mgso4 gargle significantly reduces the incidence and severity of postoperative sore throat compared to ketamine gargle, hence contributing to smoother recovery and greater patient satisfaction.

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A Comparative Study of Intrathecal Dexmedetomidine and Fentanyl in Lower Abdominal Surgeries

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Abstract

Context: Fentanyl was commonly used previously but due to its short duration of analgesia and more requirements of analgesics, efficacy of dexmedetomidine was evaluated by some studies and found to be effective. *Aim:* To compare the efficacy between dexmedetomidine and fentanyl when used for patients undergoing lower abdominal surgeries *Settings and design:* Present study was hospital based comparative study carried out at Department of Anesthesiology, Malla Reddy Institute of Medical Sciences. *Methods:* 60 consecutive eligible patients undergoing surgeries for lower abdomen were divided into two groups of 30 each. First group received dexmedetomidine 5 mcg and the other group received fentanyl 25 mcg. They were compared for the time taken for sensory regression and requirement of analgesics *Statistical analysis:* Student's t test was used for mean values and chi square test for proportions. *Results:* Both the groups were comparable to each other in terms of baseline characteristics, types of surgeries performed. Mean duration of surgery was significantly more in the dexmedetomidine group than fentanyl group. The height of sensory level was significantly different between the two groups. Both the drugs took equal time of three minutes from injection to reach the highest sensory level. But the time required for sensory regression to S1 from highest sensory level was significantly higher for dexmedetomidine group patients compared to fentanyl group patients. The requirement of analgesics was significantly higher for fentanyl group compared to the dexmedetomidine group. *Conclusion:* Dexmedetomidine was found to be more effective than fentanyl in terms of long lasting anesthesia, and lesser requirement of analgesics.

Keywords: Dexmedetomidine; Fentanyl; Analgesics; Anesthesia; Regression.

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Introduction

For surgeries of the lower abdomen, the most commonly used anesthesia is the spinal anesthesia. This is because compared to general anesthesia, it is easy to give and cheaper. But all is not well with spinal anesthesia. It is associated with problem of pain after surgery. This is due to the fact that the local anesthetics used have relatively short duration of action. Therefore there is requirement to use the analgesics most of the times to relieve pain in the patients after surgery. To overcome this problem, prolonging the spinal anesthesia effect is one solution. And to achieve this, various modalities had been tried [1]. There is more frequency of side effects like vomiting, nausea and visceral pain while patients are operated for surgeries of lower abdomen using spinal anesthesia [2].

It has been found that if the fentanyl was added to hyperbaric bupivacaine then it improved the quality

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of subarachnoid block during the surgery as well as during the early periods after surgery [3].

When opioids are added to the local anesthetics, then it has been found that the patients can develop depression of the respiratory system and some can develop itching all over the body. Studies have shown that dexmedetomidine which is a new drug and highly selective α2-agonist, has been found to be effective which prolongs the duration of anesthesia and hence reduces the requirement of analgesics. It has also been found to give satisfactory results in terms of hemodynamic stability. It has minimum side effects. Moreover Food and Drug Administration has approved the use of dexmedetomidine. Studies have shown that dexmedetomidine has been effective with all above mentioned advantages in minimal dose of 5 mcg [4].

With this background we attempted to study the efficacy of dexmedetomidine over fentanyl in patients undergoing lower abdominal surgeries in our setup.

Methods

Study Design

Present study was hospital based comparative study

Study Period

The study was carried out over a period of nine months from October 2017 to June 2018

Settings

The study was carried out at Department of Anesthesiology, Malla Reddy Institute of Medical Sciences, Hyderabad.

Sample Size

Total of 60 patients undergoing lower abdominal surgeries were studied over a period of six months

Ethical Considerations

Institutional Ethics Committee Permission was obtained before the start of the study. Informed consent and high risk consent was obtained from all selected patients for the present study.

Inclusion Criteria

1. Patients undergoing lower abdominal surgeries
2. Patients willing to participate in the present study

Exclusion Criteria

1. Patients found to be suffering from serious diseases
2. Patients not willing to participate in the present study

Methodology

Sixty eligible patients as per the abovementioned inclusion and exclusion criteria were divided into two groups in equal numbers. 30 patients received 5 mcg dexmedetomidine intrathecally and were labeled as dexmedetomidine group. 30 patients received 25 mcg fentanyl intrathecally and were labeled as fentanyl group.

Baseline characteristics like age, sex, ASA grade, type of surgery undergone, duration of surgery, dose of anesthetic given, height of sensory level, time from injection to highest sensory level, time for sensory regression to S1 from the highest sensory level, requirement of analgesics, its type and dose as well as side effects at the end of the surgery were recorded in the pre designed, pre tested, and semi structured study questionnaire.

All the studied parameters were compared between the groups.

Statistical Analysis

The data was entered in the Microsoft Excel worksheet and analyzed using means and proportions. Statistical tests like student's t test was used for comparing differences of mean between the two groups.

Results

Table 1 shows comparison of baseline clinical characteristics between the two groups. Mean age, distribution of males and females and distribution of patients with ASA grades was similar in the two groups. Thus both the groups were comparable to each other.

Table 2 shows comparison of type of surgery and mean duration of surgery for patients in two groups. The types of surgeries performed for the two groups were similar and comparable. The mean duration of surgery was significantly more in the dexmedetomidine group than that of fentanyl group.

Table 3 shows comparison of height of sensory level between the two groups. The height of sensory

level was significantly different between the two groups.

Table 4 shows comparison of time for highest sensory level and sensory regression in two groups. Both the drugs took equal time of three minutes from injection to reach the highest sensory level. But the time required for sensory regression to S1 from highest sensory level was significantly higher for dexmedetomidine group patients compared to fentanyl group patients.

Table 5 shows comparison of analgesic requirement between the two groups. The requirement of analgesics was significantly higher for fentanyl group compared to the dexmedetomidine group.

Table 6 shows comparison of side effects between the two groups. Side effect like hypotension was significantly not different between the two groups. There was only one case of bradycardia in fentanyl group compared to 15 cases in the dexmedetomidine group and this difference was found to be statistically significant.

Table 1: Comparison of baseline clinical characteristics between the two groups

Clinical characteristics		Fentanyl group (N = 30)	Dexmedetomidine group (N = 30)	T value/chi square value	P value
Age (years)		37.2±7.8	35.8±8.1	0.6819	0.4980
Sex	Male	21 (70%)	17 (56.7%)	0.6459	0.4216
	Female	09 (30%)	13 (43.3%)		
ASA grade	I	24 (80%)	27 (90%)	0.5229	0.4696
	II	06 (20%)	03 (10%)		

Table 2: Comparison of type of surgery and mean duration of surgery for patients in two groups

Type of surgery done	Fentanyl group (N = 30)		Dexmedetomidine group (N = 30)		Chi square value/T value	P value
	Number	%	Number	%		
Appendicectomy	13	43.3	07	56.7	5.5	0.067206
Hernioplasty	15	50	15	50		
Laparotomy	02	6.7	08	26.7		
Mean Surgery duration (min)	86±29.2		107±42.9		2.2164	0.0306

Table 3: Comparison of height of sensory level between the two groups

Height of sensory level	Fentanyl group (N = 30)		Dexmedetomidine group (N = 30)		Chi square value	P value
	Number	%	Number	%		
T6	06	20	23	76.7	17.09	0.0001
T8	24	80	07	23.3		

Table 4: Comparison of time for highest sensory level and sensory regression in two groups

Variables	Fentanyl group (N = 30)	Dexmedetomidine group (N = 30)	T value	P value
Time required from injection to highest sensory level (min)	3	3	-	-
Time required for sensory regression to S1 from highest sensory level (min)	166±23.3	268±29.4	14.8928	0.0001

Table 5: Comparison of analgesic requirement between the two groups

Analgesic requirement	Fentanyl group (N = 30)	Dexmedetomidine group (N = 30)	T value	P value
Diclofenac (mg)	75±0	20±33.7	8.9391	0.0001
Paracetamol (mg)	1900±305.1	1200±406.8	7.5399	0.0001

Table 6: Comparison of side effects between the two groups

Side effects		Fentanyl group (N = 30)		Dexmedetomidine group (N = 30)		Chi square value	P value
		Number	%	Number	%		
Hypotension	Yes	14	46.7	18	60	0.6027	0.4376
	No	16	53.3	12	40		
Bradycardia	Yes	01	3.3	15	50	14.4	0.0001
	No	29	96.7	15	50		

Discussion

Mean age, distribution of males and females and distribution of patients with ASA grades was similar in the two groups. Thus both the groups were comparable to each other.

The types of surgeries performed for the two groups were similar and comparable. The mean duration of surgery was significantly more in the dexmedetomidine group than that of fentanyl group.

The height of sensory level was significantly different between the two groups.

Both the drugs took equal time of three minutes from injection to reach the highest sensory level. But the time required for sensory regression to S1 from highest sensory level was significantly higher for dexmedetomidine group patients compared to fentanyl group patients.

The requirement of analgesics was significantly higher for fentanyl group compared to the dexmedetomidine group.

Side effect like hypotension was significantly not different between the two groups. There was only one case of bradycardia in fentanyl group compared to 15 cases in the dexmedetomidine group and this difference was found to be statistically significant.

Gupta R et al. [5] found that there was longer and steady sensory as well as motor block persisted with use of dexmedetomidine in comparison to fentanyl group. We also observed similar findings. The authors noted that the average time required for sensory regression to S1 was 476 minutes which is higher than that observed in the present study where we observed it as 268 minutes on an average.

The authors concluded that dexmedetomidine has better and prolonged sensory and motor block, gave a better stability in terms of hemodynamics and there was reduced requirement for analgesics in comparison to fentanyl. We also found similar findings.

Mahendru V et al. [6] found that patients from dexmedetomidine compared to other groups of patients receiving clonidine, fentanyl and bupivacaine alone showed that the motor and sensory block time was more and this difference was statistically significant. Regression time for two segment sensory blocks was 147 min in dexmedetomidine group while it was 117 min in clonidine group patients, 119 min in fentanyl group patients and 102 min in bupivacaine group patients. These differences were found to be statistically significant. Motor block regression time for going up to zero score of Bromage was 275 min in patients with dexmedetomidine group, 199 min in patients with clonidine group, 196 min in patients with dexmedetomidine group, 199 min in patients with fentanyl group, and 161 min in patients with dexmedetomidine group, 199 min in patients with bupivacaine alone group. These differences were also found to be statistically significant. Patients kept in dexmedetomidine did not demand for rescue analgesics but this demand was more from patients belonging to clonidine, fentanyl and bupivacaine groups.

The author concluded that intra-thecal dexmedetomidine gives very good results in terms of prolonged motor and sensory block time, also provides stability in terms of hemodynamics, and there is less requirement for rescue analgesics. We also observed similar findings.

Singh R et al. [7] studied 100 patients by dividing them into four groups of 25 each. One group was given intrathecal bupivacaine with normal saline (BS), second group was given bupivacaine with clonidine BC), third group was given bupivacaine with clonidine and fentanyl both (BCF) and the fourth group received bupivacaine with fentanyl.

Based on their observations the author concluded that there is prolongation of motor block as well as sensory block, the duration of analgesia after surgery increased and there were few side effects when clonidine was added in 75 μg and 37.5 μg to bupivacaine fentanyl and low dose bupivacaine.

Safari F et al. [8] carried out study among 84 patients and divided them randomly into three equal groups. They found that sensory block onset was lower as compared to patients belonging to fentanyl group and this difference was statistically significant. The patients in the dexmedetomidine group had experienced sensory block for a long time compared to fentanyl group and this difference was statistically significant. The patients in the dexmedetomidine group had experienced motor block for a long time compared to fentanyl group and this difference was statistically significant.

The author concluded that dexmedetomidine is superior to fentanyl. We also noted similar findings.

Khan AL et al. [9] observed that patients from group who received dexmedetomidine compared to patients from fentanyl group achieved highest sensitivity level of T6, T8.

The author concluded that using dexmedetomidine is beneficial to the patients in terms of motor and sensory block achievements, as well as prolonging effect of analgesics after surgery. We also reported similar findings.

Kishore H et al. [10] studied 50 patients having ASA grade I and II who underwent surgeries for lower abdomen. They compared the two drugs i.e. fentanyl and dexmedetomidine. They found that sensory and motor block duration was more in patients who received dexmedetomidine compared to the patients who received fentanyl. This difference was found to be statistically significant. Mean motor block regression time for reaching Bromage zero was noted to be more in dexmedetomidine group compared to the fentanyl group. Patients who received dexmedetomidine experienced analgesia up to 239 min on an average compared to 189 min on an average among patients who received fentanyl. This difference was also found to be statistically significant. The heart rate was also more stabilized in patients who received dexmedetomidine compared to patients who received fentanyl.

The authors thus concluded that dexmedetomidine is superior to fentanyl. We also observed similar findings.

Conclusion

Thus we conclude that intrathecal dexmedetomidine provided longer duration of analgesia as compared to fentanyl. There was significantly lesser requirement of analgesics for patients from dexmedetomidine group compared to patients from fentanyl group. Thus we recommend use of dexmedetomidine in all patients undergoing lower abdominal surgeries.

Key messages

We recommend use of dexmedetomidine over fentanyl in patients undergoing lower abdominal surgeries.

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Subarachnoid Hyperbaric Bupivacaine and Isobaric Levobupivacaine: A Prospective Randomized Double Blind Comparative Study

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Abstract

Aim: The aim of our study was to compare the efficacy, block parameters and safety profile of intrathecal hyperbaric bupivacaine and isobaric levobupivacaine for urological surgery. *Methods*: Urological patients who were scheduled for elective surgery under spinal anesthesia were enrolled in two groups. Group A received intrathecal 2.5 ml of (0.5%) hyperbaric bupivacaine, while Group B received intrathecal 2.5 ml of (0.5%) isobaric levobupivacaine. Sensory & motor block parameters, hemodynamic parameters and adverse effects in patients of both the groups were recorded. *Results*: The onset of sensory block, motor block and duration of motor block was comparable in both groups. Maximum height of sensory block was significantly higher in hyperbaric bupivacaine group and duration of sensory block was significantly higher in group B. Hemodynamic stability was better with levobupivacaine compared to hyperbaric bupivacaine. Hypotension and bradycardia were more common with hyperbaric bupivacaine group. In addition, nausea was noticed more frequently with hyperbaric bupivacaine. Other side-effects such as headache, backache, itching, vomiting, and shivering were almost similar in both the groups. *Conclusion*: We conclude that isobaric levobupivacaine is superior to hyperbaric bupivacaine in terms of longer sensory blockade and shorter motor blockade and also that intrathecal use of isobaric levobupivacaine is hemodynamically more favorable than that of hyperbaric bupivacaine.

Keywords: Levobupivacaine; Bupivacaine; Isobaric; Hyperbaric; Urological Surgeries.

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Introduction

Spinal anaesthesia was pioneered in humans by a German surgeon Dr August Bier on August 15th 1898 using Quinke method of entering the intrathecal space [1]. Since then several refinements has been done in the field of drugs and technique which has evolved into the modern concept of spinal anaesthesia. It provides simple, effective and safe analgesia in the perioperative period. 0.5% hyperbaric bupivacaine (racemic mixture), an amide local anaesthetic is presently the most common drug used for spinal anaesthesia. Due to the adverse cardiac effects of racemic bupivacaine, several studies have been performed to find anesthetic compounds of lesser toxicity to take its place. S-bupivacaine (levobupivacaine) has been found to have lesser cardiovascular and central nervous system toxicity [2,3]. When given in epidural space levobupivacaine has been found to have decreased cardiotoxicity in cases of accidental intravascular injections [4]. When administered for spinal anaesthesia it has been shown to have less motor blockade in compare of bupivacaine [5].

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Although hyperbaric local anesthetic solutions have a remarkable record of safety, their use is not totally without risk [6-8]. To prevent unilateral or saddle blocks, patients have to move rapidly from the lateral or sitting position to supine position and after mobilization of the patients, extension or early return of the block may be seen. Hyperbaric solutions may cause sudden cardiac arrest after spinal anesthesia because of the extension of the sympathetic block [9,10]. The use of truly isobaric solutions may have less sensitivity to position issues. Hyperbaric solutions may cause hypotension or bradycardia after mobilization; isobaric solutions are favored owing to their less sensitivity to position issues properties [11].

In this study we compared the clinical effects of 2 drugs hyperbaric bupivacaine and isobaric levobupivacaine in spinal anaesthesia for elective urological surgeries.

Materials and Methods

This study was conducted at Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India after taking approval from the Institutional ethics Committee and getting it registered with clinical trial registry of India viz. registration number CTRI/2017/10/010087. The duration of study was 8 months and was done from October 2017 to June 2018. With written informed consent100 adult patients of ASA grade I & II, Aged between 30-60 years undergoing urological surgeries under spinal anaesthesia were included in this study.

After routine preoperative evaluation and investigation, Persons with pre-existing neurological or spinal disease, cardiovascular, respiratory, renal, hepatic or any other systemic disease, Bleeding diathesis, Infection at the site of block, abnormalities of the spine, allergic to local anaesthetics, aspirin ingestion in the preceding week were excluded from the study.

Study design was taken as Prospective double blind Randomized clinical study. 100 patients were divided into two groups by computer generated random number method. Each group consisted of 50 patients. GROUP A patients were given 2.5 ml 0.5% hyperbaric bupivacaine whereas GROUP B patients were given 2.5 ml 0.5% isobaric levobupivacaine .

On the day of surgery, patients were shifted to the operation theatre with an 18 G IV cannula secured and they were preloaded with Ringer Lactate 10 ml/kg approximately 20 minutes prior to the administration of spinal anaesthesia. Non-invasive blood pressure monitor, pulse oximeter and ECG leads were connected to all patients and baseline values were recorded. Supplementary oxygen was provided at the rate of 5 liters/min via a face mask. Under strict aseptic precautions 2.5ml of the study drug was loaded by an anesthesiologist not involved in the study. Therefore, the patient and the anesthesiologist performing the spinal block and recording the intraoperative and postoperative data were blinded. The study drug was injected into L3-L4 sub arachnoid space using 26G whitacre spinal needles after confirming free flow of cerebrospinal fluid and the time of injection was recorded as 0 minutes. Following this the patients were made to lie supine immediately. Surgery was commenced after loss of sensation to pinprick at T6 level.

Following Parameters were noted

1. *Onset of sensory block* –Time taken from injection of study drug (0 minutes) to loss of sensation to pin-prick at T6 level. It was tested using a blunted 24G hypodermic needle bilaterally in the mid-clavicular line every 2 minutes.
2. *Maximum sensory block attained* – Time taken from injection of study drug (0 minutes) till the patient attained loss of sensation at the highest dermatome in 10 minutes. It was tested every 2 minutes using a blunted 24G hypodermic needle bilaterally in mid-clavicular line for the first 10 minutes. Time taken to reach the highest level of block was recorded.
3. *Duration of sensory block* – Time taken from maximum block height attained till regression of block to T10 dermatome. It was tested at the end of surgery using a 24G hypodermic needle bilaterally in mid-clavicular line.
4. *Onset of motor block* –Time taken from injection of study drug (0 minutes) till the patient attained Bromage 2. It was tested using modified Bromage scale every 2 minutes (0 = no paralysis, able to flex hips/knees/ankles; 1 = able to move knees, unable to raise extended legs; 2 = able to flex ankles, unable to flex knees; 3 = unable to move any part of the lower limb).
5. *Duration of motor block* – Time taken from maximum Bromage score attained to Bromage 0. It was tested at the end of surgery using modified Bromage scale.
6. *Hemodynamic changes* - Heart rate, systolic and mean arterial pressure and oxygen saturation were recorded every 5 minutes till the completion of

surgery and every 10 minutes postoperatively till the regression of sensory and motor block.

Management of Side Effects

Hypotension – drop in > 20% mean arterial pressure from baseline was treated with intermittent doses of IV mephenteramine. Total vasopressor dose required was recorded.

Bradycardia – drop in heart rate > 20% from baseline or values < 50 bpm was treated with IV atropine 0.01mg/kg stat. Total atropine dose administered was recorded.

Nausea/vomiting – was treated with IV ondansetron 4mg stat.

Patients were monitored for 6 hours in the postoperative ward for any adverse effects.

Blinding

Two Anaesthesiologists were involved in each case enrolled in this study. One Anaesthesiologist was engaged in preparation of drug and to allot a random number to the patient in that study. Second Anaesthesiologist was blinded to the study drug being given and was recording all the data for that case.

Statistical Analysis

Data were entered into Microsoft Excel spread sheet. Sample size was calculated using lambda willis formula based on data of previous studies. With power of study 80% and alpha error 5%, the sample size came to 42 for each group. Considering drop outs, 50 patients were recruited in each group. SPSS for Windows 21 (SPSS, Chicago, IL, USA) was used for statistical analysis. Continuous variables were analyzed with the unpaired t test and categorical variables were analyzed with the Chi-Square Test and Fisher Exact Test. Statistical significance was taken as $p < 0.05$.

Results

There has been no statistical difference between groups in terms of their demographic characteristics and the duration of the operation (Table 1 & Figure 1). One case in Group A and two case of Group B had failed spinal block. They were given general anesthesia and were excluded from the study. So 49 patients in Group A and 48 patients in Group B were analyzed for results. Both groups had achieved sufficient level of anesthesia and intraoperative analgesia and did not require additional analgesics.

The onset of sensory block, motor block and duration of motor block was comparable in both groups. Maximum height of sensory block was significantly higher in Group A while duration of sensory block was significantly higher in group B (Table 2 & Figure 2).

Table 1: Demographic profile

Variable	Group A	Group B	p-value	remarks
Age (yrs.)	48 ± 9.87	48.7 ± 9.18	0.871	Non-significant
Weight (kgs)	63.5 ± 7.82	62.7 ± 6.7	0.809	Non-significant
Sex (M/F)	33/16	34/14	0.628	Non-significant
Duration of surgery (mins)	50.9 ± 6.57	50.4 ± 6.73	0.868	Non-significant

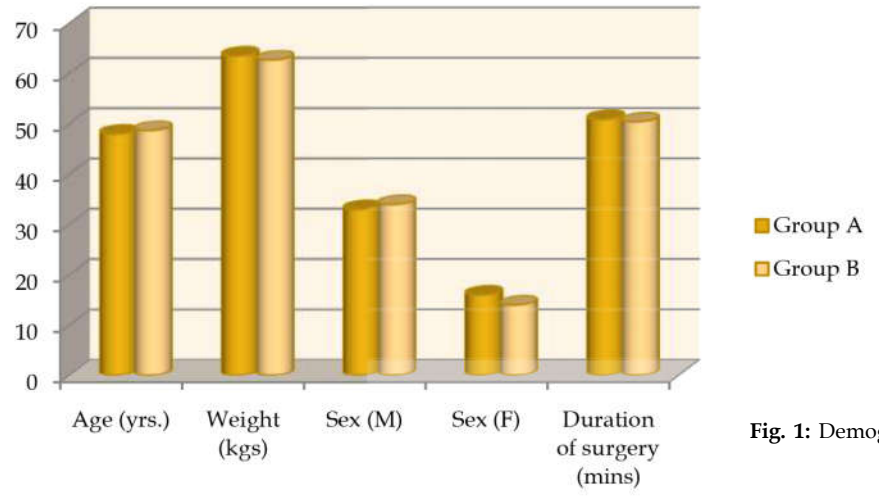

Fig. 1: Demographic profile

Hemodynamic stability was better with levobupivacaine compared to hyperbaric bupivacaine. Hypotension and bradycardia were more common with hyperbaric bupivacaine group. In addition, nausea was noticed more frequently with hyperbaric bupivacaine. Other side-effects such as headache, backache, itching, vomiting, and shivering were almost similar in both the groups. (Table 3 & Figure 3).

Table 2: Anesthesia characteristics

Variables	Group A	Group B	p-value	Remarks
Onset of sensory block (mins)	2.2 ± 0.42	2.6 ± 0.84	0.196	Non-significant
Maxim ht of sensory block (T level)	6.9 ± 0.74	6.3 ± 0.48	0.045	significant
Duration of sensory block (mins)	142.6 ± 8.33	156.6 ± 7.26	0.0008	Extremely-significant
Onset of motor block (mins)	3.25 ± 0.43	3.65 ± 0.54	0.083	Non-significant
Duration of motor block (mins)	114.1 ± 7.83	109.1 ± 5.67	0.119	Non-significant

Table 3: Side effects profile

Variables	Group A	%age	Group B	%age
Hypotension	28	56%	13	26%
Bradycardia	13	26%	3	6%
Headache	2	4%	1	2%
Nausea	8	16%	6	12%
Vomiting	4	8%	2	4%
Sedation	0	0	0	0
Itching	1	2%	1	2%
Backache	1	2%	0	0
Shivering	3	6%	2	4%

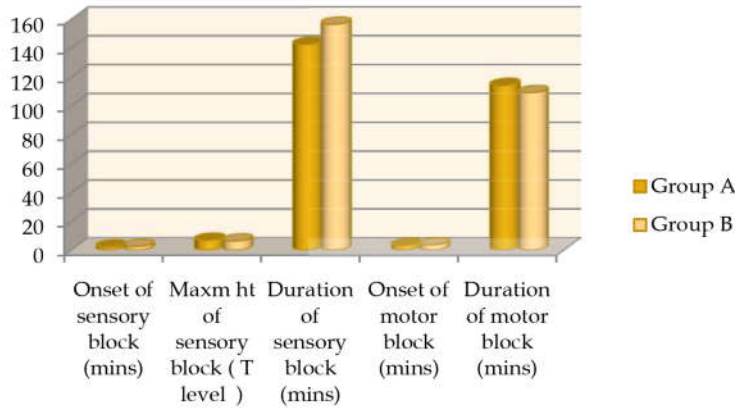

Fig. 2: Anesthesia characteristics

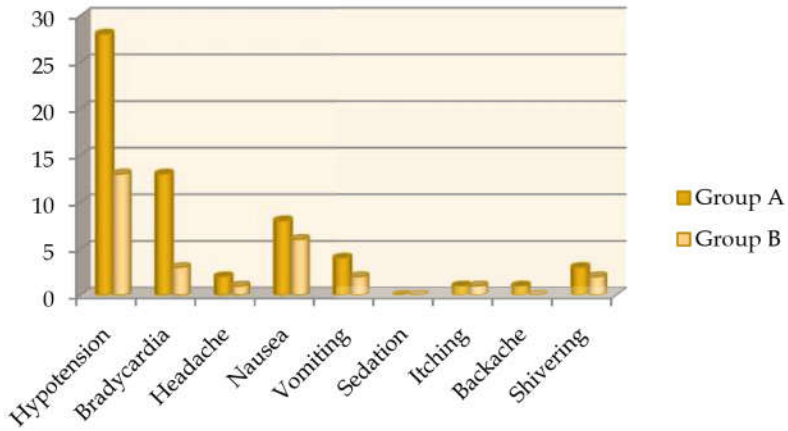

Fig. 3: Side effects profile

Discussion

In this study we compared the same doses of hyperbaric bupivacaine and isobaric levobupivacaine with regard to their hemodynamic effects, sensory block, and motor block. Both the speed of onset and offset of motor and sensory blockade were relatively quicker with hyperbaric bupivacaine. The extent of maximal block was significantly higher in hyperbaric bupivacaine group and duration of sensory blockade was significantly higher in isobaric levobupivacaine group. Baricity, defined as the density of intrathecal anesthetic solution relative to cerebrospinal fluid density, is a major determinant of the extent of subarachnoid blockade. Although they commonly lead to a more limited sensory blockade than plain solutions, hyperbaric solutions tend to gravitate to dependent areas and produce efficient analgesia during surgery.

Vercauteren et al. [12] performed a study on patients who received either 0.125% levobupivacaine or 0.125% racemic bupivacaine and found that levobupivacaine led to less motor impairment compared to racemic bupivacaine and 0.5% hyperbaric racemic bupivacaine in intrathecal labor analgesia. This is in accordance with our study.

A study by Vana et al. [13] demonstrated that 2.5 mL of 0.5% isobaric levobupivacaine and 0.5% hyperbaric racemic bupivacaine showed equally effective potencies for spinal anesthesia in transurethral resection (TUR) surgery with regard to the onset of time and duration of sensory blockade. This is in contrast to our study.

In the present study, hypotension and bradycardia was found to be more in bupivacaine group. Erdil et al. [14] noted, in spinal anesthesia, better hemodynamic stability associated with low-dose levobupivacaine plus fentanyl compared with that seen with low-dose bupivacaine plus fentanyl. Coppejans and Vercauteren [15] compared equipotent doses of bupivacaine, levobupivacaine, and ropivacaine combined with sufentanil in patients undergoing elective CS with combined spinal–epidural anesthesia. They found that hemodynamic values were comparable between the three groups (although a trend towards better SBPs and a lower prevalence of severe hypotension were noticed with levobupivacaine). These are in accordance with our study. Guler et al. [16] reported that levobupivacaine, compared with bupivacaine, causes less bradycardia, and hypotension which is also observed in our study. Goyal et al. [17] went further to conclude that levobupivacaine with fentanyl should be the preferred alternative to bupivacaine. The present study differs from the above studies as no opioid has been combined to local anesthetic for intrathecal administration. In contrast, in a study comparing 10 mg hyperbaric bupivacaine, 11 mg levobupivacaine and 11 mg bupivacaine, all with 10 μg fentanyl given intrathecally for cesarean section, Sundarathiti et al. [18] found that there was no difference in hemodynamic parameters in any of the groups. Glaser et al. [19] compared 3.5 ml of 0.5% isobaric levobupivacaine to 3.5 ml of 0.5% racemic isobaric bupivacaine in 80 patients undergoing elective hip replacement. None of the 79 patients required sup-plemental analgesics during surgery. Cuvas et al. [20] compared 1 ml of 0.5% plain bupivacaine to 0.5% levobupivacaine for a subarachnoid block in patients undergoing pilonidal sinus sur-gery performed in the prone position. All patients who received bupivacaine and 92% of the patients who recievd levobupivacaine were satisfied with the quality of anaesthesia.

Conclusion

In conclusion to our study we noticed that isobaric levobupivacaine is superior to hyperbaric bupivacaine in terms of longer sensory blockade and shorter motor blockade and also that intrathecal use of isobaric levobupivacaine is hemodynamically more favorable than that of hyperbaric bupivacaine.

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Acromio Axillo Suprasternal Notch Index a New Method of Predicting Difficult Intubation: Prospective Observational Study

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Abstract

Background: The fundamental responsibility of anesthetist is to maintain the airway and provide adequate oxygenation. Failure to do this will lead to hazardous complication. So identification of difficult airway is important during pre operative evaluation. Difficult intubation can be predicted by modified mallampati test (MMP), inter-incisor distance, thyro-mental distance (TMD), sterno-mental distance, upper lip bite test and hyo-mental distance ratio, but no single factor reliably predicts difficult intubation. AASI, a relatively new test, based on surface land mark, has been suggested to reliably predict difficult visualization of larynx. *Methods:* A total of 250 adult patients, of either sex, aged 18- 65 years, belonging to ASA class 1, 2 and 3 who were candidates undergoing elective surgery under general anaesthesia requiring tracheal intubation participated in a prospective, comparative, observational study. Preoperative airway assessment was carried out with AASI, TMD and MMP. Sensitivity, specificity, positive predictive value, negative predictive value, odd's ratio, positive likelihood ratio, negative likelihood ratio were calculated for MMP, TMD and AASI. Chi-square test was used to analyze data. P value of less than 0.05 was considered statistically significant. *Results:* The demographic data was normally distributed in terms of age, height, weight, bmi, and gender distribution. The sensitivity between MMP and TMD was statistically significant. There was no significant difference between the Specificity, positive predictive value & negative predictive value of MMP and TMD ($p>0.05$). There was no significant difference between the Sensitivity, Specificity, positive predictive value & negative predictive value of MMP and AASI. ($p>0.05$) There was significant difference in Sensitivity of TMD & AASI. But, there was no significant difference between the Specificity, Positive predictive value & Negative predictive value between TMD and AASI. *Conclusion:* Upon comparing AASI, MMP and TMD, AASI was found to be better only with regards to sensitivity no difference in any of the measured parameters in comparison to modified mallampati test. To conclude we would recommend further studies with larger sample size before validating or refuting the ASSI.

Keywords: Acromio-Axillo-Suprasternal Notch Index; Thyromental Distance; Modified Mallampati Test.

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Introduction

The fundamental responsibility of an anesthesiologist is to maintain adequate gas exchange in the patient after induction of general anaesthesia. For this to be done, the patient's airway must be managed so that it is almost continuously patent. Failure to maintain a patent airway for more than a few minutes results in brain damage or death [1]. So identification of difficult airway is very important aspect of pre operative evaluation.

The incidence of difficult laryngoscopy or tracheal intubation was reported to be in the range of 0.1–20.2%; this variation was due to the different patient

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populations and criteria used [2,3]. Prediction of difficult intubation in preoperative evaluation has been attempted by many investigators using simple bedside physical examinations based on anatomical landmarks such as modified mallampati test (MMP), inter-incisor distance, thyro-mental distance (TMD), sterno-mental distance, upper lip bite test and hyo-mental distance ratio [4], all of which have shown different sensitivities and specificities.

At present, no single factor reliably predicts difficult intubation. Consequently, prediction of difficult intubation relies on various tests and their combinations. Yet, these tests either individually or in combination failed to predict difficult visualization of larynx reliably. So the quest for a new test continues. A new test should be simple, painless, requiring no special equipment for screening of difficult airway. The test should be objective, with little inter-examiner variation and with high sensitivity and positive predictive value.

AASI, a relatively new test, based on surface land mark, has been suggested to reliably predict difficult visualization of larynx. It has been observed that DVL was observed in individuals with neck situated deep in chest. So, portion of arm chest junction above the level of suprasternal notch could be used as an indicator to estimate DVL. Hence this study was designed to evaluate the ability of this new test to predict DVL and compare it with TMD and MMP.

Aims

To evaluate the predictive validity of a new index called acromio-axillo-suprasternal notch index and compare it with a previously established test (MMP) and TMD for assessing difficult laryngoscopic view in conformation with Cormack- Lehane grading in patients who were candidates for general anaesthesia.

Objectives

To compare acromio-axillo-suprasternal notch index with modified mallampati test and thyromental distance in terms of sensitivity, specificity, negative predictive value, positive predictive value, odd's ratio, positive likelihood ratio and negative likelihood ratio in predicting difficult visualization of larynx.

Methodology

Source of Data

After institutional medical ethics committee approval written informed consent was obtained from all patient. A total of 250 adult patients, of either gender, aged 18- 65 years, belonging to ASA class 1,2 and 3 who were candidates undergoing elective surgery under general anaesthesia requiring tracheal intubation.

Study Design

Prospective, randamised, comparative, observational study.

Sampling Technique

A sample size of 250 was calculated with the help of statistician using the URL www.statstodo.com Where: Probability of type I error (α) =0.05, Power (1-β): 0.8, Expected sensitivity of group I: 0.789, Expected sensitivity of group II: 0.524. The sample size required for unpaired comparison per group was 46 patients. This was the minimum sample required for each test. So we decided to select a sample size of 250 patients for our study.

Inclusion Criteria

1. Age 18 to 65 years.
2. ASA class 1, 2 and 3.

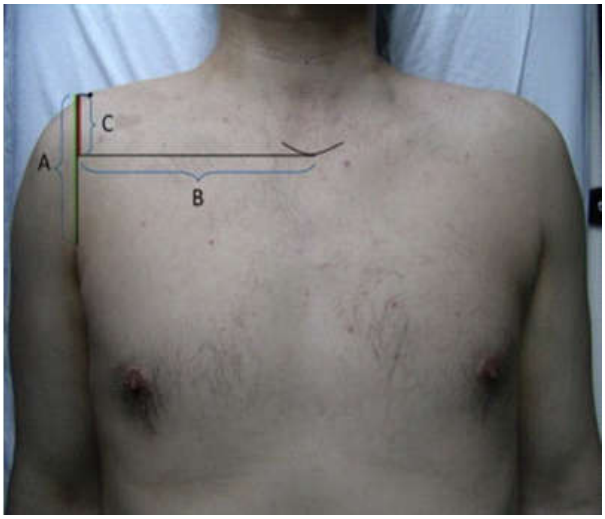
Exclusion Criteria

1. ASA class other than 4, 5 and 6.
2. Regional Anatomical abnormality.
3. Tongue tumor, maxillo facial tumor, fracture.
4. Recent head and neck surgery.
5. Restricted mouth opening.

Preoperative airway assessment was carried out with AASI, TMD and MMP. The new AASI score will be calculated based on the following measurements: (Figure 1) (1) using a ruler, a vertical line was drawn from the top of the acromion process to the superior border of the axilla at the pectoralis major muscle (line A); (2) a second line was drawn perpendicular to line A from the suprasternal notch (line B); and (3) the portion of line A that lies above the point where line B intersects it will be line C. AASI was calculated by dividing the length of line C by that of line A (AASI = C/A).

MMP (Modified mallampati) classification will be graded as follows:

Class I = soft palate, fauces, uvula, and pillars were visible.



Class II = soft palate, fauces, and uvula were visible.

Class III= soft palate and base of uvula were visible.

Class IV= soft palate was not visible.

TMD was graded with neck in full extension as follows:

More than (>) 6 cms -easy intubation

Less than (<) 6 cms- intubation may be impossible.

After induction of anesthesia, the laryngeal view was recorded according to the Cormack-Lehane grading system. All patients were pre-medicated with midazolam (0.03mg/kg) and fentanyl (2mcg/kg).All patients were induced with propofol (2mg/kg) and atracurium (0.6 mg/kg). With the head in the sniffing position, laryngoscopy was attempted by an attending anesthesiologist blinded to the measurements following ventilation of the lungs with 100% oxygen. Laryngoscopy was performed after the loss of the fourth twitch in the train of four, with a Mackintosh blade (No. 3) and Cormack–Lehane grading was assessed. The laryngeal view was graded according to the Cormack and Lehane grading system:

Grade I— full view of the glottis,

Grade II— glottis partly exposed, anterior commissure not seen,

Grade III— only epiglottis seen,

Grade IV— epiglottis not seen.

Grades I and II was considered as easy visualization of larynx (EVL) and Grades III and IV as difficult visualization of larynx (DVL). All preoperative assessments including MMP, TMD and AASI were performed by an attending anesthesiologist. Sensitivity, specificity, positive predictive value, negative predictive value, odd's ratio, positive likelihood ratio, negative likelihood ratio were calculated for MMP, TMD and AASI were calculated. Chi-square test was used to analyze data of MMP, TMD and AASI. P value of less than 0.05 was considered statistically significant.

Results

(Tables 1-7).

Table 1: Shows distribution according to modified mallamapati test

MMP	Frequency (n)	Percent
1	89	35.6%
2	126	50.4%
3	34	13.6%
4	1	0.4%
Total	250	100%

Table 2: Shows interpretation in terms of EVL and DVL

MMP	C – L grading	
	I & II(EVL) n (%)	III & IV(DVL) n (%)
1 & 2	202 (92.2)	13 (41.9)
3 & 4	17 (7.8)	18 (58.1)
Total	219 (100)	31 (100)

Table 3: Shows thyromental distance in sample

TMD	Frequency(n)	Percent
< 6 cms	26	10.4%
> 6 cms	224	89.6%
Total	250	100%

Table 4: Shows Distribution of Acromio-Axillo Suprasternal Notch Index (AASI) in sample

AASI	Frequency(n)	Percent
> 0.5	41	16.4%
< 0.5	209	83.6%
Total	250	100%

Table 5: Shows Comparison of MMP, EVL and DVL

MMP	C – L grading	
	I & II(EVL) N (%)	III & IV(DVL) N (%)
1 & 2	202 (92.2)	13 (41.9)
3 & 4	17 (7.8)	18 (58.1)
Total	219 (100)	31 (100)

χ^2= 57.07,
Degree of freedom DF=1,
p value =0.000, (Significant)
Sensitivity = 58.1%
Specificity=92.2%
Positive predictive value=51.4%
Negative predictive value=94.0%
Odd's ratio=16.5
Positive likelihood ratio=7.4
Negative likelihood ratio=0.5

Table 6: Shows Distribution of patients based on TMD among EVL and DVL

TMD	C – L grading	
	I & II(EVL) N (%)	III & IV(DVL) N (%)
< 6 Cms	14 (6.4)	12 (38.7)
> 6 Cms	205 (93.6)	19 (61.3)
Total	219 (100)	31 (100)

χ^2= 30.436,
Degree of freedom (DF) =1,
p value =0.000, (Sig.)
Sensitivity = 38.7%
Specificity=93.6%
Positive predictive value=46.2%
Negative predictive value=91.5%
Odd's ratio=9.2
Positive likelihood ratio=9.6
Negative likelihood ratio=0.4

Table 7: Shows distribution of patients based on AASI

AASI	C – L grading	
	I & II(EVL) N (%)	III & IV(DVL) N (%)
> 0.5	20 (9.1%)	21(67.7%)
< 0.5	199 (90.9%)	10(32.3%)
Total	219 (100%)	31 (100%)

χ^2= 68.038,
Degree of freedom (df)=1,
p value =0.000,(Sig.)
Sensitivity = 67.7%
Specificity=90.
Positive predictive value=51.2%
Negative predictive value=95.2%
Odd's ratio=20.9
Positive likelihood ratio=9.6
Negative likelihood ratio=0.4

Discussion

The demographic data was normally distributed in terms of age, height, weight, bmi, and gender distribution. The sensitivity between MMP and TMD was statistically significant. There was no significant difference between the Specificity, positive predictive value & negative predictive value of MMP and TMD (p>0.05). There was no significant difference between the Sensitivity, Specificity, positive predictive value & negative predictive value of MMP and AASI. (p>0.05) There was significant difference in Sensitivity of TMD & AASI. But, there was no significant difference between the Specificity, Positive predictive value & Negative predictive value between TMD and AASI. Difficult intubation and inability to secure airway remains a significant source of morbidity and mortality in anaesthetic practice. The most common cause of difficult intubation has been attributed to difficult visualization of larynx. Pre-operative detection of difficult intubation in patients at risk forms the most important part of pre-anaesthetic evaluation. At present there is no single reliable test to detect difficult airway. The existing literature suggests that incidence of difficult visualization of larynx can vary between 1.7-20.2%[11]. The incidence of difficult visualization of larynx in our study was 12.4 % which concurs with Huh et al study[12], but it is almost twice of what was observed in Mohammed et al (6.3%). This variability in incidence of difficult visualization of larynx has been attributed to age, gender, obesity, degree of relaxation, previous history of difficult intubation and oropharyngeal view.[4]

We observed difficult visualization of larynx had a male preponderance, 20 patients accounting for 64.5% of cases. Similar finding was observed by Rose et al. [4]. This can possibly be explained by increased muscle mass around neck in men as compared to women. We also observed increased incidence of difficult visualization of larynx in the age group of 51-60 years accounting for 26% of all cases. Rose et al. [5], in their study to identify risk factors for difficult intubation also found an increased incidence of difficult visualization of larynx in the age group 40-59 years. They attributed this to patient illness, reasons for operation or dental pattern.

Mohamed et al. [2], in their study to evaluate acromio-axillo-suprasternal notch index, found that AASI was better than modified mallampati test in predicting difficult visualization of larynx with regard to sensitivity, specificity, positive predictive value and accuracy.

We observed that there was no significant difference between modified mallampati test and acromio-axillo-suprasternal notch index with regard to sensitivity, specificity, positive predictive value & negative predictive value with regards to predicting difficult visualization of larynx (p>0.05). Mohammed et al noted that sensitivity of acromio-axillo-suprasternal notch index 78.9% as against 67.7% in our study. However, specificity was similar in both of our studies (90.9% and 89.4% respectively). However, sensitivity and specificity of modified mallampati test in our study were slightly higher compared to values obtained by Mohamed et al. [2] (58.1% & 92.2 % as against 52.4% & 85.7%) The values we obtained were similar to

the observations made by Shiga et al. in their meta analysis [11].

Upon comparing AASI and TMD, AASI was found to be better only with regards to sensitivity (67.7% and 38.7%, $p<0.05$). Specificity, positive predictive value, negative predictive value, odds ratio, positive and negative likelihood ratio were found to be similar ($p>0.05$).

MMT was found to be better than TMD only with regards to sensitivity (58.1% and 38.7%, $p<0.05$). No significant difference was observed between the specificity, positive predictive value & negative predictive values of MMT and TMD ($p>0.05$). In contrast Ferk [9] had obtained higher sensitivities for MMT and TMD (81.2% and 90.9% respectively), but specificities observed were slightly lesser compared to our study (81.5% and 81.5%respectively).

Even though AASI has been advocated as having low inter-observer variability, we observed that for correct interpretation of AASI, positioning of patient, lying flat with hand by side is of utmost importance. Slight variation in position can introduce error in interpretation of AASI. This might explain the difference in observations between our study and the study conducted by Mohamed et al. As a result of which we might not have been able to validate the findings of their study. A smaller sample size (250 as against 603) and different sample population might also have contributed to this.

In our study, we compared a novel test, acromio-axillo-suprasternal notch index for detection of difficult visualization of larynx with commonly used tests, like modified mallampati test and thyromental distance. However we failed to validate the findings of study by Mohamed et al. Diagnostic test should be associated with low false negative rate and high sensitivity. No single test can reliably detect difficult visualization of larynx, so various tests; individually or in combination have to be used to predict difficult visualization of larynx. So the need for development of new tests or their combinations in predicting difficult visualization of larynx continues.

Conclusion

Though acromio-axillo-suprasternal notch index, a novel test was better than thyromental distance in terms of sensitivity, it did not fare better in terms of other parameters like specificity, positive predictive value, negative predictive value, odds ratio, positive and negative likelihood ratios. We could not demonstrate difference in any of the measured parameters in comparison to modified mallampati test. To conclude we would recommend further studies with larger sample size before validating or refuting the ASSI.

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Original Research Article

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Tramadol and Dexmedetomidine in the Treatment of Shivering Following Spinal Anesthesia

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Abstract

Introduction: It is imperative for an anaesthetist to know the adverse effects of shivering and hypothermia on human body which may occur when the patients are under anesthesia, so that timely treatment can be provided. *Aim:* To compare tramadol and dexmedetomidine in the treatment of shivering after spinal anesthesia. *Materials and Methods:* This was a randomized, prospective study in which 80 patients posted for elective surgeries given spinal anesthesia who developed shivering were included in the study. *Results:* The incidence of shivering was 40% in our study. The difference in the time interval between administration of drug after the onset of shivering and cessation of shivering was significantly shorter in the dexmedetomidine group when compared to the tramadol group. Changes in Heart rate, body temperature, mean blood pressure are not significant in our study in both groups. Nausea and vomiting observed in tramadol group, and not in the dexmedetomidine group. *Conclusion:* Dexmedetomidine can be a substituent to tramadol for cessation of post spinal anesthesia shivering.

Keywords: Shivering; Dexmedetomidine; Tramadol.

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Introduction

Shivering is response of body to hypothermia in order to increase the heat production. The primary causes of shivering in intra and postoperative periods are heat loss, pain, and systemic release of pyrogens or increased sympathetic tone. Spinal anaesthesia impairs the thermoregulation system by inhibition of tonic vasoconstriction, which plays an important role in thermoregulation. These factors precipitate hypothermia and shivering in patients. It is important as anaesthesiologists to know the adverse effects of hypothermia [1].

Various pharmacologic and nonpharmacologic modalities are available for treatment of shivering. Pharmocologically drugs studied for the prophylaxis as well as treatment of shivering include pethidine, nefopam, tramadol, ketamine, dexmedetomidine, physostigmine, granisetron, magnesium sulphate, clonidine, and dexamethasone [2]. But no single drug proved to be effective, without any unwanted effects. Pethidine was considered as the treatment of choice to treat shivering but many studies have shown that it should be avoided because of its adverse effects [3,4].

Previous studies involving Tramadol and dexmedetomidine have shown varying success rates

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and also few studies have been reported from the Asia and Indian subcontinent. Hence, our aim is to compare the efficacy, hemodynamic variability and complications of tramadol and dexmedetomidine in the treatment of shivering after spinal anesthesia.

Materials and Methods

This is a prospective, randomized study that included 80 patients posted for elective surgeries under spinal anesthesia and developed shivering.

Inclusion Criteria

Patients of both genders between 18–70 yrs age with American Society of Anesthesiologists (ASA) class 1 and 2.

Exclusion Criteria

Patients of ASA 3 and above, those with cardiac, liver and renal diseases, those allergic to any of the study drugs or patient refusal and pregnant patients were excluded.

The patients who developed shivering under spinal anesthesia were chosen for the study and randomly allocated to two groups with 40 patients in each group.

Group T: Subjects received tramadol 1 $mg.kg^{-1}$,

Group D: Subjects received dexmedetomidine 0.5 $mcg.kg^{-1}$.

ECG, blood pressure, O_2 saturation and temperature were noted in all patients. The operating room temperature was maintained at 22^0C for all the surgeries. No external warming devices were used and fluids were administered at room temperature to all patients. The patients received spinal anesthesia with 25 gauge Quincke spinal needle to achieve a block of at least T10 depending on the type of surgery. Patients who developed shivering were included in the study.

For measuring shivering intensity, a scale of 1–4 as per Wrench was used as following [5].

Grade 1: Piloerection, peripheral vasoconstriction, peripheral cyanosis, but without visible muscle activity.

Grade 2: Visible muscle activity confined to one muscle group.

Grade 3: Visible muscle activity in more than one muscle group.

Grade 4: Taken as gross muscle activity involving the whole body.

The hemodynamic monitoring was continued after the administration of study drugs. The time taken to control shivering, and adverse effects like nausea, vomiting, dry mouth and also recurrences of shivering were observed. The monitoring was done for two hours after the administration of spinal anesthesia.

Statistical analysis was done using a standard statistical program, Statistical Package for Social Sciences version 17.0. The time taken to control shivering, heart rate and blood pressure were taken as mean ± standard deviation. The level for all analyses was set at $p = 0.05$ with a p-value less than 0.05 was considered statistically significant and p-value <0.01 was considered extremely significant.

Results

In the present study incidence of shivering was 40%. Written informed consent was taken from 200 patients undergoing various surgeries under Spinal anesthesia, until the time 80 patients who developed shivering were selected in the study.

Age, gender, weight, duration of surgery and duration of spinal anesthesia are expressed in Mean ± SD. p value <0.05 is significant (Table 1).

All the demographic details in the study were insignificant when compared in 2 groups.

Table 1: Demographic data in study

Parameter	Dexmedetomidine N=40	Tramodol N=40	P-value
Age(in years)	39±10.2	40.1±9.7	0.71
Gender(M/F)	14/26	18/22	0.21
Weight in Kgs	61.5±17.3	62.8±18.7	0.92
ASA 1 and 2	40	40	1
Duration of surgery (in mins)	62.3±7.8	65.8±7.5	0.27
Duration of spinal anesthesia(mins)	135.6±17.8	137±18.6	0.29

There was no statistically significant difference in time for the onset of shivering between the two groups. There is difference in the time interval between administration of drug after the onset of shivering and cessation of shivering. It was significantly shorter with dexmedetomidine. Recurrence of shivering was observed in 2 patients with dexmedetomidine and in 4 patients with tramadol (Table 2).

Table 2: Parameters for post-spinal anaesthesia shivering

Parameter	Dexmedetomidine	Tramadol	P-value
Onset of shivering (in mins)	21.4±11.2	20±10.5	0.95
Time of control on shivering (in mins)	2.67±0.56	6.01±0.96	0.0027
Response rate	100 %	100 %	1
Recurrence	2/40(5%)	4/40(10%)	

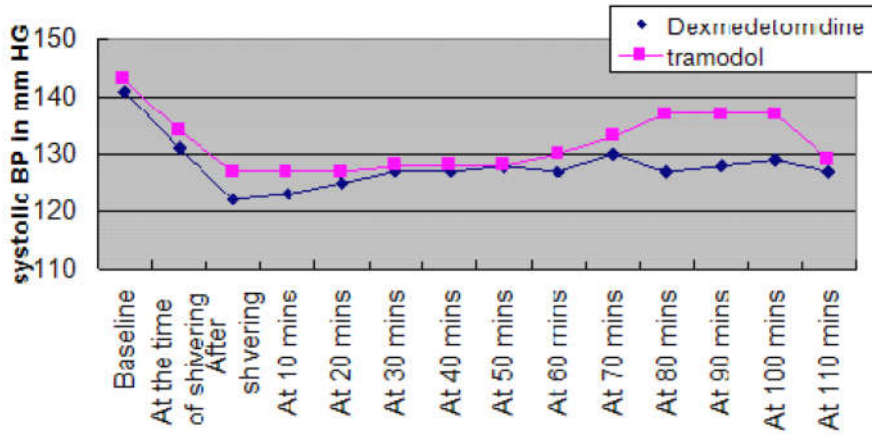

Fig. 1: Comparison of systolic blood pressure at various time intervals in the two groups

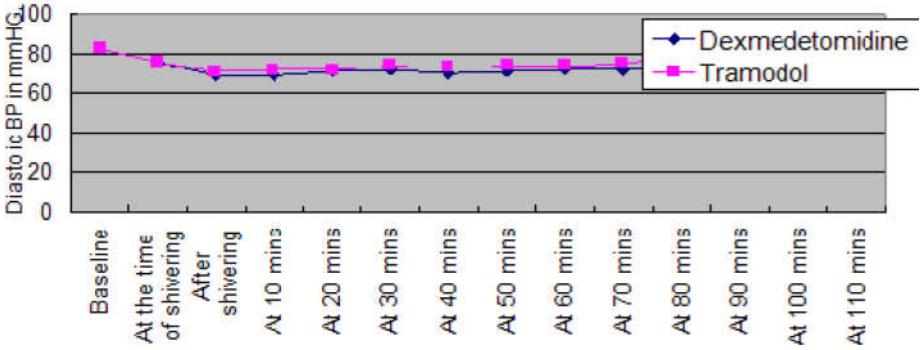

Fig. 2: Comparison of diastolic blood pressure at various time intervals in the two groups

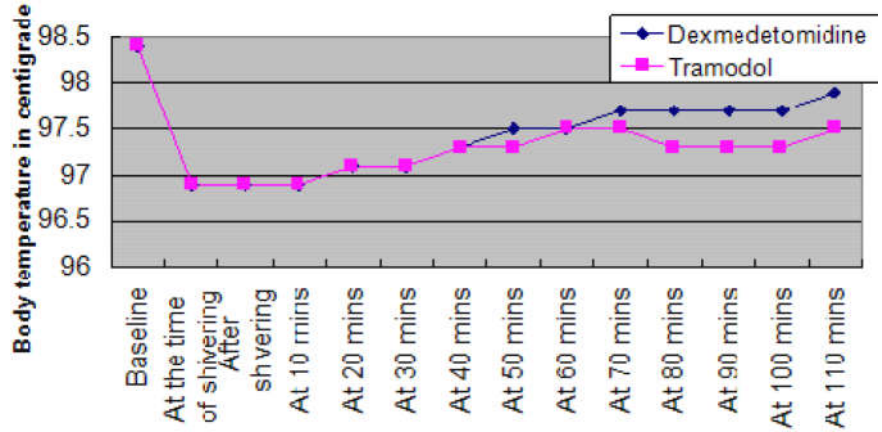

Fig. 3: Comparison of axillary temperature at various time intervals in the two groups

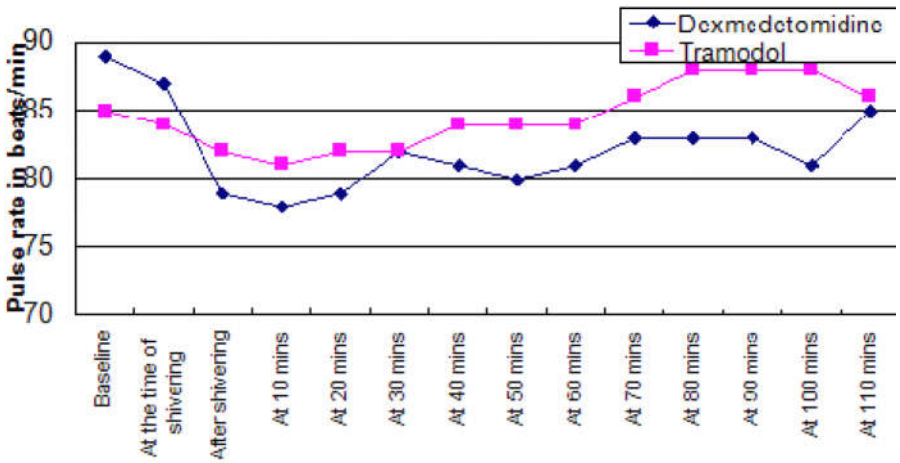

Fig. 4: Comparison of pulse rate at various time intervals in the two groups

Table 3: Adverse reactions in study groups

Parameter	Dexmedetomidine	Tramodol
Nausea	0	9
vomiting	0	6
Sedation	7	8
Hypotension	0	0
Bradycardia	0	0
Respiratory depression	0	0

HR, mean blood pressure, body temperature variations were insignificant in both groups on comparision with each other.

Nausea and vomiting was observed in tramadol group, and absent in the dexmedetomidine group.

Discussion

Tramadol is an opioid analgesic, whose effect is mainly mediated through mu receptors with minute effect on delta and kappa receptors. opioid or serotonergic and noradrenergic activity mediate anti-shivering action of tramadol [6,7,8]. It is a well-known agent and used in the treatment of post-anaesthetic shivering.

Alpha-2 adrenergic agonists are frequently used for anaesthesia and also in intensive care units. Dexmedetomidine is an Alpha-2 adrenoceptor agonist, with analgesic, antihypertensive, sedative and anti-shivering effects or properties [9]. The anti-shivering property of alpha adrenoceptor agonists is mediated by binding to Alpha-2 receptors that results in vasoconstriction and anti-shivering effect. In addition it has hypothalamic thermoregulatory action [10]. Dexmedetomidine decreases vasoconstriction and shivering thresholds and are thought to act on the central thermoregulatory system thus preventing shivering peripherally. It is widely used along with local anaesthetics in spinal anaesthesia and also in peripheral nerve blockade, for sedation in mechanically ventilated patients in the Intensive Care Units, and also as supplementation of post-operative analgesia. Many studies evaluate importance of dexmedetomidine in the treatment of shivering [11]. It can be an alternative and better choice because of its effects in relation to 'anti-shivering' and sedation.

Shivering is common complication in patients who are undergo surgery under neuraxial anesthesia. Shukla et al. [2] reported incidence of shivering in patients undergoing surgery under regional anesthesia at 40–70%. Tanveer Singh Kundra et al. [12] reported an incidence of 41% which is in correlation with our study which is 40%.

Tanveer Singh Kundra et al. [12] study reported the time to cessation of shivering was significantly lesser with dexmedetomidine in comparision with tramadol ($p < 0.001$). The recurrence rate of shivering was less (6%) with dexmedetomidine in comparision to tramadol (16%). Nausea and vomiting was found to be more in the case of tramadol in his study which is in correlation with our study noting that onset of shivering and cessation of shivering was significantly less in use of dexmedetomidine when

compared to tramadol. There was recurrence of shivering in dexmedetomidine group- 2 patients and 4 patients tramadol group in present study. The patients were given rescue doses of dexmedetomidine or tramadol if needed .

The efficacy of dexmedetomidine is similar to that of a previous study by Blaine Easley et al. [13] who studied the role of dexmedetomidine in the treatment of postoperative shivering in children. All children had a cessation of shivering within 3.5±0.9 min, while in our study cessation of shivering is within 2.9±0.23 min (174.12 ± 14.366). While Blaine Easley et al. recorded their results as the number of patients who had stopped shivering after 1 min, after 2 min and so on, and then extrapolated the time taken for cessation of shivering from these data. However, in our study, we directly observed the time taken for shivering to stop.

Our study results indicate that dexmedetomidine takes less time to control shivering. The incidence of adverse effects like nausea and vomiting was found to be more in case of tramadol when compared to dexmedetomidine. In the present study, shivering recurrence was 5% in dexmedetomidine group and 10% in the tramadol group, recurrence rates with dexmedetomidine and tramadol were comparable and there was no significant difference.

Mittal G et al. [14], Abdel Ghaffar HS et al. [15] Bansal P and Jain G, Chan AM et al. [16], found a similar range of tramadol response ranging from around 70-80%. Recurrence rates with dexmedetomidine have been reported in range of 0-10% in studies of Mittal G et al., Abdel Ghaffar HS et al., Blaine Easley R et al. with tramadol in range of 0-9%. Tramadol caused nausea (22%) and vomiting (15%) more in comparison to dexmedetomidine which is similar to study done by Mittal G et al., Shukla U et al. [16,17]. Myles PS et al., have reported a strong positive correlation between postoperative nausea, vomiting and patient dissatisfaction after surgery and anaesthesia [18]. More studies are needed to be undertaken with varying dose ranges to complete the results of this study. Absence of nausea and vomiting during dexmedetomidine usage, is advantageous for the surgeon, anaesthetist as well as the patient. It provided more comfort to the patient, improved surgical conditions, maintain hemodynamic stability and also provided amnesia during surgery.

Conclusion

Dexmedetomidine has better or increased efficiency and faster control than tramadol when used to treat shivering that develops after spinal anaesthesia without any unwanted side effects as well as inducing a comfortable sedation for the patient. Tramadol though effective to treat shivering in post spinal anaesthesia cases has a low efficacy as compared to dexmedetomidine as well as causes an increased incidence of unwanted nausea and vomiting. Dexmedetomidine is a useful substitute to tramadol for cessation of post-spinal anesthesia shivering.

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Original Research Article

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Efficacy of Spinal Anaesthesia as a Safer Technique in Laparoscopic Cholecystectomy with Better Outcome

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Abstract

Spinal anaesthesia is always a safe, cost effective and a better option in patients where general anaesthesia can be complicated and to fulfill the purpose of post-operative analgesia. After conducting many upper abdominal surgeries and open cholecystectomy under spinal anaesthesia, this study was conducted on single, three and conventional four port laparoscopic cholecystectomy under spinal anaesthesia to assess its efficacy, safety, reliability and as an alternative to general anaesthesia with minimum risk. This study was conducted on 300 patients of either sex belonging to ASA-I & II, age 20-70 years admitted for planned laparoscopic cholecystectomy. Bupivacaine (2.5 to 4ml) was injected indurally in lateral position at the level of L2. Dose of bupivacaine varied according to the feasibility and compatibility of the operating surgeon. Pneumoperitoneum with CO_2 was created with the range of 10-14mmHg intra-abdominal pressure, according to the ease of the surgeon, at the rate of 1 L/min. Patients were sedated with Inj pentazocine 30mg and midazolam 2mg/ diazepam 10mg intravenously after performing spinal anaesthesia. Any discomfort and intensity to the patient due to right shoulder pain was observed and managed accordingly from right shoulder massage to supplementation with propofol 1mg/kg. No patient was converted into general anaesthesia with tracheal intubation. Mean age was 41.7 years. Mean surgical duration was 53.19±12.55 min. Mean duration of sensory block was 157.39±23.47 min and mean duration of motor block was 134.17±19.52 min. Laparoscopic cholecystectomy can be performed under spinal anaesthesia with better outcome and safety without having any major complication.

Keywords: Spinal Anaesthesia; Single; Three & Four Port; Laparoscopic Cholecystectomy; Pneumoperitoneum; CO_2 Insufflation.

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Introduction

With the advancement in surgery, anaesthetist daily meets with new challenges. To counter those challenges, better alternative anaesthetic techniques are taking place. Laparoscopic surgeries has increased and becoming a trend during past few years and replacing conventional open cholecystectomy as the gold standard modality. The reason is it is well recognized minimal invasive surgery and expedited post-operative recovery with minimum hospital stay [1]. Abdominal insufflations upto 14-16 mmHg with CO_2 is required to perform laparoscopic surgeries, which increases intra-abdominal pressure. The normal intra-abdominal pressure is less than 5 $mmHg^2$. Increased intra-abdominal pressure created by pneumoperitoneum leads to systemic absorption of CO_2, enhances venous stasis, produces hypercarbia, systemic acidosis, lowers respiratory compliance,

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increases airway pressure and impairs cardiac functions and hypertensive episodes [3]. A longer operative period causes longer exposure of the patient to the adverse effects of pneumoperitoneum. Till now general anaesthesia was considered for such procedures as a gold standard, but it also has its own deleterious effects.

Nowadays, spinal anaesthesia is becoming popular in laparoscopic surgeries to avoid the associated detrimental effects of general anaesthesia along with the systemic effects of pneumoperitoneum created during laparoscopic surgeries.

Spinal anaesthesia is a form of regional anaesthesia involving the injection of local anaesthetic agent in subarachnoid space through a fine bore needle. It is also called as subarachnoid block, intradural block and intrathecal block. It is an alternative technique to general anaesthesia in some operations to avoid its undesirable detrimental effects or in patients where general anaesthesia can be risky and contra-indicated [3,4]. Spinal anaesthesia allows the patient remain awake during the operation without feeling any pain. Local anaesthetic drug injected intradurally blocks the autonomic, sensory and motor fibres and produces numbness and adequate muscular relaxation to perform surgery. Nowadays spinal anaesthesia is a commonly used technique. It can solely be given alone or can be supplemented with sedation. It is a favourable technique in patients having severe respiratory disease to avoid potential respiratory consequences of intubation and ventilation. It may also be useful in patients with anatomical abnormalities affecting the airway and making the tracheal intubation difficult.

There are few conditions where spinal anaesthesia is contra-indicated

- Patients refusal
- Local infection or sepsis at the site of lumber puncture
- Bleeding disorders
- Space occupying lesion in the brain and raised ICT
- Anatomical abnormalities of spine
- Hypovolaemia and shock

Risks and complications

- Hypotension
- High block
- Bradycardia and cardiac arrest
- Post-dural puncture headache
- Spinal canal haematoma
- Cauda equina (very rare)

Aims of Study

This study was conducted for the assessment of efficacy, safety and hemodynamic changes during laparoscopic cholecystectomy under spinal anaesthesia.

Material and Method

This study was conducted on 300 patients of either sex belonging to ASA I & II from age 20-70 yr admitted for planned laparoscopic cholecystectomy.

A written informed consent was obtained from the patients and protocol of the study and intraoperative events were explained to the patients during pre-anaesthetic check up. Patients were advised for 6-8 hr fasting and tab alprazolam 0.5mg given night before surgery to alleviate anxiety. Patients who refused for spinal anaesthesia, having any local sepsis in the lumber region, bleeding disorder and patients with spinal bony deformity were excluded from this study.

A patent running intravenous line was secured with 18 G cannula and patients were preloaded with 1 litre crystalloid fluid (ringer lactate) in operation theatre before performing spinal anaesthesia and monitor was attached to record basal heart rate, blood pressure, oxygen saturation and ECG. Patients were prepared for spinal anaesthesia with all aseptic precautions, infiltration of local anaesthetic was done in L1-L2 interspace. Spinal anaesthesia was given by 23 G spinal needle in lateral position with precaution not damaging the spinal cord. Bevel of the needle was directed cephalic after reaching in the subarachnoid space and bupivacaine 2.5-4 ml (depending upon the surgeon's compatibility) was injected to achieve dense block and prolonged effect [4]. Patients were turned supine and kept for 5-10 minutes with a 15 degree head down tilt (with a 3 inch width pillow under the shoulders) to achieve the block upto the level of T4-T5. Premedication was given with pentazocine 30mg, midazolam 2mg/ diazepam 10mg, ondensetron 4mg and ranitidine 50mg intravenously. Oxygenation was given by ventimask at the rate of 5-6 litre/min. Heart rate, respiratory rate, blood pressure and SpO_2 was monitored frequently after spinal anaesthesia and intra-operatively. Pneumoperitoneum (10-14 mmHg)

was created through umbilical port with CO_2 with a rate of 1 litre/min and laparoscopic cholecystectomy was done by single port, three port or by traditional four ports [5]. Initially hypotension was observed after spinal anaesthesia, which was corrected with intravenous fluids, oxygenation and ephedrine 6mg/mephentermine 6mg intravenously. Once the pneumoperitoneum was created, blood pressure remained stable.

Most of the patients (244 patients) were operated under spinal anaesthesia and sedation without any complaint. 47 patients had experienced right shoulder pain during the middle and during the end moments of surgery, which was relieved with shoulder massage. 9 patients had experienced severe shoulder pain with anxiety and restlessness. They were supplemented with propofol 1mg/kg. Pneumoperitoneum, alongwith excessive smoke due to cauterization aggravates the shoulder pain [6]. Smoke was evacuated intermittently. No incidence of high spinal, cardiac or respiratory arrest was noted. No patient was converted into general anaesthesia with tracheal intubation.

Observations

Two hundred sixty six (266) females had undergone for laparoscopic cholecystectomy shows cholecystitis and cholelithiasis occurs more in females over age of 40. In this study, Mean age of patients was 41.7 yr. No nausea, vomiting and post-spinal headache was observed. Table shows mean duration of sensory block was 157.39±23.47 min and mean duration of motor block was 134.17±19.52 min (Table 1).

This table shows respiratory rate was increased after CO_2 insufflation, to wash out the absorbed CO_2. $EtCO_2$ was also raised after insufflation. (Table 2).

Discussion

Whenever we think of spinal anaesthesia, we get scared of hypotension. This study was conducted after a long experience of 15 yrs of upper abdominal, open and single, three and four port laparoscopic surgeries under spinal anaesthesia to observe spinal anaesthesia as an alternative to general anaesthesia as a safe, cost effective technique with better outcome.

In this study it was observed that with few precautions, despite of giving spinal anaesthesia at a higher level, severe hypotension was never been a problem during the procedure, neither there were any hypertensive episodes after creating

Table 1:

Mean Age (in yrs)	**41.7**
Sex	Males -34 Females- 266
Attempts for spinal	Single attempt
Level of block	T4-T5
Intra-abdominal pressure	10-14 mmHg
Rate of insufflation	1 litre/min
Hypotension	In 81 patients
Respiratory rate/min	22±4.84
Referred shoulder pain	47
Anxiety and restlessness	9
Nausea /vomiting	Nil
Mean Duration of sensory block	157.39±23.47 min
Mean duration of motor block	134.17±19.52 min
Mean surgical duration	53.19±12.55 min
Postdural puncture headache	Nil

Table 2:

Heart rate	67.28±3.17
Mean arterial pressure	86.43±3.71
Respiratory rate Basal	14-17/ min
Respiratory rate after insufflations	21-26/min
SPO_2 with oxygen	99-100%
SPO_2 without oxygen	94-96%
Basal $ETCO_2$	13.47±3.86
$ETCO_2$ after insufflation	26.31±3.12

pneumoperitoneum, as was observed in previous studies [9,10,11]. Even after achieving a block up toT4- T5, properly hydrated patient needed only single dose of vasoconstrictor agent (ephedrine/ mephemtermine 6mg IV) to maintain the blood pressure. In this study it was observed that initial fall in blood pressure was during 3-5 mins after spinal anaesthesia, which was corrected with fast running intravenous drip and oxygenation and sometimes vasopressor drug was given to maintain the blood pressure. 67 patients (22.33%) required single dose of vasopressor agent and only 14 patients (4.66%) required second dose to control hypotension [12].

It may be due to hypertensive response of pneumoperitoneum, which would have compensated the incidence of hypotension and would have helped in maintaining the blood pressure during the procedure. Hence, it can be said that hypertensive response of pneumoperitoneum had become an advantage in maintaining the blood pressure in limits [13], which could have been the problem under general anaesthesia.

Incidence of referred shoulder pain was observed in 56 patients (18.66%), which was relieved by gentle shoulder massage in 47 patients and frequent evacuation of smoke produced due to cauterization. 9 patients were found anxious and restless and they were supplemented with 1mg/kg propofol intravenously.

Despite of using 23 G spinal needle, there was no incidence observed of post spinal headache. It may be due to single dural puncture. This study correlates with the study of Jabbari A et al. [14], who observed 0.1-36% incidence of post spinal headache in his study. Spinal anaesthesia had provided numerous advantages like quick washout of CO_2 with no residual effect, prolonged and effective post-operative analgesia, no airway manipulation, less incidence of nausea, vomiting or any other complication and cost effectiveness [12,15,16,17].

Conclusion

On the basis of this study, it can be concluded that spinal anaesthesia can be a better alternative technique to general anaesthesia for laparoscopic cholecystectomy, with minimum respiratory, cardiovascular and other complications, safe, cost effective, with better post-operative analgesia and with better outcome.

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Original Research Article

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Is Thoracic Epidural Anesthesia a Better Alternative to General Anesthesia in Modified Radical Mastectomy Surgeries?

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Abstract

Background and objectives: Though the breast surgeries are usually performed under general anesthesia (GA), it is not without any attendant risks. Thoracic Epidural anesthesia (TEA) is gaining more attention in view of better intraoperative conditions, postoperative recovery profile and fewer postoperative complications. This study was designed to determine the efficacy and safety of TEA as an alternative anesthetic technique to GA for Modified radical mastectomy (MRM). *Methodology:* Group G (n = 25) was administered conventional GA. The Group T (n = 25) received TEA with 0.25% Bupivacaine and Fentanyl. Postoperative pain management was provided with Tramadol for GA patients and epidural infusion for TEA patients. The need for anesthesia supplementation, sedation, hemodynamic changes, respiratory depression and other intercurrences like pruritus, nausea, vomiting were recorded. The duration of surgery, length of stay in the recovery room and quality of post-operative analgesia were also recorded. *Results:* In group T, Supplementation with axillary infiltration was required in 20% of patients and all patients required sedation. Hypertension was more frequent in group G, whereas hypotension and bradycardia were more frequent in group T. Postoperatively, the incidence of nausea and vomiting were observed frequently in group G. The group G patients had longer duration of stay in recovery room (202.32 vs 160.80 minutes). The Visual Analog scores and requirement of supplementary analgesics upto 24 hours of postoperative period were significantly lower in group T patients. *Conclusion:* TEA is a safe, reliable and better alternative to GA in patients undergoing MRM.

Keywords: General Anesthesia; Modified Radical Mastectomy; Postoperative Analgesia; Thoracic Epidural Anesthesia.

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Introduction

As the incidence of breast malignancies is on the rise, Modified Radical Mastectomy (MRM) is now frequently performed. Though the breast surgeries can be performed under Cervical Epidural Anesthesia, Thoracic Epidural Anesthesia (TEA), Thoracic Paravertebral Blocks and Intercostal Blocks [1-3], oncologic breast surgeries are usually performed under general anesthesia (GA) and is more acceptable by patients also. But GA does not eliminate the surgical stress response, may aggravate immunosuppression [4] and cause undesirable side effects such as nausea and vomiting [5-7]. Due to lack of residual analgesia, Postoperative pain is one of the most debilitating outcomes, often necessitating the use of opioids. This aggravates the incidence of nausea and vomiting, impaired ventilation and postoperative sedation [8], ultimately resulting in prolonged hospital stay [9]. In recent days, regional anesthesia particularly TEA, is gaining more

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attention in view of better intraoperative hemodynamic stability, fewer postoperative complications, early mobilization and thereby becoming an useful adjunct for fast track surgery. It reduces the overall costs of perioperative care of patients undergoing MRM.

TEA allows utilization of incremental doses of local anesthetic agent, which offers preservation of the respiratory function [4,10-12]. TEA also selectively blocks cardiac sympathetic fibers, thereby it attenuates surgical stress response, improves myocardial oxygen balance and stabilizes intraoperative hemodynamics [7,13]. It also avoids the problems of difficult tracheal intubation and hemodynamic changes associated with it. Thus TEA reduces perioperative cardiac complications and mortality [14]. Thereby it is more beneficial in patients with difficult airway, compromised cardiac and pulmonary reserve and elderly patients [15,16]. TEA decreases intraoperative blood loss and also allows early feeding. Postoperative pain relief can be provided through the epidural catheter [17]. All these factors positively affects the early mobilization and shorter duration of hospital stay [18]. But the technique of thoracic epidural requires special skill and expertise to avoid potential complications like inadvertent dural puncture, spinal cord trauma, and epidural hematoma/abscess.

Various studies had demonstrated the effectiveness and the decreased incidence of complications associated with TEA [5,6,8]. Still exclusive TEA for MRM surgeries is not frequently performed. Hence, this study was designed to determine the efficacy and safety of TEA as an alternative anesthetic technique to GA for mastectomy and axillary dissection.

Materials and Methods

After getting approval from institutional ethics committee, fifty cases of Carcinoma Breast scheduled for elective Modified Radical Mastectomy were enrolled in this Prospective randomized comparative study, after signing an informed consent. These patients were randomized into two groups by Sealed Envelope technique. Group G (n = 25) General Anesthesia group and Group T (n = 25) Thoracic Epidural Anesthesia group.

Inclusion Criteria

1. Female patients of carcinoma breast proven by FNAC or biopsy and mammogram.
2. Age between 30-65 years

Exclusion Criteria

1. Patient refusal
2. American Society of Anesthesiologists (ASA) physical status > III
3. Infection at the site of epidural placement
4. Difficult airway
5. Coagulation disorder
6. known allergy to bupivacaine
7. Hypovolemia
8. Vertebral column deformity

Procedure

Prior to the day of surgery, anesthesiologists had evaluated all patients and explained the anesthesia process and method. Demographic data were recorded. The patients were advised fasting as per ASA guidelines. Tab. Alprazolam 0.5mg, Tab. Ranitidine 150 mg and Tab. Metoclopramide 10 mg were administered orally the night before surgery. On arrival in the operating room, ECG (leads II and V5) for heart rate (HR) and ST segment changes, Pulse oximetry (SpO_2), and non-invasive blood pressure monitors were attached and baseline readings were recorded. After securing intravenous access with 18G cannula, the patient was preloaded with 10 mL/kg of lactated Ringer's solution slowly over 30 minutes. Oxygen was administered through facemask. The patients were sedated with intravenous Midazolam 2 mg, and Fentanyl 25 µg; After that the group G patients receiving GA were pre-medicated with inj. Glycopyrrolate 0.2mg, inj. ondanseteron 4 mg intravenously and induced with inj. Fentanyl 1.5mcg/kg followed by inj. Propofol 2 mg/kg intravenously. Tracheal intubation was facilitated using inj. Vecuronium 0.1 mg/kg. Anesthesia was maintained using Isoflurane along with admixture of oxygen and nitrous oxide (1:2) and additional doses of Vecuronium (1 mg), as required. Supplementation of Fentanyl was given as analgesia, whenever necessary. At the end of the surgery, the residual neuromuscular blockade was reversed with Neostigmine 0.05 mg/kg and glycopyrrolate 0.01mg/kg.

The group T patients received thoracic epidural block by a qualified anesthesiologist. Under strict aseptic precautions, with patient in lateral position, the area was cleaned and the T4-5 intervertebral space, or the one closer to this space considered to be an easier access, was anesthetized. An 18G Tuohy needle was introduced using midline approach and

epidural space identified by loss of resistance technique. The epidural catheter 20G was inserted 3 – 4 cms cephalad into epidural space. A test dose of 3ml 2% lignocaine with 1:2,00,000 adrenaline was given after careful aspiration. The patient was positioned supine and 17 mL of 0.25% bupivacaine with 100 µg fentanyl was administered incrementally. After testing the quality of anesthesia (adequate analgesia determined by pinprick method from the lower border of the clavicle to the inferior costal margin), the surgery was initiated. Whenever necessary, supplemental doses of midazolam 1 mg was administered for sedation. The procedure was considered as failure, if targeted dermatomal levels were not attained even after 10 minutes and GA was instituted. If the patient experienced pain or discomfort during axillary exploration, the surgeon infiltrated the area with with 5 to 10ml of 1% lignocaine with adrenaline. Anesthesia was maintained by injecting 5 mL of 0.25% bupivacaine every 60 to 90 minutes through the epidural catheter. Oxygen was administered through facemask. After the surgery, the patient was shifted to recovery room with continuous monitoring for vital parameters. After anesthesiologist clearance, the patient was then transferred to postoperative ward.

The need for supplementary sedation and anesthesia supplementation, hemodynamic changes [tachycardia (HR > 100 beats per minute), bradycardia (HR < 60 beats per minute), hypotension (20% drop in baseline blood pressure) and hypertension (20% increase in baseline blood pressure)], respiratory depression and other intercurrences like pruritus, nausea, and vomiting were recorded both intraoperatively and postoperatively upto 24 hours. The duration of surgery and the length of stay in the recovery room were also noted. Hypotension was treated with fluid boluses and 6 mg Ephedrine, bradycardia was treated with 0.3-0.6 mg Atropine and vomiting with 10 mg Metoclopramide intravenously.

In GA patients, postoperative pain management was provided with inj. Tramadol 50 mg intravenously every 6 hours for the first 24 hours and TEA patients were managed with epidural infusion of 0.125% bupivacaine 6 mL/h for 24 hours. Quality of post-operative analgesia was evaluated at 30 minutes, 2nd hour, 6th hour, 12th hour and 24th hour postoperatively, by using a 10 cm Visual Analog Scale (VAS), where zero represented no pain and 10 cm represented worst possible pain. A VAS score ≤ 4 cm was considered to be an acceptable level of pain. The VAS score > 4 was treated with rescue analgesics Diclofenac (iv or oral) and Paracetamol (i.v. or oral). All drug administrations were recorded.

Statistical Analysis

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois, USA) version 23. Quantitative parameters were analysed using students' t-test whereas qualitative parameters are compared using Chi square test and fisher exact test. Data are shown as mean± standard deviation and in absolute numbers or percentages. $p < 0.05$ was considered statistically significant.

Results

The patients in both the groups are comparable with regard to demographic characteristics like age, height and weight. Baseline HR, Systolic and Diastolic blood pressure and the duration of surgery was also similar between both the groups (Table 1). The difference was not statistically significant.

In group T, Supplementation of anesthesia with axillary infiltration was required in 20% of patients and all patients required sedation, mostly at the beginning of surgery without any complaints of pain.

Table 1: Patient characteristics

Variable	Group G	Group T	p value
Age(years)*	49.64 ± 5.83	48.12 ± 6.52	0.195 NS
Height(cms)*	154.56 ± 5.12	153.68 ± 4.91	0.269 NS
Weight(kg)*	62.08 ± 9.79	58.84 ± 9.2	0.117 NS
Baseline systolic pressure (mmHg)*	127.56 ± 12.24	125.44 ± 10.38	0.256 NS
Baseline Diastolic pressure (mmHg)*	80.68 ± 8.40	77.72 ± 7.77	0.101 NS
Baseline Heart rate (beats per minute)*	85.2 ± 12.43	85 ± 13.28	0.478 NS

*Data as Mean ± Standard Deviation
NS – Not significant

Hypertension was more frequent in group G whereas hypotension and bradycardia were more frequent in group T (Table 2). Postoperatively, the incidence of nausea and vomiting were observed more frequently in group G. The group G patients had longer duration of stay in recovery room when compared to group T patients (202.32 vs 160.80 minutes) and the difference was statistically significant (Table 3). The VAS scores and requirement of supplementary analgesics upto 24 hours of postoperative period were significantly lower in group T patients (Table 4).

Discussion

With increasing trend of breast cancer, the current tendency is towards radical surgical procedures. The use of an anesthetic technique, which allows for optimal surgical conditions, reduced blood loss, rapid recovery and excellent postoperative analgesia may have a positive impact on the patient's recovery from this major surgical insult.

The TEA has been increasingly practiced in recent years. It offers protection against the

Table 2: Intraoperative patient Characteristics

Parameters	Group G	Group T	P value
Duration of surgery (minutes)*	159.72 ± 7.56	158.64 ± 7.97	0.313 NS
Axillary supplementation**	0(0%)	5(20%)	0.05 S
Supplementary Sedation**	0(0%)	25(100%)	0.05 S
Hypertension**	8(32%)	0(0%)	0.05 S
Hypotension**	3(12%)	13(52%)	0.002 S
Tachycardia**	3(12%)	7(28%)	0.157 NS
Bradycardia**	2(8%)	12(48%)	0.002 S

*Data as Mean±Standard Deviation
**Data as number of patients (percentage)
S – Significant NS – Not Significant

Table 3: Postoperative patient Characteristics

Parameters	Group G	Group T	P value
Nausea**	11(44%)	3(12%)	0.012 S
Vomiting**	15(60%)	2(8%)	0.0001 S
Pruritus**#	0(0%)	10(40%)	<0.05 S
Respiratory Depression**	0(0%)	0(0%)	NS
Duration of stay in recovery room (minutes)*	202.32 ± 20.23	160.8 ± 15.7	0.00001 S

*Data as Mean±Standard Deviation
**Data as number of patients (percentage)
perioperative
S – Significant NS – Not Significant

Table 4: Postoperative Visual Analog Scores(VAS)

VAS	Group G	Group T	P value
Postop 30 minutes*	3.44 ± 0.51	0.36 ± 0.64	0.00001 S
Postop 2 hours*	5.36 ± 1.0	2.92 ± 0.76	0.00001 S
Postop 6 hours*	5.16 ± 1.2	1.56 ± 0.65	0.00001 S
Postop 12 hours*	5.08 ± 0.81	1.52 ± 0.59	0.00001 S
Postop 24 hours*	3.64 ± 1.08	1.36 ± 0.57	0.00001 S

*Data as Mean±Standard Deviation
S – Significant

perioperative stress response and the beneficial effects have been attributed to the physiological changes caused by neuraxial anesthesia and better pain management. The benefits include an effective postoperative analgesia, lower incidence of pulmonary complications, stabilization of endothelial coronary function, improved hemodynamic stability, earlier return of bowel function, preservation of immune competence, early ambulation and a reduction in the cost of perioperative care [19,20]. TEA offers protection against arrhythmias, particularly of ventricular origin [21] and also maintains the myocardial oxygen demand /supply ratio along with maintenance of the coronary perfusion pressures even in the ischemic myocardial tissue [22], thereby having a positive impact on the cardiovascular status [23]. But the main apprehension behind its regular use are technical difficulty and spinal cord injury. With utmost precautions and experienced hands, dural puncture is rare and the incidence of neurological injury is 0.01–0.001% [24]. Brull et al had reported the incidence of permanent neurological sequelae related to TEA as <0.07% [25].

GA may increase the risk of impaired cardiac function [22] by decreasing myocardial blood flow and left ventricular function. It also increases the risk of alveolar barotrauma [26] and pneumonia. Neuromuscular blockade during GA increases atelectasis in the dependent lung, leading to a right-to-left shunt and increased risk of intraoperative hypoxia. In addition, difficult intubation and intubation-related trauma to teeth or vocal cords can also occur. Further these complications can be aggravated according to the comorbid conditions of the patient. Considering the risk benefit ratio, this study was designed to determine the efficacy of TEA as a safe and better alternative to GA in MRM surgeries.

The preoperative subject characteristics were statistically comparable between both the groups. The baseline hemodynamic variables and duration of surgery were also comparable. The T4-5 intervertebral space, or the next closer space, considered to be an easier access was selected. In similar other studies, Belzarena et al. [6], Sagiroglu G et al. [27] and Sundarathiti P et al. [8] had all selected T4-T5 space. The drug used was 0.25% Bupivacaine. As breast surgery does not need muscle relaxation, 0.25% concentration was chosen. Bupivacaine has an acceptable onset time, long duration of action, profound conduction blockade and significant separation of sensory and motor blockade. It provides safe, effective and hemodynamically stable analgesia. The volume used was 20ml (3ml as test dose followed by 17ml) in line with other similar studies [6,28]. None of the patients had difficulty or complications in instituting TEA.

The quality of anesthesia was adequate in most patients. But five patients in group T required complementation by local infiltration of axilla with 5-10ml of 1% lignocaine with adrenaline. This problem arose when dissection involved the second or third level (behind and medially to the pectoralis minor muscle), during which time along with second thoracic root, the other cervical roots (up to fourth cervical root) are involved in the innervation. On the surface, the territory of the fourth cervical root is above the second thoracic dermatome. Thus blockade up to the level of fourth cervical root is necessary and can be consistently achieved by administration of a large volume dose of local anesthetic with an opioid. Visser et al[29] had concluded that the total dose and volume of local anesthetic was the most important determinant factor for the extent of the blockade, while the site of epidural puncture controlled the pattern of distribution of sensory blockade. The median thoracic approach, as used in the present study, tends to cause greater caudal dispersion of the local anesthetic, justifying the use of larger volumes [30]. All the patients in TEA group received sedation, mostly before the beginning of surgery to allay apprehension. Few patients required intraoperatively either during axillary sparing or when the surgery was getting prolonged. Belzarena et al. [6] had observed axillary sparing and subsequent supplementation in 15% patients and complimentary sedation in 100% patients despite high level of blockade. Similar observation was made in many other studies [31,32]. None of the patients in TEA group had respiratory depression.

The incidence of hypotension (52%) and bradycardia (48%) were significantly high in TEA patients but were mild due to segmental blockade, lower concentration of local anesthetic used and preserved venous return. It was easily managed with fluid boluses, low doses of vasopressor and Atropine accordingly. Medium thoracic block is considered to cause hypotension and bradycardia by inhibiting sympathetic cardiac fibers. Tachycardia was encountered in both the groups and there was statistically significant incidence of hypertension in group G patients (32%). Tachycardia in group T might be secondary to hypotension. But hypertension and tachycardia noted in group G correlated with intubation and surgical stimulation especially after skin incision. Oktavia et al. [28] and many others

[6,31] had made a similar observation in their comparative study between TEA and GA on MRM surgeries.

When compared to GA group, TEA patients had a lower incidence of Postoperative nausea and vomiting (PONV), which had been demonstrated in several other studies [5-7,13,31]. Administration of Opioids during GA, can induce nausea and vomiting by direct stimulation [33] of the chemoreceptor trigger zone. Increased pain scores in GA group also could have resulted in more analgesic dosage with possible side effects. In high frequency, PONV will be distressing to patients and potentially detrimental to their postoperative recovery. Pruritus was noted in 40% of the patients in TEA group. Since pruritus was not severe, specific treatment was not required. Pruritus was encountered in studies which used fentanyl as epidural adjuvant [6,13].

GA patients stayed for a longer time in recovery room when compared to TEA patients (202.32 vs 160.8 minutes) and it was statistically significant. This finding correlates with the observation made by Belzarena et al. [6] and Bhardwaj et al. [31]. Apart from delayed recovery from anesthesia, other factors like nausea, vomiting, high pain scores and human factors, such as late discharge order from attending anesthesiologist might prolong the stay. But Sagiroglu G et al. [27] had observed that TEA patients stayed for a longer time in recovery room. Probably, the propofol infusion used to maintain intraoperative sedation in these patients might be the cause for delay.

Ineffective analgesia may result in harmful physiological and psychological effects and in turn these adverse effects may result in significant morbidity and even mortality [34]. Adequate postoperative control of pain is very important as it makes for a better postoperative period, early hospital discharge and can have a long-term effect of decreasing complications such as chronic pain [7,35]. Calimli S et al. [36] had found significantly high VAS scores in patients undergoing mastectomy under GA. Doss NW et al. [5] had observed that TEA patients experienced significantly less pain after surgery. Accordingly in our study also, the VAS scores were very significantly lower in TEA group for upto 24 hours postoperatively and required less parenteral analgesics. Lahiry et al. [37] also had found significantly lower VAS scores in TEA patients in the immediate postoperative period. The post-operative analgesia and opioid sparing effect can be demonstrated by administering local anaesthetic through the epidural route [38]. TEA may also have a role in controlling the scar pain and phantom pain [35].

Yeh CC et al. in his comparative study between GA and TEA for MRM patients concluded that TEA provided a more prolonged analgesic effect than GA after operation. Side effects were observed at a higher frequency in the GA group. The average bed rest time was significantly shorter in the TEA group. Overall satisfaction scores were significantly higher in the TEA group than in the GA group [13].

Although not specifically assessed in this study, intraoperative blood loss, duration of hospital stay and hospital costs were more in GA group than TEA group [39]. It was observed that patients in TEA group were ambulating early with more comfort and satisfaction than patients in GA group.

Few limitations of this study were a small sample size, and patients of ASA physical status IV were not assessed. So the efficacy of TEA in sicker patients remains under evaluated. A longer follow up of the patients may show the effect of TEA on the scar pain and phantom pain.

Conclusion

Both TEA and GA offered good operating conditions. TEA has no effect on inducing hypertension, but hypotension and bradycardia may occur. Postoperative recovery profile was better in TEA patients in terms of reduced incidence of nausea and vomiting, adequate postoperative analgesia and shorter stay in recovery room. Postoperative epidural infusion provided excellent analgesia without any major hemodynamic fluctuations which in turn contributed to reduced analgesic requirements and its attendant side effects.

Thus Thoracic epidural anesthesia is a safe, reliable and better alternative to General anesthesia in patients undergoing Modified Radical Mastectomy. However meticulous dosing and proper asepsis is of utmost importance for the success of TEA. Further extensive studies are needed to validate our conclusion.

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Conflicts of Interest: None

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Indian Journal of Maternal-Fetal & Neonatal Medicine	Tri-Annual	9500	9000	742	703
Indian Journal of Medical & Health Sciences	Semiannual	7000	6500	547	508
Indian Journal of Obstetrics and Gynecology	Bi-monthly	9500	9000	742	703
Indian Journal of Pathology: Research and Practice	Monthly	12000	11500	938	898
Indian Journal of Plant and Soil	Semiannual	6500	6000	508	469
Indian Journal of Preventive Medicine	Semiannual	7000	6500	547	508
Indian Journal of Research in Anthropology	Semiannual	12500	12000	977	938
Indian Journal of Surgical Nursing	Triannual	5500	5000	430	391
Indian Journal of Trauma and Emergency Pediatrics	Quarterly	9500	9000	742	703
Indian Journal of Waste Management	Semiannual	9500	8500	742	664
International Journal of Food, Nutrition & Dietetics	Triannual	5500	5000	430	391
International Journal of Neurology and Neurosurgery	Quarterly	10500	10000	820	781
International Journal of Pediatric Nursing	Triannual	5500	5000	430	391
International Journal of Political Science	Semiannual	6000	5500	450	413
International Journal of Practical Nursing	Triannual	5500	5000	430	391
International Physiology	Triannual	7500	7000	586	547
Journal of Animal Feed Science and Technology	Semiannual	7800	7300	609	570
Journal of Cardiovascular Medicine and Surgery	Quarterly	10000	9500	781	742
Journal of Forensic Chemistry and Toxicology	Semiannual	9500	9000	742	703
Journal of Global Medical Education and Research	Semiannual	5900	5500	440	410
Journal of Global Public Health	Semiannual	12000	11500	896	858
Journal of Microbiology and Related Research	Semiannual	8500	8000	664	625
Journal of Nurse Midwifery and Maternal Health	Triannual	5500	5000	430	391
Journal of Orthopedic Education	Triannual	5500	5000	430	391
Journal of Pharmaceutical and Medicinal Chemistry	Semiannual	16500	16000	1289	1250
Journal of Plastic Surgery and Transplantation	Semiannual	26400	25900	2063	2023
Journal of Practical Biochemistry and Biophysics	Semiannual	7000	6500	547	508
Journal of Psychiatric Nursing	Triannual	5500	5000	430	391
Journal of Social Welfare and Management	Triannual	7500	7000	586	547
New Indian Journal of Surgery	Monthly	8000	7500	625	586
Ophthalmology and Allied Sciences	Quarterly	6000	5500	469	430
Otolaryngology International	Semiannual	5500	5000	430	391
Pediatric Education and Research	Triannual	7500	7000	586	547
Physiotherapy and Occupational Therapy Journal	Quarterly	9000	8500	703	664
RFP Indian Journal of Medical Psychiatry	Semiannual	8000	7500	625	586
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