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A Randomised Controlled Study Evaluating the Efficacy of Dexamethasone in Preventing Post-operative Nausea and Vomiting and its Effect on Blood Glucose

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Abstract

Context: Persistent vomiting leads to poor patient satisfaction, delayed wound healing, dehydration and electrolyte disturbances. In addition, vomiting or retching can sometimes result in more serious complications like aspiration, wound dehiscence, increased intracranial pressure, oesophageal rupture and pneumothorax. The expanding number of procedures performed as daycare surgeries has led to the increasing use of dexamethasone for PONV. *Aims:* The present study is to evaluate the optimum dose of dexamethasone for prevention of PONV and to measure the extent of the hyperglycemic side effects post-operatively in non-diabetics. *Settings and Design:* Prospective randomized controlled comparative study. *Methods and Materials:* After approval from the Institutional Ethics Committee, study was conducted on 135 patients of the American Society of Anesthesiologists (ASA) Grade I, II and III, aged between 20 to 60 years and included both genders that underwent elective surgeries under general anesthesia. Patients were randomized into 3 Groups to assess the efficacy of different doses of dexamethasone for prevention of PONV. All post-operative cases were followed up at 0, 12 and 24 *hours*, PONV and blood sugar levels were measured. PONV was being evaluated on a five-point ordinal scale. *Statistical analysis used:* Percentage analysis was used for categorical variables and the mean and SD was used for continuous variables. ANOVA with Tukey's Post-hoc test was used for the significant difference and for the repeated measures of ANOVA was used with Bonferroni correction to control the Type I error on multiple comparisons. The collected data were analysed with IBM® SPSS statistics software 23.0 Version. *Results:* Among categorical variables, p values for age (*p* - 0.611), gender (*p* - 0.533), ASA status (*p* - 0.234) with Chi-square testing were not significant. It is interesting to note that only 1 (2.2%) patient had nausea and vomiting in Group C compared to 5 (11.1%) in Group A and 3 (6.7%) in Group B in the immediate post-operative period. Post-operative blood glucose levels varied significantly in different Groups. In Group A blood sugar levels were 106.93 ± 14.426 *mg/dl*, Group B 117.31 ± 11.791 *mg/dl* and Group C 129.49 ± 16.170 *mg/dl* respectively in the immediate post-operative period. *Conclusions:* The benefits of administering higher doses of IV Dexamethasone should be weighed against the potential side-effects of short-lasting hyperglycemia.

Keywords: Dexamethasone; PONV; Blood glucose; Antiemetics.

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Introduction

With the introduction of general anesthesia in the first half of the nineteenth century, managing post-operative nausea and vomiting (PONV) has always been a challenge. In 1848, John Snow recognized and pioneered the management, eighteen months after the introduction of chloroform to anesthesia. The term PONV is typically used to describe nausea and/or vomiting or retching in the post-anesthesia recovery room or in the first *24 hours*. There are patient, anesthesia and surgery-related risk factors that increase the incidence of post-operative nausea and vomiting, which invariably results in increased morbidity and poor patient outcome. They often rate PONV as worse than post-operative pain.[1]PONV usually resolves or is treated without a sequel, but may require unanticipated hospital admission and delayed discharge from recovery room or the hospital.[2]

Persistent vomiting leads to poor patient satisfaction, delayed wound healing, dehydration and electrolyte disturbances. In addition, vomiting or retching can sometimes result in more serious complications like aspiration, wound dehiscence, increased intracranial pressure, oesophageal rupture and pneumothorax. Despite the availability of a number of anti-emetic drugs, no single agent is 100% effective against PONV. This may be because PONV is multifocal in origin and stimulus. In recent years, interest has been focused on the combination of drugs. Ondansetron and dexamethasone are being used successfully to treat emesis refractory to ondansetron alone.[3] Hence, the present study was carried out to find the role and safety of ondansetron plus dexamethasone in preventing PONV in patients undergoing elective surgical procedures under general anesthesia and its effect on blood sugar. Non-diabetic surgical patients, especially those suffering from acute illnesses, often become hyperglycemic. Physiological stress associated with trauma, serious illness and surgery, can cause insulin resistance, glucose intolerance, and hyperglycemia, a syndrome often referred to as diabetes of injury.[4] Whether peri-operative hyperglycemia causes serious complications to remain controversial, but high plasma glucose concentrations are inflammatory and decrease immune competence. Peri-operative use of steroids like dexamethasone is often administered because of its effective antiemetic action. Some clinicians have used steroids to reduce post-operative edema, inflammation and fatigue. The most important complication of peri-operative steroid administration is immune suppression and so impaired resistance to infection, besides that steroids also cause insulin resistance and hyperglycemia. Dexamethasone is a synthetic adrenocortical steroid and many of procedures performed as daycare a surgery has led to the increasing use of dexamethasone for PONV. It is regarded by many as an ideal peri-operative agent which is cheap, readily available for the prevention of PONV. It also promotes appetite, a feeling of well-being which is associated with earlier discharge from daycare surgery units. Hence, it is used widely now-a-day. Side-effects are generally thought to be linked to long-term steroid use.

So, the present study is to evaluate the optimum dose of dexamethasone for prevention of PONV and to measure the extent of the hyperglycemic side effects post-operatively in non-diabetics.

Materials and Methods

After approval from the Institutional Ethics Committee a prospective randomized controlled comparative study was conducted for *4 months* from *March 2018* to *June 2018* on 135 patients of the American Society of Anesthesiologists (ASA) Grade I, II and III, aged between *20* to *60 years* and included both genders that under went elective surgeries under general anesthesia. Patients with the physical status of ASA IV, patients who received opioids or anti-emetic agents *48 hrs* prior to surgery and patients receiving Total Intravenous Anesthesia (TIVA) or target-controlled infusion (TCI) intra-operatively were excluded from the study. The study conformed to the Helsinki Declaration (World Medical Association, 1995). Written informed consent from each patient was taken before enrolment in the study. Patients were randomized into 3 Groups as under:

Group A ($n = 45$) –Non-diabetic Patients receiving ondansetron *4 mg* only;

Group B ($n = 45$) –Non-diabetic Patients receiving ondansetron *4 mg* and dexamethasone *4mg*;

Group C ($n = 45$) –Non-diabetic Patients receiving ondansetron *4 mg* and dexamethasone *8 mg*.

Sample size calculation: The number of participants required in each group was 43.8 for a confidence level of 95% and power of 80%. However, for the sake of greater accuracy, it is decided to include 45 cases in each Group.

$$\text{The sample size (n)} = \frac{2\,x\{z\,(1-\alpha/2)+z\,(1-\beta)\}}{\Delta^2}$$

$Z_{(1-\alpha/2)}$ is the alpha error whose value for a significance level of 5% (confidence level of 95%),

is 1.96 and $z_{(1-\beta)}$ is the beta error or the power of the study whose value power of 80% is 0.8416 and

$$\Delta^2 = (p_1-p_2)^2 \quad \text{where } p' = p_1 + p_2$$
$$p'(1-p')^2$$

$p_1 = 0.35$ and $p_2 = 0.1$ $p' = (0.35 + 0.1)/2 = 0.225$

$\Delta^2 = (0.35\text{-}0.1)^2/0.225\ (1\text{-}0.225)$ ×= 0.0625/0.225 × 0.775 = 0.0625/0.1744 = 0.358

Alpha error at 5% significance level = 1.96

Beta error (power) at 80% = 0.8416

Sample size (n) = 2 $(1.96 + 0.8416)^2/0.358$ = 15.698/0.358 = 43.8 rounded off to 45 for easy calculation.

Total sample size for the three Groups = 3 × 45 = 135

The sample size for this study is 135 (3 × 45) cases. The required sample size was 135 cases for a significance level of 5% (confidence level of 95%) and a power of 80%. Based on a previous study[16] which assessed efficacy of different doses of dexamethasone for prevention of PONV, the authors had reported the figures for incidence of PONV in the ondansetron the only group as 28 out of 80 ('p^1' = 28/80 = 0.35) and the ondansetron and dexamethasone group as 8 out of 80 ('p^2' = 8/80 = 0.1) respectively.

All the patients who were scheduled to undergo elective surgeries and who satisfied the inclusion criteria and exclusion criteria were included in the study.

Observer 1: Anesthesia resident performing the study, did the pre-operative evaluation, checked for the inclusion and exclusion criteria and obtained informed written consent. The same observer did the post-operative assessment of the patient.

Observer 2: Primary anesthesia consultant who is responsible for peri-operative management.

Routine Pre-anesthetic checkup was done prior to the surgery and routine investigations were done as per the protocol. After checking the identity and consent, the patients were shifted to the operation room, multipara monitor attached and anti-emetics were administered after induction of anesthesia. In the post-operative period, patients vitals were monitored. All post-operative cases were followed up at *0,12* and *24 hours*, PONV and blood sugar levels were measured.

PONV was being evaluated on a five point ordinal scale:

0 = none, 1 = Nausea, 2 = Retching, 3 = Vomiting, 4 = Severe Vomiting (> 4 episodes);

In patients who complained of vomiting-metoclopramide/ondansetron/prochloromethazine were used as rescue anti-emetics.

Statistical Analysis

The information collected regarding all the selected cases were recorded in a Microsoft Excel spreadsheet. The collected data were analysed with IBM® SPSS statistics software 23.0 Version. To describe the data descriptive statistics frequency analysis, percentage analysis was used for categorical variables and the mean & SD was used for continuous variables. To find the significant difference in the multivariate analysis the one way ANOVA with Tukey's Post-Hoc test was used and for repeated measures, the repeated measures of ANOVA was used with Bonferroni correction to control the type I error on multiple comparisons. Chi-square test was used to find the significance in categorical data. In all the above statistical tools the probability value 0.05 was considered as significant level. $p < 0.05$ was considered to be significant.

Results

A total of 135 patients between age group *20–60 years*, 75 males (55.6%) and 60 females (44.4%), physical status ASA I–III underwent elective surgery under general anesthesia were included in the study. Table 1 summarizes the demographic and clinical characteristics of patients.

Table 1: Demographic characteristic of patients

	Group A	Group B	Group C	Total
Age				
20–30	12	12	5	29
31–40	12	12	13	37
41–50	13	13	17	43
51–60	8	8	10	26
Sex				
Female	18	19	23	60
Male	27	26	22	75
ASA				
I	29	21	20	70
II	14	23	24	61
III	2	1	1	4

p-value for age, sex and ASA are 0.611, 0.533 and 0.234 which were statistically insignificant, so our study was comparable with age, sex and ASA physical status. Table 2 shows the continuous variables like pulse rate, systolic and diastolic blood pressure and blood sugar level.

Table 2: Continuous variables

	0 hr	12th hr	24th hr
Pulse rate			
Group A	79.89	78.38	77.78
Group B	76.84	74.58	73.64
Group C	78.22	75.07	74.04
Systolic blood pressure			
Group A	127.40	123.29	121.78
Group B	128.60	122.44	124.00
Group C	132.44	126.44	124.22
Diastolic blood pressure			
Group A	82.20	81.11	80.89
Group B	81.58	80.22	80.44
Group C	79.24	81.56	78.67
Blood Sugar levels			
Group A	106.93	109.64	108.07
Group B	117.31	117.82	118.51
Group C	129.49	124.53	122.73

On comparison of blood sugar levels among 3 study groups, dexamethasone was associated with higher incidence of post-operative hyperglycemia in Group A and B whereas it was decreased in Group C. *p* value is 0.017 and 0.003 which is significant between groups.

During *24 hr* of follow-up, it was observed that in Group A, B and C post-operative nausea and vomiting at baseline (*0 hr*) was 11.1%, 6.7% and 2.2% respectively whereas it was absent during 12*th* and 24*th* hr as shown in (Fig. 1). So, the incidence of rescue anti-emetics in Group A, B and C was 11.1%, 6.7% and 2.2% respectively. *p* value was 0.240 which was not significant.

Discussion

Several important findings have emerged from the meta-analysis of the previous study[5] on the effect of dexamethasone for the prevention of post-operative nausea and/or vomiting. Different from Karanicolas *et al*.,[6] who detected dose effects of dexamethasone on the incidence of PONV. No single drug has proved to be a universal solution to PONV. It is not advisable to give the same drug in multiple doses because of saturation effects and safety, so, a combination of anti-emetic and corticosteroids are a possibility. Ondansetron has generally been considered as the most effective medication in preventing and managing PONV. In other view, Tramèr and Walder[7] reported more anti-vomiting than anti-nausea properties of ondansetron, other commonly used medication to prevent PONV. Nevertheless, it seems that previous comparisons between these individual

Pairwise Comparisons

(I) BSL		Mean Difference (I-J)	Std Error	Sig	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
A	B	4.956*	1.707	0.017	0.707	9.204
	C	6.756*	1.885	0.003	2.063	11.448
B	A	-4.956*	1.707	0.017	-9.204	-0.707
	C	1.800	0.951	0.195	-0.566	4.166
C	A	-6.756*	1.885	0.003	-11.448	-2.063
	B	-1.800	0.951	0.195	-4.166	0.566

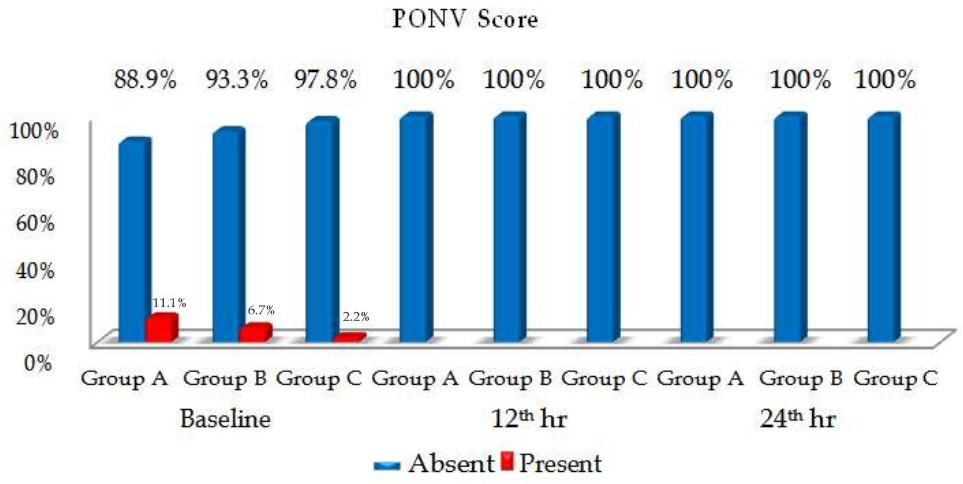

Fig. 1: PONV score among 3 Study Groups

drugs did not show a significant benefit in favor of a specific drug.[8]

We have conducted a study on 135 patients who underwent various elective surgeries under general anesthesia in the non-diabetic population. They were randomly distributed into three Groups of 45 each depending upon the anti-emetic agent given and data obtained were tabulated and analyzed statistically with reference to age, sex, ASA physical status, pulse rate, blood pressure, PONV score and blood sugar levels.

Among categorical variables, *p* values for age (*p*-0.611), gender (*p*-0.533), ASA status (*p*-0.234) with Chi-square testing were not significant, hence our patients were comparable with age, sex, -ASA status and equally distributed among the groups. It is interesting to note that only 1 (2.2%) patient had nausea and vomiting in Group C compared to 5 (11.1%) in Group A and 3 (6.7%) in Group B in the immediate post-operative period. However, rescue anti-emetic medication was given to those patients who had PONV. *p*-value is 0.240 in the immediate post-operative period which can be compared within the groups.

The current trend is focused on combination therapy because there is no single effective agent against PONV, because of its multifactorial in origin. The idea of combination therapy for prevention and treatment of PONV came from various studies where ondansetron and dexamethasone have been used successfully to treat emesis refractory to ondansetron alone but none of the studies has evaluated the optimum dose of dexamethasone required for prevention of PONV and measured the extent of the hyperglycemic side effects post-operatively. Hence, among the continuous variables, our interest was on post-operative blood sugars levels of all the groups.

Patient variables may affect the incidence of peri-operative hyperglycemia, which includes age, sex, body weight, and pre-operative medications.[9] Our study focussed on non-diabetics because it may be more harmful and unethical to use a high dose of dexamethasone in diabetic patients. So, we have evaluated and compared the effect of blood glucose levels and PONV with different doses of dexamethasone in these 3 Groups of patients. Morerises in blood glucose concentration in the dexamethasone group may be due to increase in gluconeogenesis[10] and development of insulin resistance induced by it which was seen as early as *4 hrs* after induction of anesthesia. Previous study[11] correlate with the study of Jeffrey *et al*.[12] who observed that a single dose of dexamethasone produceda significant increase in blood glucose concentration.

Post-operative blood glucose levels varied significantly in different groups. In Group A blood sugar levels were *106.93 ± 14.426 mg/dl*, Group B *117.31 ± 11.791 mg/dl* and Group C *129.49 ± 16.170 mg/dl* respectively in the immediate post-operative period. A *p*-value of 0.0005 was found when ANOVA and Tukey's Post-hoc test were used for blood sugar in *0 hours*.

Blood sugar levels were lower in patients with a lower dose of dexamethasone (*4 mg*) but PONV is marginally higher than in patients with a higher dose of dexamethasone (*8 mg*). Incidence of PONV is more in Group A compared to B and C in the initial post-operative period but *12 hours* and *24 hours* post-operatively there is no difference between the groups.

According to our study blood sugar levels were relatively higher in Group C patients than other two Groups even after *12* to *24 hours* post-operatively but the mean difference was relatively lesser than immediate post-operative period. However, the incidence of PONV is relatively less when compared to Group A.

Limitations of the study:

- The study had to be done within a fixed time frame;
- Some patients who were enrolled were excluded from analysis as there was a significant violation of the protocol;
- Delay in wound healing with the use of dexamethasone was not studied;
- We did not document the incidence of wound infection in the study groups;
- None of the patients in study groups developed life-threatening arrhythmia. However, we didn't do an ECG routinely to look for the above in the post-operative period;
- All types of elective surgeries under general anesthesia were compared rather than specific types of procedures;
- Some patients who were enrolled were discharged within *24 hrs* of the surgery which led to their exclusion.

On conclusion, as there are different receptor systems involved in the etiology of PONV, a combination of agents acting on different receptors

results in better prophylaxis of PONV, as no single agent is entirely effective in preventing it. Prophylactic administration of a combination of IV Ondansetron (*4 mg*) with IV Dexamethasone (*4 mg*) is safe and more effective compared to IV Ondansetron (*4 mg*) alone in reducing incidence of PONV in patients undergoing elective surgeries under general anesthesia. Although higher doses of IV Dexamethasone (*8 mg*) are frequently used for reducing the incidence of PONV, it results in maximum hyperglycemia in the immediate post-operative period. Thus, the benefits of administering higher doses of IV Dexamethasone should be weighed against the potential side-effects of short-lasting hyperglycemia. None of the patients in our study required correction for hyperglycemia, but it would be prudent to keep a close watch on blood sugar levels in the immediate post-operative period.

Based on our study, considering the risks and benefits, we recommend that IV ondansetron (*4 mg*) with IV dexamethasone (*4 mg*) as the ideal drug combination to effectively reduce PONV with minimal side effects.

Key Messages

Prophylactic administration of a combination of IV Ondansetron (4 *mg*) with IV Dexamethasone (4 *mg*) is safe and more effective compared to IV Ondansetron (4 *mg*) alone in reducing incidence of PONV.

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Evaluation of Efficacy of Two Different Doses of Dexmedetomidine Infusion on the Peri-operative Hemodynamic Response and Dose Sparing Effect on the Anesthetics in Patient's Undergoing Laparoscopic Cholecystectomy under General Anesthesia

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Abstract

Introduction: Intravenous use of dexmedetomidine in the peri-operative period had been found to decrease serum catecholamine levels by 90%, to blunt the hemodynamic response to laryngoscopy, tracheal intubation, pneumoperitoneum and extubation, to provide sedation without respiratory depression and to decrease post-operative analgesic requirements. *Aims:* We aimed primarily to evaluate the effects of two different doses dexmedetomidine infusion on hemodynamic response to critical incidences such as laryngoscopy, endotracheal intubation, creation of pneumoperitoneum in patients undergoing laparoscopic cholecystectomy. The secondary aims were to study the dose sparing effect of dexmedetomidine on anesthetic drugs used. *Methods:* Hundred patients of American Society of Anesthesiologists (ASA) physical Grades I and II undergoing laparoscopic cholecystectomy were randomly allocated into two Groups of 50 patients each. Group A patients received dexmedetomidine infusion at 1 *µg/kg* and Group B patients received dexmedetomidine infusion at 0.6 *µg/kg* both over twenty minutes, starting 20 *min* before induction and thereafter, dexmedetomedine infusion continued at 0.2 *µ/kg/hr* in both the Groups till end of surgery. Parameters noted were pulse rate, mean arterial pressure, oxygen saturation, post-operative sedation and anesthetic drugs requirements. Chi-square test was used for qualitative data were applied. *Results:* Dexmedetomidine 1 *µg/kg* is more effective compared to Dexmedetomidine at 0.6 *µ/kg* in attenuating the tachycardia response to laryngoscopy, intubation and pneumoperitonem. Also, Dexmedetomidine at 1 *µg/kg* has a better dose sparing effect on anesthetic drugs used intra-operatively than Dexmedetomidine at 0.6 *µg/kg*. Both the Dexmedetomidine Groups provide light and arousable sedation post-operatively without respiratory depression. *Conclusion:* Dexmedetomidine infusion in the dose of 1 *µg/kg* effectively attenuates hemodynamic stress response during laparoscopic surgery with reduction in post-operative analgesic requirements.

Keywords: Laparoscopy; Cholecystectomy; Pneumoperitoneum; Dexmedetomidine.

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Introduction

Laproscopic surgery is one of most important diagnostic and therapeutic tools in the present surgical era. Since 1987, when the first laproscopic cholecystectomy was successfully performed by Philipe Mouret, this has become gold standard.[1]

The benefits of minimal access techniques include

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less pain, early mobilization, shorter hospital stay and better cosmetic results, which have further increased its applications. During general anesthesia laryngoscopy, tracheal intubation and extubation are the critical events provoking transient, but marked sympathoadernal response manifesting as hypertension and tachycardia.[2] In addition, in laparoscopic surgery CO_2 is routinely used to create pneumoperitoneum, which causes increased plasma level of catecholamine and vasopressin. Elevation of intra-abdominal pressure with raised diaphragm causes various adverse effects on cardiovascular system such as decreased cardiac output, elevated arterial pressure and increased systemic and pulmonary vascular resistance leading to hypertension and tachycardia. Hence, a drug, which can blunt hemodynamic response to laryngoscopy, intubation and pneumoperitoneum without having any adverse effects like respiratory depression and post-operative nausea and vomiting, was required for purpose.[3]

Alpha-2 adrenergic agonists have both analgesic and sedative properties. Dexmedetomidine is a highly selective alpha-2 adrenergic agonist with an affinity of eight times greater than Clonidine. Intravenous use of dexmedetomidine in the peri-operative period had been found to decrease serum catecholamine levels by 90%[4] to blunt the hemodynamic response to laryngoscopy, tracheal intubation, pneumoperitoneum and extubation,[5] to provide sedation without respiratory depression[3] and to decrease post-operative analgesic requirements.[6]

The anesthetic, analgesic drugs and muscle relaxant dose requirement get reduced to huge extent by the use of Dexmedetomidine, which is shown by many studies.[3]

Many studies have been conducted with dose of dexmedetomidine at *1 μg/kg*, *0.6 μg/kg* and *0.2 μg/kg*.[7,8] But not many studies have been conducted to compare the efficacy between *1 μg/kg* and *0.6 μg/kg*.

Hence, a study was undertaken to compare the efficacy between *0.6 μ/kg* and *1 μg/kg* of dexmedetomidine in laparoscopic surgeries to evaluate hemodynamic variables, anesthetic and analgesic drug requirement and sedation post-operatively.

Aims

We aimed primarily to evaluate the effects of two different doses dexmedetomidine infusion on hemodynamic response to critical incidences such as laryngoscopy, endotracheal intubation, creation of pneumoperitoneum in patients undergoing laparoscopic cholecystectomy. The secondary aims were to study the dose sparing effect of dexmedetomidine on anesthetic drugs used.

Materials and Methods

Following approval of institutional ethical committee, 100 patients between *18* and *65 years*, of either sex belonging to ASA 1 and 2 posted for laparoscopic cholecystectomy. It was a prospective, randomised, double blind, placebo controlled clinical study. Patients with decreased autonomic control such as the elderly, diabetic patients, patients with chronic hypertension or severe cardiac disease, patients on drugs like β blockers or calcium channel blockers, pregnant or lactating women, patients with history of allergy to egg proteins and drugs particularly α^2 agonists were not considered for the study. Patients will be randomly allocated into two Groups of 50 each, using sealed envelope technique:

Group A: Receives *1 μ/kg* of dexmedetomedine infusion over *twenty minutes*;

Group B: Receives *0.6 μ/kg* of dexmedetomedine infusion over *twenty minutes*.

All patients on arrival to the operation theatre, two intravenous lines will be secured with a 18 G or 20 G cannulas one for intravenous fluid and another for administering the test drug. Injection Dexmedetomidine prepared in infusion syringes, loading dose of *0.6 μ/kg* for one Group, *1 μ/kg* for another Group. To prepare infusion, dexmedetomidine *0.5 ml* containing *50 μg* of the drug was withdrawn in a *20 ml* syringe and diluted to *20 ml*. depending on the weight of the patient, the pump was set so as to deliver the targeted infusion rate. After the setting the infusion pump, it was covered with black cloth so that, the assessor did not come to know about the grouping of the patient. Thus, the syringe was same, volume of prepared solution was same, only the rate of injection was different according to the weight and group of patient. Thus, the assessor and the patient were unaware of the group. *500 ml* ringer lactate infusion started in one IV line and infused over *20 minutes* prior to induction for both the groups with respective doses.

Pulse oximeter, non-invasive blood pressure and ECG monitors, BIS will be connected. Base line heart rate, blood pressure, SpO_2, Respiratory rate and BIS values will be recorded before pre-medication. Sedation level will be assessed by Modified Ramsay

Sedation scale. *Twenty minutes* after starting the drug infusion, pre-oxygenation was performed for *3 min*. Both groups were Pre-medicated with Inj glycopyrrolate *0.2 mg*, Inj midazolam *0.5 mg*, Inj fentanyl *1 μ/kg* (IV). Anesthesia was induced with Inj propofol as a 1% solution till loss of eye lash reflex occurred and dose of propofol required for loss of eye lash reflex recorded and Inj vecuronium *0.1 mg/kg*. Tracheal intubation was achieved with appropriate sized cuffed endotracheal tube. Thereafter, dexmedetomedine infusion started at *0.2 μ/kg/hr* in both the groups.

Patient will be maintained with O_2:N_2O mixture of 50:50 connected to closed circuit and inhalational agent isoflurane varying between 0.2%–1% to maintain depth of anesthesia. Monitoring BIS values between 40–60. Muscle relaxation will be maintained with Inj vecuronium. Total dose of vecuronium required for the surgery recorded. Test drug infusion will be discontinued on deflation of pneumoperitoneum.

Patient will be reversed with Inj neostigmine *0.05 mg/kg* and Inj glycopyrrolate *8 mcg/kg* (IV) and will be extubated after adequate return of muscle power and fulfilling major extubation criteria.

Intra-operative monitoring will be documented during pre-induction, after the loading dose of dexmedetomedine, at the induction of anesthesia. *1* and *3 min* after laryngoscopy and intubation, and at pneumoperitoneum and every *15 min* till the end of surgery and continued during extubation and post-operatively for *2 hrs*. Any side effects like Hypotension (MAP < 30% of baseline, treated with bolus intravenous ringer lactate solution and Inj ephedrine *6 mg* IV), Bradycardia (heart rate < 60 with Inj atropine *0.01 mg/kg -0.02 mg/kg* IV), Respiratory depression, post-operative nausea and vomiting will noted and treated patients will be observed in the recovery room for *2 hrs* before shifting to ward. Observer and the patient.

To detect a minimum of 20% difference in dexmedetomedine *0.6 μ/kg* and dexmedetomidine *1 μ/kg* minimum of 48 patients will be required when alpha error is kept at 0.05 and power of study at 80%. So, sample size was estimated as 50 patients in each group. Chi-square test was used for qualitative data (sex, ASA grade), PR, blood pressure, oxygen saturation, end tidal carbon dioxide etc., were compared within the group against baseline values using paired *t*-test. The results were expressed as mean ± standard deviation. $p > 0.05$ was considered insignificant, < 0.05 as significant and highly significant if < 0.001.

Results

Demographic data (age, sex, weight and ASA grading) of the patients were comparable in both the study groups ($p > 0.05$). Base line of hemodynamic data (HR, SBP, DBP and MAP) were comparable in both the groups and statistically insignificant ($p > 0.05$).

The baseline mean heart rate (Group A = *84 bpm*, Group B = *89 bpm*) in both the groups were comparable prior to starting the study drugs. There was a significant fall in heart rate in Group A compared to Group B after the starting dexmedetomidine infusion upto *10 minutes*, *1 min* after induction, *1 min* after laryngoscopy and intubation and *1 min* after initiation of pneumoperitoneum ($p < 0.05$), (Tables 1–7).

Baseline systolic blood pressure (mm hg) in Group A (mean = 127.2) and Group B (mean = 125.9) were comparable. Baseline diastolic blood pressure (*mm Hg*) in Group A (mean = 79.5) and Group B (mean = 79) were also comparable ($p > 0.05$).

The Mean Arterial Pressure (MAP) decreased significantly in Group A compared Group B. No further significant changes were observed immediately after induction. After intubation and initiation of pneumoperitoneum, the heart rate and MAP decreased significantly below the pre-infusion level in both the groups, though, this decrease was more in Group A than B but it was not statistically significant. ($p > 0.05$). None of the patients in both the groups developed severe bradycardia, hypotension or hypertension requiring treatment.

In group, A mean dose of Propofol required for loss of eye lash reflex is *84 ± 3.62 mg* (*1.52 mg/kg*) and in Group B mean dose is *95 ± 4.22 mg* (*1.72 mg/kg*). Statistical evaluation between the groups showed that the statistically significant reduction in dose of Propofol required for induction in Group A, ($p < 0.05$).

In group, A dose of vecuronium bromide required for muscle relaxation is *5.64 ± 1.52 mg* (duration of surgery: *99 minutes*) and in Group B dose of vecuronium bromide required for muscle relaxation is *8.48 ± 1.91 mg* (duration of surgery:100.5 *minutes*). Statistical evaluation between the groups showed that the statistically significant reduction in dose of vecuronium bromide required for muscle relaxation in Group A ($p < 0.05$).

The mean sedation scores were more in Group A than Group B. None of the patients in both the dexmedetomidine groups developed siginificant sedation levels and the patients were co-operative, oriented and tranquil all the time.

Tachycardia and hypertension were seen in 3 patients of Group A compared to 2 patients of group Group B. Hypotension was noted in 1 patient of Group A and reflex bradycardia was seen in 1 patient of Group A.

Table 1: Demographic characteristics and duration of surgery and anesthesia (mean ± SD)

Parameters	Group A	Group B	p
Age (yrs)	38.3 ± 11.676	38.02 ± 10.693	NS
Sex			
Male	24	27	NS
Female	26	23	NS
Mean body weight in *Kg* ± SD	56.12 ± 6.15	55.34 ± 7.56	NS
Duration of Surgery	99 ± 3.85	100.5 ± 4.12	NS

Table 2: Changes in HR (beats *per minute*) (mean ± SD)

Time	Group A	Group B	p
Before starting infusion	84.3 ± 16.5	89 ± 11.9	NS
10 min after starting infusion	67.3 ± 9.4	75.2 ± 11.1	< 0.05
1 min after induction	66.5 ± 6.6	70.2 ± 4.1	NS
1 min after laryngoscopy and intubation	73.4 ± 8.8	84 ± 7.8	< 0.05
After Pneumoperitoneum			
1 min	74.1 ± 4	84.5 ± 4.5	< 0.05
15 min	72.5 ± 10.1	78.6 ± 8.4	NS
30 min	72.4 ± 13	76.3 ± 16.8	NS
45 min	71.2 ± 5.4	75.1 ± 2.1	NS
60 min	73.6 ± 6.6	77.2 ± 3.2	NS

Table 3: Changes in MAP (*mm* of *Hg*) (mean ± SD)

Time	Group A	Group B	p
Before starting infusion	97.12 ± 9.21	98.5 ± 11.32	NS
10 min after starting infusion	96.54 ± 4.2	98.2 ± 10.22	NS
1 min after induction	96.45 ± 5.307	97.53 ± 8.2	NS
1 min after laryngoscopy and intubation	102.21 ± 9.79	103.34 ± 4.5	NS
After Pneumoperitoneum			
1 min	100.2 ± 7.34	101.3 ± 5.4	NS
15 min	99.2 ± 3.3	100.2 ± 6.2	NS
30 min	98.63 ± 4.3	98.72 ± 9.9	NS
45 min	98.88 ± 5.5	98.92 ± 1.1	NS
60 min	97.56 ± 6.8	98.12 ± 2.34	NS

Table 4: Dose of Propofol required for induction

Groups	Mean Dose of Propofol required for induction (*mg*)
Group A	*84 ± 3.62 mg* (*1.52 mg/kg*)
Group B	*95 ± 4.22 mg* (*1.72 mg/kg*)
p value	< 0.05

Table 5: Dose of Vecuronium bromide required for muscle relaxation

Groups	Dose of Vecuronium bromide required for muscle Relaxation (*mg*)
Group A	*5.64 ± 1.52 mg*
Group B	*8.48 ± 1.91 mg*
p value	< 0.05

Table 6: Showing the sedation score

Groups	Sedation score
Group A	2.74 ± 0.5
Group B	2.52 ± 0.4
p value	> 0.05

Table 7: Post-operative analgesic requirements

Groups	Time for first rescue analgesic requirement (*in min*)
Group A	255
Group B	187

Discussion

In laparoscopic surgery pneumoperitoneum created using Carbon-di-oxide. Various hemodynamic changes can obscure the operative area and make the surgery difficult, which may lead to complications, resulting in increased morbidity and prolonged post-operative hospital stay. Various physiological methods and pharmacological agents have been used for controlling hemodynamics in laparoscopic surgery with varying success. Dexmedetomidine, a α^2 agonist, provides dose dependent sedation, analgesia, sympatholysis, anxiolysis and controlled hypotension without relevant respiratory depression. Dexmedetomidine has also been found to be effective in attenuating pressor response to intubation and pneumoperitoneum.

Activation of α^2 A receptors in brain stem vasomotor centre results in suppression of norepinephrine release, hypotension and bradycardia. Stimulation of α^2 A and α^2 C in locus ceruleus causes sedation. In the spinal cord, activation of both α^2 A and α^2 C receptors directly reduce pain transmission by reducing release of substance *p*.

Dexmedetomidine infusion rates varying from *0.1* to *10 mcg/kg/hr* have been studied. With higher dose infusion of dexmedetomidine, high incidence of adverse cardiac effects have been observed. Higher doses of Dexmedetomidine can cause hypotension and bradycardia. Pre-loading with intravenous fluid prior to administration of dexmedetomidine reduces the incidence of hypotension. A biphasic

response on blood pressure occurs with a bolus dose.[4] Initially, there occurs hypertension followed by fall in blood pressure. This response is seen often more in young and healthy patients.[9] Stimulation of α^2 B receptors in vascular smooth muscles is said to be responsible for this.

Many studies have been conducted with dose of dexmedetomidine at *1 µ/kg*, *0.6 µ/kg* and *0.2 µ/kg*. But not many studies have been done to compare efficacy between *1 mcg/kg* and *0.6 µ/kg*. Hence, a study was undertaken to compare the efficacy between *0.6 µ/kg* and *1 µ/kg* of dexmedetomidine in laparoscopic surgeries to evaluate hemodynamic variables, anesthetic and analgesic drug requirement and sedation post-operatively. In our study, both the groups were comparable with regards to mean age, weight and sex.

In our study, we noted hemodynamic response during critical incidences like laryngoscopy and intubation, pneumoperitoneum. From our study, we observed Dexmedetomidine attenuates this sympathoadrenal response and provides hemodynamic stability. However, Dexmedetomidine at a dose of *1 µg/kg* appears to be more effective in attenuating tachycardia response compared to *0.6 µg/kg*. Statistically significant differences were noted between the groups, *1 min* following laryngoscopy and intubation and pneumoperitoneum. At other intervals values were comparable.

Dexmedetomidine at doses of *1* and *0.6 µg/kg* used in our study, were effective in attenuating the blood pressure to laryngoscopy and intubation and pneumoperitoneum. Statistically no significant differences were noted between the groups Dexmedetomidine potentiates anesthetic effects of all intra-operative anesthetics, regardless of the method of administration. The profound reduction in anesthetic requirement was shown to be mediated through central α^2 adrenergic receptors. Dose sparing effects with Dexmedetomidine also noted with opioids and inhalational agents.[10–12]

We studied the total dose of propofol required for induction in each group. In Dexmedetomidine *1 µg/kg* group dose of propofol required for induction was *84 ± 3.62 mg* (*1.52 mg/kg*) and in Dexmedetomidine *0.6 µg/kg* group dose required was *95 ± 4.22 mg* (*1.72 mg/kg*). This is statistically and clinically significant ($p < 0.05$).

We also studied the total dose of vecuronium required in each group. We found in Dexmedetomidine *0.6 µ/kg* group dose of vecuronium bromide required for muscle relaxation was *8.48 mg* (duration of surgery: *99 minutes*) and in Dexmedetomidine *1 µ/kg* group dose required was *5.64 mg* (duration of surgery: *100.5 minutes min*). There is a significant reduction in the dose of vecuronium required in the Dexmedetomidine *1 µg/kg* (< 0.05) compared to the control group. Since, duration of action of vecuronium depends on the dose given, we can expect a prolongation of action of vecuronium by Dexmedetomidine if similar doses were used in both the groups. Limittation here is nerve stimulators were not used due to unavailability in our hospital.

Dexmedetomidine is known to produce arousable sedation by its action on locus coeruleus nucleus without producing any respiratory depression. No patient in our study in both the dexmedetomidine groups had any post operative respiratory depression. Sedation scores were slightly higher in Dexmedetomidine *1 µg/kg* group compared to *0.6 µg/kg* group and it was not statistically significant.

We also observed an increase in the time to receive first rescue analgesia and a decrease in total analgesic requirements in first *24h* post-operatively in both dexmedetomidine Groups.

Conclusion

Dexmedetomidine *1 µg/kg* is more effective compared to Dexmedetomidine at *0.6 µ/kg* in attenuating the tachycardia response to laryngoscopy, intubation and pneumoperitonem. Also, Dexmedetomidine at *1 µg/kg* has a better dose sparing effect on anesthetic drugs used intra-operatively than Dexmedetomidine at *0.6 µg/kg*. Both the Dexmedetomidine Groups provide light and arousable sedation post-operatively without respiratory depression.

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Original Research Article

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Dexmedetomidine Vs Fentanyl in Scalp Nerve Block for Blunting Response to Skull Pin Insertion and Post-operative Pain: A Randomized Double Blinded Study

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Abstract

Background: Dexmedetomidine and Fentanyl have both been used as adjuvant to prolong the effect of local anesthetics in various peripheral nerve blocks. The primary aim of this study was to compare these two in scalp nerve block for obtunding pain response to skull pin insertion. The secondary aim was to study their effect on post-operative pain relief, time required for extubation and post-operative sedation score. *Methodology:* A total of 80 American Society of Anesthesiologists' physical status Grade 1 and 2 patients between 18 to 60 *years*, electively posted for supratentorial craniotomy for space occupying lesion, were randomly divided into two groups to receive either Dexmedetomidine 1 *µg/kg* (Group D) or Fentanyl citrate 1 *µg/kg* (Group F) added to 20 *ml* of 0.25% Bupivacaine in bilateral scalp nerve block, 10 *minutes* before May field pin insertion. Hemodynamic parameters were assessed at regular time intervals and time taken for extubation after surgical closure was noted. Post-extubation pain scores and sedation scores were assessed periodically and time taken for first rescue analgesic was also noted. The observer was blinded to randomization, preparation of drug syringes and statistical analysis. Chi-square test, Fischer-exact test, Post-hoc tukey test and student's t-test were used for analysis. *Results:* Requirement of propofol was significantly lower in Group D than Group F, ($p = 0.013$) one minute after pin insertion. Hemodynamic variables, Extubation time and sedation scores were comparable in both groups. Pain-free period was longer in Group D, ($p = 0.045$). *Conclusion:* Addition of dexmedetomidine as adjuvant to local anesthetic in scalp nerve block provides superior attenuatation of hemodynamic response to skull pin insertion and prolongation of analgesia than Fentanyl used for the same purpose.

Keywords: Scalp block; Fentanyl; Dexmedetomidine.

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Introduction

The intense nociceptive stimulus produced by application of the skull-pin head holder is known to cause an abrupt rise in blood pressure and cerebral blood flow even under general anesthesia.[1] A severe fluctuation may also potentially cause brain oedema and tissue damage.[2] A scalp nerve block with a local anesthetic is an effective and well-established method to reduce this sympathetic response. In addition to this benefit, scalp nerve block also gives an added advantage of relieving

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craniotomy pain in the immediate post-operative period.[3]

Addition of an adjuvant to a local anesthetic agent not only improves the quality and depth of the block but also prolongs its effect. The opiod Fentanyl citrate is the most widely used adjuvant which has been extensively studied so far, in improving the efficacy of various nerve blocks throughout the body.[4,5] Recent studies have also recommended the use of Dexmedetomidine, a selective a_2 agonist, to prolong the duration and improve the quality of different nerve blocks.[6,7]

This study was conducted with an aim to compare Fentanyl and Dexmedetomidine, both as adjuvants to 0.25% bupivacaine in scalp nerve block, for their effect on the quality and duration of block. Secondly, as both the study drugs exhibit sedative properties we also compared their influence on recovery from general anesthesia if any, by observing time required for extubation and post-operative sedation scores.

Materials and Methods

After approval from the institutional ethics committee, this prospective, randomized, double blinded, clinical investigation was carried out in 80 adult consenting patients scheduled to undergo elective supratentorial craniotomies for space occupying lesions within a period of *12 months*.

Sample size calculation

A sample size of 80 was calculated based on clinical findings from two similiar studies[8,9] considering their findings of duration of analgesia in minutes as the study parameter. We used the statistical software G power 3.1.9.2 (Universitat Dusseldorf, Germany) with 0.1 as effect size (Cohen small co-efficient), an *a* error of 0.05, and power of 80% (1–β error probability) using ANOVA repeated measures, within between interaction. Along with a routine pre-anesthetic checkup, an informed consent was taken from each participant one day before surgery.

Our exclusion criteria were extremes of ages (< *18 years* and > *60 years*), those with uncontrolled hypertension, patients with a pre-operative Glasgow coma score of < 15, longer surgeries (> *4 hours*), and cases with raised intracranial pressure or tense brain/bulging brain as an intra-operative finding.

All the remaining ASA Grade 1 or 2 patients were randomly divided into two groups of 40 each using a computer generated randomization table (Microsoft excel 2010, Microsoft corporation, Washington, (USA). The observer was blinded to the randomization process.

The two Groups received:

Group F (n = 40): Inj Fentanyl citrate *1 µg/kg* as adjuvant to *20 ml* 0.25% bupivacaine in scalp nerve block.

Group D (n = 40): Inj Dexmedetomiditine *1 µg/kg* as adjuvant to *20 ml* 0.25% bupivacaine in scalp nerve block.

The syringes were loaded by the same technician every time and the person who administered the scalp nerve block and later observed the findings was blinded to the contents of the syringes.

Demographic details and baseline heart rate, systolic, diastolic and mean arterial pressures were noted. This was followed by routine neuroanesthetic management as per our institutional protocol which included pre-medication with Fentanyl citrate (*2 µg/kg*), glycopyrrolate (*4 mcg/kg*), pantoprazole (*0.8 mg/kg*), induction with thiopentone (*5–7 mg/kg*) and atracurium besylate (*0.4 mg/kg*), followed by endotracheal intubation and mechanical ventilation with oxygen air mixture, a tidal volume of *7 ml/kg*, a PEEP of *3 cm* H_2O, and 1 MAC of isoflurane. Under sterile asceptic precautions, a bilateral scalp nerve block with *20 ml* of bupivacaine 0.25% with the study drug was administered by the investigator on the guidelines given by Pinosky *et al*. The Mayfield skull pin head holder was applied *10 minutes* after completion of block.

Heart rate, systolic, diastolic and mean arterial pressures were monitored at Baseline (T1), Endotracheal Intubation (T2), During block (T3), *1 min* before pin application (T4) and thereafter at *1 min* (T5), *3 min* (T6), *5 min* (T7) and *10 min* (T8) following pin application. If the MAP increased above *90 mm Hg* a bolus dose of *10 mg* propofol was given and requirement of propofol was noted.

Anesthesia was thereafter maintained with Inj atracurium infusion (*0.3 mg/kg/h*) and isoflurane at a MAC of 1. Dexamethasone (*0.08 mg/kg*) as anti-emetic and phenytoin as per requirement were given towards the end of surgery. Analgesic supplementation was avoided.

Extubation was done after ensuring adequate respiratory efforts and response to verbal commands. Time taken from surgical closure to endotracheal extubation was noted in minutes.

A visual analog scale was used to assess pain in the post-operative period which was assessed at

10 min (T9), *30 min* (T10), *1 hour* (T11) and *2 hours* (T12) after extubation. The Ramsay sedation scale[10] was used at the same time intervals to assess the sedation score.

Inj diclofenac *75 mg* was given as rescue analgesic when VAS score was observed to be above 4, and the time taken from surgical closure to requirement of first rescue analgesic (min) was noted. This time was taken as duration of analgesia.

The observations were analyzed statistically using student's *t*-test (continuous data), Chi-square test and Fisher-exact test (categorical data) and repeated ANOVA test with Post-hoc Tukey Kramer (two tailed, independent) for data within the group and in between the two groups, using NCSS software version 9.0. All values have been expressed in mean ± SD, and ratio for categorical data. Probability values of less than 5% were taken as significant. The investigator was also blinded to the statistical analysis.

Results

Demographic observations (age, gender, height, weight and ASA status) were comparable in both the groups, (Table 1). Surgical duration (min) taken as time from surgical incision to surgical closure was also comparable in both the groups (*236 ± 14.1 min* and *222.92 ± 1.5 min* (p = 0.34)).

Table 1: Demographic characteristics

	Group F	Group D	p - value
Age (*years*)	38.28 ± 13.79	42.33 ± 16.15	0.215
Height (*cm*)	160.83 ± 8.99	160.75 ± 8.94	0.970
Weight (*kg*)	60.75 ± 12.763	62.73 ± 11.71	0.471
Gender (M/F)	22:18	25:15	0.6
Surgical duration (*min*)	236 ± 14.1	222.92 ± 1.5	0.34
ASA status (I/II)	27:13	24:16	0.62

n = 40, values in mean ± SD, $p < 0.05$ = significant*, $p < 0.01$ = highly significant**

Heart rate was comparable at all the time intervals in both the groups, (**Fig. 1**). Mean arterial pressure from baseline at T5, was lower in the dexmedetomidine group clinically, (*106.72 ± 34.2* vs *83.12 ± 11.07 mm Hg*), although, this difference was not found to be of statistical significance (p = 0.064), (**Fig. 2**). Requirement of Propofol bolus to maintain MAP below *90 mm Hg* was however,

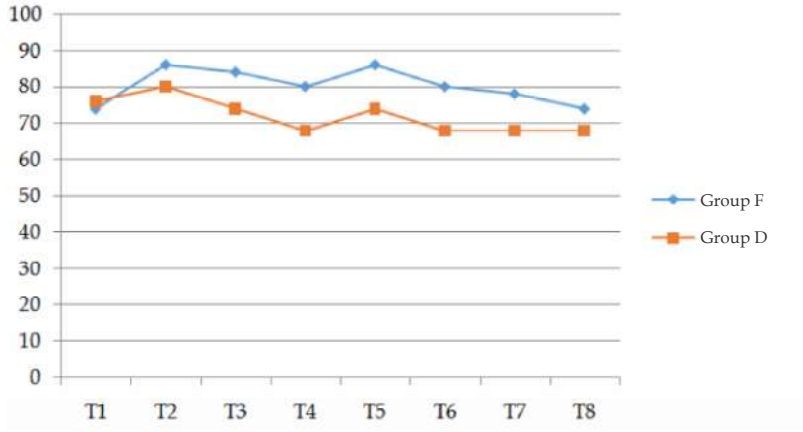

Fig. 1: Changes in mean heart rate in both the groups at different time intervals

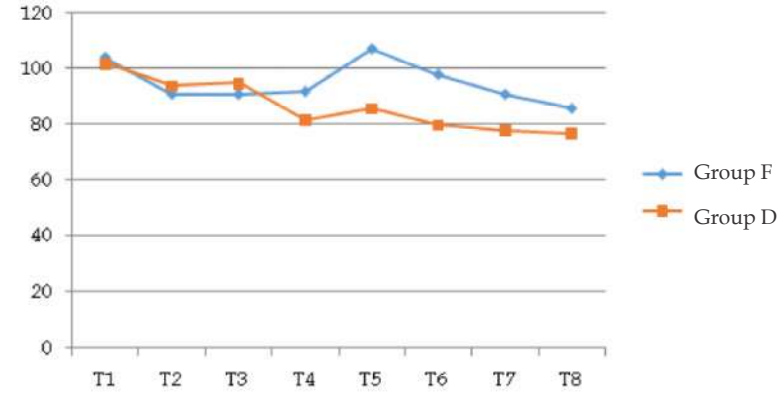

Fig. 2: Changes in mean arterial pressure in both the groups at different time intervals

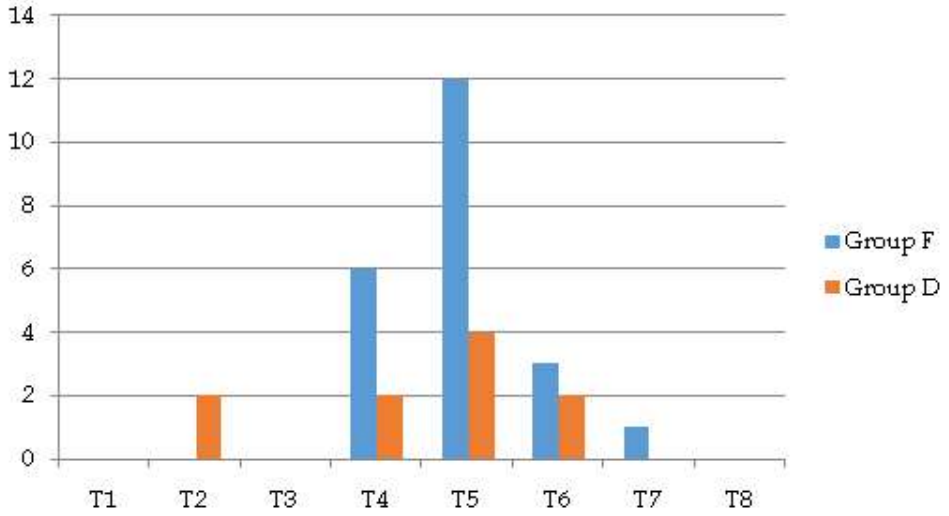

Fig. 3: Number of patients requiring Propofol boluses in both the groups at different time intervals

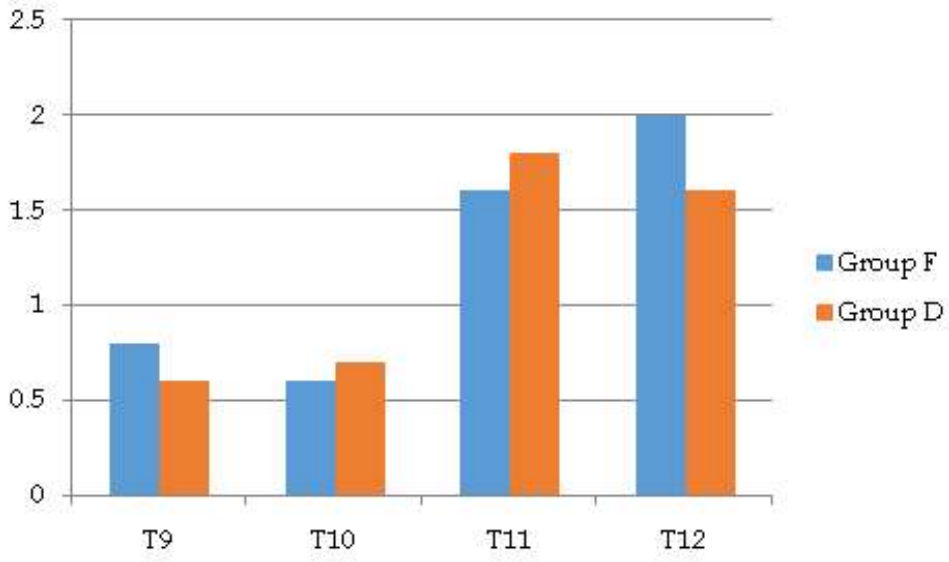

Fig. 4: Mean pain scores in the immediate post-operative period

seen to be significantly higher in the Fentanyl group at T5 (p = 0.013)*, (Fig. 3). There was no statistically significant difference in time taken for endotracheal extubation from surgical closure in both the groups, (Table 2).

Table 2: Time taken for endotracheal extubation after surgical closure (*min*)

	Group F	Group D	*p* - value
Time (min)	10.36 ± 14.7	11.02 ± 0.98	0.274

n = 40, n = 80, values in mean ± SD, $p < 0.05$ = significant*, $p < 0.01$ = highly significant**

Duration between surgical closure and demand of the first rescue analgesic, (duration of analgesia) was significantly longer in the dexmedetomidine group by *89.10 minutes*. (p = 0.045), (Table 3). However, mean VAS scores were found to be comparable in both the groups at *10 min*, *30 min*, *1 hour* and *2 hour* post-operatively, (Fig. 4) and so were the post-operative sedation scores, (Fig. 5).

Table 3: Duration of Analgesia

	Group F	Group D	*p* - value
Time (min)	483.87 ± 10.22	572.97 ± 5.86	0.045*

n = 40, values in mean ± SD, $p < 0.05$ = significant*, $p < 0.01$ = highly significant**

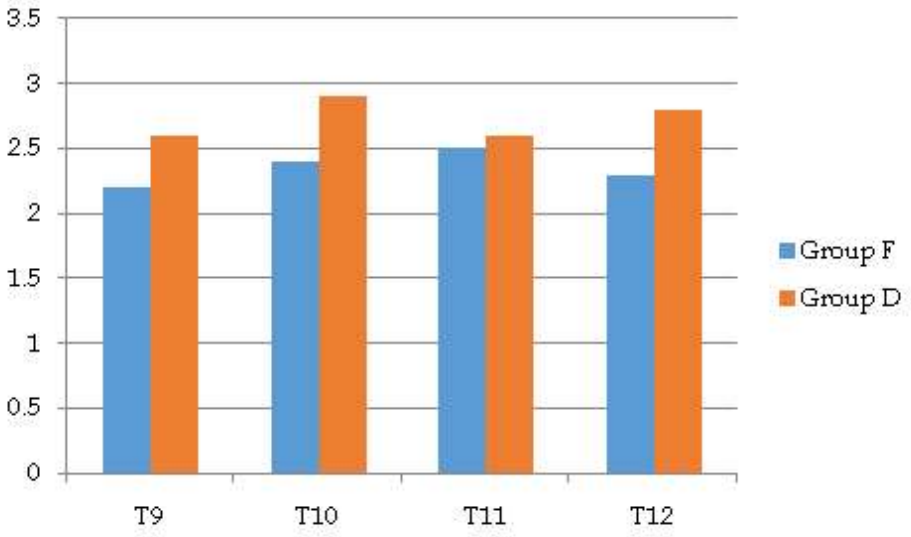

Fig. 5: Mean sedation score in the immediate postoperative period

Discussion

We observed that addition of dexmedetomidine to 0.5% bupivacaine in scalp nerve block prolonged the demand of a rescue analgesic by approximately *an hour* and a half compared to the addition of Fentanyl citrate for the same purpose. This property of dexmedetomidine can probably be attributed to its selective a_2-A receptor activation resulting in local vasoconstriction and delayed absorption of local anesthetic prolonging the analgesic effect.[11] Although Fentanyl is known to demonstrate similar properties by G-protein coupled receptor blockade causing hyperpolarisation of the afferent sensory neurons,[12] many studies comparing the two in various other regional blocks have documented superiority of dexmedetomidine in terms of longer duration of analgesia, over fentanyl as an adjuvant.[13–15] Hamed MA, Ghaber S, Reda A in 2018,[16] compared dexmedetomidine and Fentanyl as adjuvants to 0.5% bupivacaine, for supraclavicular brachial plexus block in 60 patients. The duration of analgesia in the dexmedetomidine group was significantly longer (*13.5 hours* versus *8.3 hours* respectively). The doses of study drugs used by us, were based on this clinical investigation.

High selectivity of a_2-A receptor activation by dexmedetomidine has also been shown to cause central sympathetic blockade, thereby, decreasing the heart rate transiently and leading to sedation or anxiolysis.[17] Some authors who used dexmedetomidine as an adjuvant to local anesthetics in peripheral nerve blocks have reported transient episodes of bradycardia in few of their patients.[18–20] We did not come across any episode of bradycardia in our study. However, in anticipation we were prepared with anticholinergic agents, to tackle the event if any. Similiarly sedation scores which were monitored in the post-operative period after extubation were low and comparable in both the groups.

The central sympathetic blockade by dexmedetomidine, however, was of merit to us in terms of blocking the sympathetic response to Mayfield pin head holder insertion. This was seen as lower requirement of propofol bolus doses needed to maintain the mean arterial pressure at *90 mm Hg* in the dexmedetomidine group (12 *vs* 4 at T5 (*one minute* after pin insertion) $p = 0.013$*).

The limitation of of the study is that hemodynamic changes were considered as surrogate markers of attenuation of pain, in addition to this, monitoring of depth of anesthesia by entropy or bispectral index would have added more valuable information to the study. The consequences of the hemodynamic responses were not included in the study and the surgeries with serious consequences to the hemodynamic changes such as intracranial aneurysm surgeries and significant increase in the intracranial pressure were not included.

Conclusion

Addition of dexmedetomidine as adjuvant to local anesthetic in scalp nerve block provides superior attenuatation of hemodynamic response to skull pin insertion and prolongation of the duration of analgesia than Fentanyl used for the same purpose.

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Effectiveness and Efficacy of Segmental Epidural Neural Blockage in Hernia Repair

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Abstract

Background: As inguinal hernia is usually seen in elderly age group, so as to avoid or reduce the complications which could occur in the conventional dosages this clinical study of segmental epidural anesthesia was undertaken where the extent of block is limited to only few segments involved in the field of surgery. *Materials and Methods:* Study was conducted on 200 patients of ASA I and II posted for elective inguinal hernia repair. Segmental epidural block was performed with Ing. Bupivacaine 0.5% 5–6 *ml*. *Result:* In the present study, the mean onset of analgesia was 10.53 *minutes*. The quality of analgesia was excellent in 106 cases, good in 68 cases, fair in 20 cases and poor in 6 cases. *Conclusion:* Segmental epidural block with 5–6 *ml* of 0.5% Bupivacaine is found to be safe and fulfils the surgical requirement. Could be successfully employed for inguinal hernia repair with limited spread of analgesia involving only few segments.

Keywords: Bupivacaine; Epidural anesthesia; Inguinal hernia repair.

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Introduction

Segmental Epidural Anesthesia (SEA) selectively blocks pain fibres from the surgical site. It limits sympathetic and motor block which could probably avoid hypotension and aid in easy positioning in PCNL surgery. Considering the potential advantages, the basis of the current study was to selectively block thoracic epidural segments from T_6 to T_{12} for PCNL surgery. In this randomised controlled trial, our aim was to compare SEA and GA for PCNL with overall patient satisfaction as the primary end point.[1]

Inguinal hernia repair is one of the most commonly encountered surgical corrections in men representing 12.5% of total surgical repair in Britain. In the international classification of diseases 9th division clinical manifestation, the number was 9 for hernias with relative value guide of 6.[2] In providing anesthesia for inguinal herniorraphy, the technique chosen must be cost effective with respect to speed of recovery, patient comfort, and associated incremental costs.[3]

Epidural anesthesia is suitable as a sole agent for lower abdominal surgery and on lower limbs. It has some definite advantages over spinal anesthesia like avoidance of post-spinal headache, minimal chances of meningitis, and minimal chances of nausea and vomiting in post-operative period.[4] But administration of conventional dosage of

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local epidural anesthetics (*15 ml* and above) for surgical anesthesia frequently results in multiple hemodynamic changes, including decreases in chronotropism, inotropism, dromotropism, systemic vascular resistance, cardiac output, and myocardial oxygen consumption. The economic consequences of these hemodynamic changes are far from being calculated.[5]

This study is undertaken to evaluate the advantages of segmental epidural anesthesia for inguinal hernia repair to reduce the conventional dosage of epidural anesthesia to block only the segments involved in the field of surgery.

Materials and Methods

A clinical study was undertaken for anesthetising 200 patients aged between *18–70 years* posted for elective inguinal hernia repair, agreeing and co-operative for epidural anesthesia. Study was conducted at Medical College and Research Hospital.

Selection of Patients

The patient undergoing inguinal hernia repair, of age range of *18–70 years* and belonging to ASA Grade I and II were included in the study. Exclusion criteria were as follow: All the patients who were below *18 years* and above *70 years*, Patients with ASA Grade III and IV, patients who are allergic to local anesthesia, Presence of renal problems, bleeding disorders, patients on chronic drug medications such as MAO inhibitors, acute substance abuse, previous problem with anesthesia, obesity.

Pre-anesthetic Evaluation

Pre-anesthetic evaluation was done a day prior to the elective surgery. History of present complaints, duration of swelling and any co-existing disease, previous surgery were noted. A thorough physical, systemic examination was done which included the size of the swelling, type of hernia, weight of the patient, vital signs and airway assessment.

All patients were assessed and they were graded according to the ASA physical status I and II. They were educated regarding the anesthetic technique. Consent for the same was obtained. Local anesthetic test dose was carried out on the previous day of surgery. Patients were pre-medicated with oral Alprazolam *0.5 mg* and Oral Ranitidine *150 mg* on the night prior to surgery and *2 hours* before the surgery.

The department of anesthesiology in which regional anesthesia is to be performed in a sophisticated fashion must have a significant inventory of regional anesthetic technique must be kept ready.

Drugs

Inj Bupivacaine 0.5% isotonic. To perform epidural analgesia, equipments and drugs for resuscitation and treatment of complications should be kept ready. This should include a means of administering oxygen by positive pressure, such as an anesthesia machine or an resuscitation bag and mask connected to a source of oxygen, airway equipment, working laryngoscope, oro-pharyngeal airways of several sizes, cuffed endotracheal tubes of appropriate sizes, a suction apparatus and labelled syringes that contain atropine and a dilute solution of vasopressors.

Procedure

Each patients selected for the study was positioned laterally (on affected side) on the operation theatre table. With all aseptic precautions the epidural space was identified at L1–L2 space, with 18G epidural needle *5 ml* of 0.5% Bupivacaine is injected very slowly only to block the segments (T12–L2) involved in the field of surgery. Later epidural catheter was inserted and secured and patient positioned back to supine position.

Level of analgesia was checked by needle prick. After conforming the adequacy and level of analgesia, the surgery was commenced. If the patient complained of pain during needle prick, then injected local anesthetic (0.5% Bupivacaine) with an incremental dosage of *1 ml* at a time, till the complete onset of analgesia.

Pulse Rate and Blood Pressure were recorded at an interval of *1 minute* for first *5 minutes* and then every *5 minutes* till the end of the surgery. Oxygen saturation and ECG monitoring was done continuously. Onset of analgesia, level of analgesia (pre- & post-operatively), duration of analgesia, total dosage of local anesthetic used were recorded.

In the present study, the following scale was adopted to grade quality of analgesia and relaxation:

1. *Excellent*: Patient comfortable, analgesia and surgical relaxation adequate, no supplementation required during surgery;

2. *Good*: Analgesia and relaxation adequate, minimal discomfort present during surgical

procedure. Additional top-ups of local anesthetic at an incremental dose of *1 ml* are given;

3. *Fair*: Analgesia and relaxation adequate, discomfort present even after additional top-up of epidural local anesthetic, this was alleviated by analgesic dose of Ing Fentanyl *1 Mcg/kg* IV;

4. *Poor*: Patients complaining of severe intolerable pain during surgery without relaxation. These cases were supplemented with general anesthesia.

Statistical analysis

Descriptive data included mean, standard deviation and percentage which were determined for the study group.

Results

Segmental epidural anesthesia was given to two hundred patients undergoing inguinal hernia repair at Medical College and Research Hospital and the present cases were taken up for study as outlined in the methodology.

Age of the patients included in the study range from *18 years* to *70 years*. The mean age was found to be *43 years*. The majority of the patients were in the age range of *31* to *40 years*, (Table 1). Regarding the sex incidence it is the male who predominates as compared to females. Owing to the incidences of hernia there was 54 patients suffering from direct hernia and 146 patients had indirect hernia. The volume of bupivacaine required ranged from *5 ml* to *8 ml*. The mean of the volume required was *5.8 ml*.

Table 1: Distribution of age among the patients

Age group	No of cases
18–29	42
30–39	60
40–49	44
50–59	34
60–70	20
Total	200

Table 2 shows, the quality of analgesia and relaxation in patients. Excellent type of relaxation and analgesia were found in 106 patients. All the patients were comfortable and there was no requirement of any supplementation during the surgery. Minimal discomfort was present in 68 patients, the analgesia and relaxation was adequate. 1 ml of additional anesthesia was given when required, (Table 3).

Table 2: Sex incidence present in the study

Sex	No of cases
Male	194
Female	6
Total	200

Table 3: Quality of analgesia present in the study

Quality of analgesia	No of cases
Excellent	106
Good	66
Fair	20
Poor	6
Cases excluded from the study	4
Total	200

There was discomfort found in 20 patients. Discomfort was present even after additional top-up of epidural local anesthetic; this was alleviated by analgesic dose of Ing Fentanyl *1 Mcg/kg* IV. 6 patients had no analgesia at all, Patients were complaining of severe intolerable pain during surgery without relaxation. These cases were converted to general anesthesia. 4 cases were withdrawn from the study as there was an inadvertent dural puncture. Side effects were seen in some cases. Sweating was seen in 18 patients; in 10 patients shivering was present.

Discussion

For the lower abdominal surgery and in lower limbs, the epidural anesthesia is the sole agent. There are advantages like avoidance of post-spinal headaches, minimal chances of nausea and minimal chances of meningitis over the spinal analgesia.[6] These works have given a useful suggestion for extending the technique as "Segmental Epidural Block" for Inguinal hernia repair as the nerve supply to this area is very suitable for carrying out this procedure and also has some attractive advantages over the conventional epidural block using larger doses.[7]

The study of Segmental Epidural Analgesia for inguinal hernia repair was carried out with an intension of administering limited quantity of drug required to make the procedure precise and safe. Segmental or conventional block can be performed at any region like cervical, thoracic, lumber or caudal. However, the volume used in the segmental block is very small, so that, the block covers only the particular segments concern.[8]

Studies conducted by MH Rao and Phani Thota, on Segmental dose requirement of epidural lignocaine stated that dose required to block each segment in males was about *22.3 mg/segment* and

in females about *19.7 mg/segment*.[3] Based on these studies volume of the drug injected by us was *5 ml*, so, as to limit the spread to only the segments involved in the field of surgery.

In this study, a majority of patients (106 patients) who received *5 ml* the analgesic effect was found to be satisfactory. 44 patients received *6 ml*, 32 patients *7 ml* and 18 patients received *8 ml*. It is observed that the majority of patients who required the additional top-ups upto *7* and *8 ml* were younger age group. This can be explained by, in younger age group the spread is minimal due to spillage of drug through the patent intervertebral foramina. But escape of fluid is reduced to minimum in the elderly patients due to the stenosed intervertebral foramina which can be observed by the largest spread of volume as seen in two patient aged 70 and 65 years.

In a study by Prys Roberts and Andrew Black, stated that in 90% of the patients undergoing lower abdominal surgeries where block required is between T10-L2 the volume of local anesthetic required is *5 ml* and the duration of block with Bupivacaine 0.5% is limited to *3–4 hours*. In the present study, mean onset of analgesia was *8.09 minutes* and mean duration of analgesia was *167.42 minutes* (*120 min–240 min*).

Conclusion

The segmental epidural block with *5–6 ml* is found to be safe and it fulfils all the surgical requirement. For inguinal hernia 0.5% bupivacaine can be successfully employed with limited spread. There are minimal complications like fall in blood pressure. The present technique can be safely use in elderly patients.

Conflict of Interest: none

Source of Support: Nil

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Original Research Article

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Comparison of Oral Dexmedetomidine Vs Oral Midazolam as Pre-Medication for Children Undergoing Elective Surgical Procedures

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Abstract

Pre-medications are frequently administered in children to alleviate the stress and fear of treatment as well as to ease child-parent separation and promote a smooth induction of anesthesia. Various drugs have been tried ranging from midazolam, ketamine, fentanyl, promethazine, and triclorfos. Of late alpha-2 agonists like Dexmedetomidine are being used, it has both sedative and analgesic properties and is devoid of respiratory depressant effect. These properties render it potentially useful for anesthesia pre-medication. Aim is to compare the effects of midazolam and dexmedetomidine when administered orally as pre-anesthetic medication for children. *Materials and Methods:* Children are randomised into Group M receiving midazolam 0.5 *mg/kg* and Group D receiving dexmedetomidine 2 *mcg/kg* orally. *Results:* Demographic and hemodynamic parameters are comparable between two drugs. Child separation Score 1 in Group D is 29 out of 35 (83%) and in Group M is 16 out of 35 (45.7%) with *p* value of < 0.05. Mask acceptance Score 1 and 2 in Group D is 34 out of 35 (97.2%) where as in Group M is 22 out of 35 (62.8%) with *p*-value of < 0.05. Sedation score of 2 and 3 in Group D is 29 out of 35 (82.9%) and Group M is 32 out of 35 (91%) with *p* value of > 0.05. Dexmedetomidine is a better drug in terms of child parent separation and mask acceptance score than midazolam. However, sedation scores were comparable. To conclude Dexmedetomidine is a superior pre-medication compared to Midazolam when given by oral route. Dexmedetomidine may find a regular place for pre-medication in children pre-operatively.

Keywords: Dexmedetomidine; Midazolam; Oral pre-medication.

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Introduction

Anesthesia practice is a major contributor to the outcomes of surgical operation. Distress and the psychological trauma from maternal separation are major challenges in the practice of paediatric anesthesia.[1] Pre-medications are frequently administered in children to alleviate the stress and fear of treatment as well as to ease child-parent separation and promote a smooth induction of anesthesia.[2] Oral midazolam, the most common anesthetic pre-medication in children, is being widely used to ease the children's separation anxiety during maternal deprivation on transfer into the operation room. Despite several advantages of midazolam for anesthetic pre-medication in children, some of its side effects such as paradoxical reaction, restlessness, and other unfavorable behavioral changes (post-surgery) have limited it's application as an ideal option.[3]

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New drugs such as the α_2-agonists have emerged as alternatives for pre-medication in pediatric anesthesia.[4] Dexmedetomidine is a highly selective α_2-agonist with both sedative and analgesic properties and is devoid of respiratory depressant effect. These properties render it potentially useful for anesthesia pre-medication.[5] Hence, this study intended to compare oral midazolam and oral dexmedetomidine as a pre-anesthetic medication for children.

Aim and Objectives

Primary: To compare the effects of midazolam and dexmedetomidine when administered orally as pre-anesthetic medication for children;

Secondary: To compare hemodynamic parameters and side effects of study drugs;

Expected outcome: To know the better premedication drug among children, between midazolam and dexmedetomidine.

Materials and Methods

Source of data: MS Ramaiah teaching hospital;

Sample size: 60 patients with 30 in each group.

Rationale for sample size calculation: A study carried out by Sayedeh *et al*.[5] revealed that the mean sedation scores to be 1.93 (0.6) and 2.0 (0.63) with midazolam and dexmedetomidine respectively. Based on the above findings, with power of 90% and error of 1% it has been estimated that 24 subjects need to be included in each group. However, allowing for drop outs we proposed to include 30 children in each group. The above sample size would be sufficient to evaluate the mask acceptance and child parent separation score too.

Inclusion criteria

1. Age *1–6 yrs;*
2. ASA 1 and 2;
3. Children posted for elective surgical procedures.

Exclusion criteria

1. Anticipated difficult airway cases;
2. Syndromic children;
3. Child with recent respiratory tract infections.

Methods

After institutional ethical committee clearance and informed written consent from the parents, 60 children satisfying the inclusion criteria were enrolled into the study. They were randomised using computer generated random numbers into two groups, Group M receiving midazolam *0.5 mg/kg* and Group D receiving dexmedetomidine *2 mcg/kg* orally. After confirming fasting status, child was shifted to pre-operative room, monitors connected and baseline parameters noted. *45 minutes* prior to the surgery, patient received the study drug diluted to *5 ml* by reconstituting with 5% dextrose solution and given orally by dropper. The child's parent and the observing anesthetist were blinded to the study. Child was observed for child-parent separation score, mask acceptance behavior and sedation during anesthesia, hemodynamic parameters like heart rate, blood pressure, saturation and adverse effects if any.

Statistics

Data was analysed using Statistical Package for Social Science SPSS V18 software. p - value < 0.05 was considered for statistical significance. Descriptive statistics like blood pressure, saturation, respiratory rate and heart rate were analysed and presented with mean and standard deviation. Child-parent separation score, mask acceptance behavior, sedation and any adverse events during anesthesia, was summarised in terms of percentage.

Independent *t*-test was used to compare the blood pressure, saturation, respiratory rate and heart rate between the groups at different time. Chi-square test was used to compare child-parent separation score, mask acceptance behavior, sedation and any adverse events during anesthesia between two groups. Continuous covariates were compared using analysis of variance (ANOVA).

Results

The demographic parameters of the patients like age, weight, height, type of surgery and gender in the study were comparable with a p - value of > 0.05. The mean age in Group D was *4.33 ± 1.5 years* and Group M was *3.53 ± 1.4 years*. The mean weight was *15.1 ± 4.9 kgs* and *17 ± 5.5 kgs* in Group D and M respectively. The mean height was *65.1 ± 7.23 cms* and *56 ± 11.1 cms* in Group D and M respectively. All these were statistically not significant.

Out of 70 patients, 39 were males and 31 were females. In Group D 18 were males and 17 were females. In Group M 21 were males and 14 were females. The results were statistically not significant.

Heart rate changes from baseline upto *15 minutes* in both the groups are not statistically significant. From *15 minutes* to the end of the surgery (mean *120 minutes*) there is decrease in heart rate in Group D with a *p* - value of > 0.05 which is statistically not significant. In Group M the decrease in heart rate is not statistically significant.

Mean arterial blood pressure changes in Group D and M from baseline till end of the surgery with a mean duration of *120 min*. The decrease in mean arterial blood pressure in both the groups is not statistically significant with a *p* - value of > 0.05. Demographic and hemodynamic parameters are comparable between two drugs.

Child-Parent separation score: in group D, Score 1 in 29 out of 35 (83%), Score 2 in 6 out of 35 (17%) and Score 3 in none of the patients. In Group M, Score 1 in 16 out of 35 (45.7%), Score 2 in 17 out of 35 (48.6%) and Score 3 in 23 out of 35 (32.9%). Child-Parent separation Score is clinically better in Group D when compared to Group M with *p* - value of < 0.05, which is statistically significant, (Graph 1).

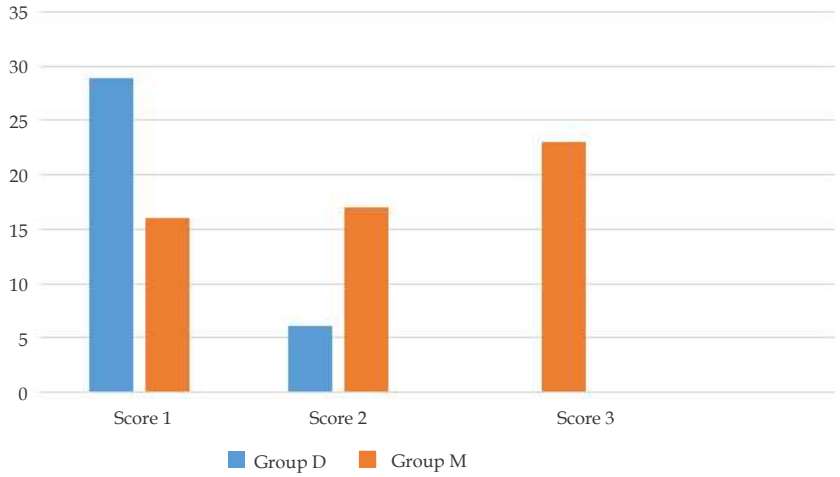
***Child-parent Separation Score*[3]**

Patient unafraid, co-operative, or asleep 1

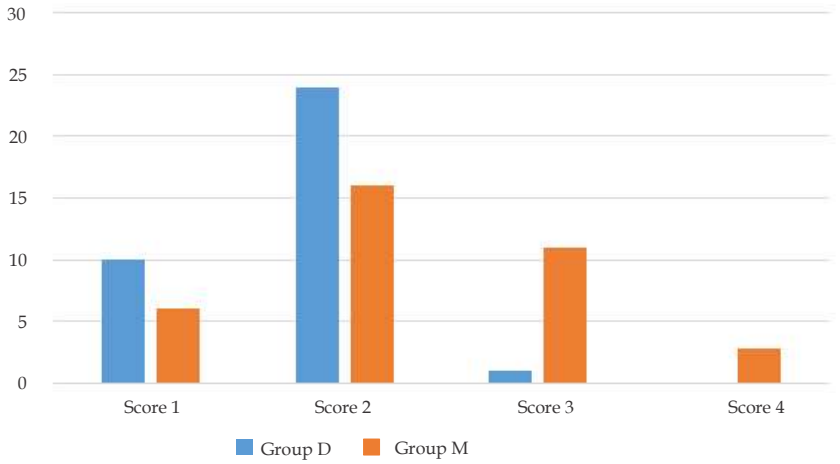
Patient slightly fearful and/or crying; quieted with reassurance 2

Patient fearful and crying; not quietened with reassurance 3

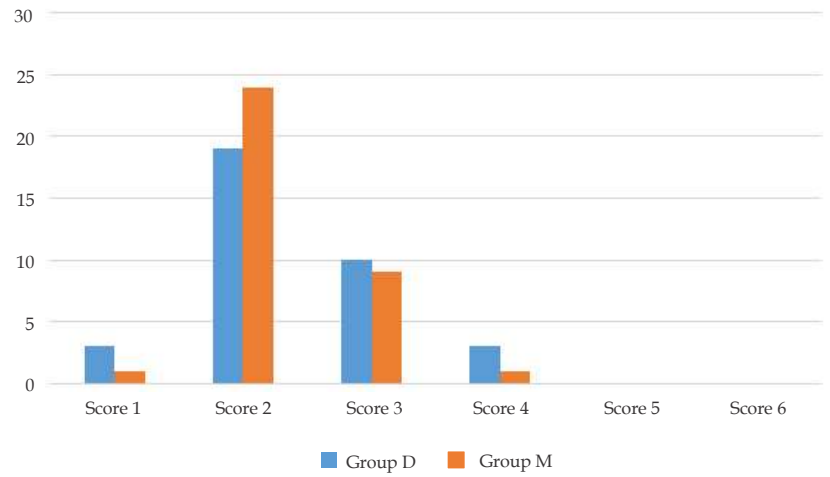
In Group D Mask acceptance Score 1 is 10 out of 35 (28.6%) patients, Score 2 is 24 out of 35 (68.6%) patients, Score 3 is 1 out of 35 (2.9%) patient and Score 4 is 0 patient. In Group M Mask acceptance Score 1 is 6 out of 35 (17.1%) patients, Score 2 is 16 out of 35 patient (45.7%), Score 3 is 11 out of 35 patient (31.4%) and Score 4 is 2 out of 35 (5.7%) patients.



Graph 1: Shows Child-Parent separation Score between Group D and Group M



Graph 2: Showing Mask Acceptance Score between the Groups D and M



Graph 3: Showing sedation score between the groups D and M

Mask acceptance Score 1 and 2 in Group D is 34 out of 35 (97.2%) where as in Group M is 22 out of 35 (62.8%) indicating Mask acceptance score is better in Group D when compared to Group M with *p* - value of < 0.05, which is statistically significant, (Graph 2).

Mask Acceptance Score[5]

Score	Description
1	Calm and co-operating
2	Anxious but without resistance
3	Anxious with slight resistance
4	Crying and/or struggling against mask

In Group D sedation Score of 1 is 3 out of 35 (8.6%) patients, Score 2 is 19 out of 35 (54.3%) patients, Score 3 is 10 out of 35 (28.6%) patients, Score 4 is 3 out of 35 (8.6%) patients and no patients in Score of 5 and 6.

In Group M sedation Score is 1 is 1 out of 35 (2.9%) patient, Score 2 is 24 out of 35 (68.6%) patient, Score 3 is 9 out of 35 (25.7%) patient, Score 4 is 1 out of 35 (2.9%) and no patients in Score of 5 and 6.

Sedation Score of 2 and 3 in Group D is 29 out of 35 (82.9%) and Group M is 32 out of 35 (91%) which is statistically comparable with *p* - value of > 0.05 between the Groups, (Graph 3).

Ramsay Sedation Score[2]

Score	Description
1	Anxious and agitated or restless, or both
2	Co-operative, oriented, and calm
3	Responsive to commands only
4	Exhibiting brisk response to light glabellar tap or loud auditory stimulus
5	Exhibiting a sluggish response to light glabellar tap or loud auditory stimulus
6	Unresponsive

No complications were observed in terms of nausea, vomiting, bradycardia, hypotension, desaturation, and pruritis in both the Groups.

Discussion

Midazolam is the most commonly used anxiolytic pre-medication in young children. It facilitates Gamma Amino Butyric Acid (GABA) receptor-mediated chloride conductance, which has an inhibitory effect on neurons in the cerebral cortex. It has been successfully used through various routes, *e.g.* intravenous, intramuscular, oral and intranasal route.[6] A recent evidence-based clinical update has shown that oral midazolam *0.5 mg/kg* is effective in reducing both separation and induction anxiety in children, with minimal effect on recovery time.[7]

Dexmedetomidine possesses many properties that are advantageous for a sedative and anesthetic drug. It has been reported to provide sedation that parallels natural sleep, anxiolysis, analgesia, sympatholysis, and an anesthetic-sparing effect with minimal respiratory depression. These favorable physiological effects combined with a limited adverse effect profile make dexmedetomidine an attractive adjunct to anesthesia.[8]

Demographic and hemodynamic parameters are comparable between two drugs. Even though there was marginally decrease of heart rate in dexmedetomidine Group when compared to midazolam Group, this was not statistically significant.

This infers both dexmedetomidine and midazolam have safe hemodynamic margin. Child separation Score 1 means child unafraid, co-operative, or asleep. Score 1 in Group D is 29 out of 35 (83%) and in Group M is 16 out of 35 (45.7%).

Child-Parent separation score is clinically better in Group D when compared to Group M with *p* - value of < 0.05, which is statistically significant. This indicates dexmedetomidine provides adequate conscious sedation which is helpful to separate children from parents while taking inside the operating theatre. Similar to Shailesh *et al*.[7] study where both drugs were give intranasal. However, Jannu *et al*.[9] found no difference in both the Groups probably due to different doses used by them.

Mask acceptance Score 1 is child being Calm and co-operating and Score 2 is child is anxious but without resistance. 1 and 2 score is taken as an acceptable score for mask ventilation. Mask acceptance Score 1 and 2 in Group D is 34 out of 35 (97.2%) where as in Group M is 22 out of 35 (62.8%) indicating Mask acceptance is better in Group D when compared to Group M with *p* - value of < 05, which is statistically significant. This is in accordance with syeedah *et al*.[5] and Deepak *et al*.[6] This indicates dexmedetomidine will provide better mask acceptance for children during pre-oxygenation in general anesthesia without any struggle during mask holding.

Ramsay sedation Score of 2 was child being Co-operative, oriented, and calm, where as Score of 3 is responsive to commands only. Score of 2 and 3 is taken as adequate sedation required for pre-medication. Sedation Score of 2 and 3 in Group D is 29 out of 35 (82.9%) and Group M is 32 out of 35 (91%). The sedation appears clinically better in Group M but it's not statistically significant with *p* value of > 0.05. This implies dexmedetomidine provides equal and effective sedation comparable to midazolam. This is in accordance with studies of Lakshmi *et al*.,[10] Sukanya *et al*.[1]

The sedation produced by dexmedetomidine differs from other sedatives as patients may be easily aroused and co-operative. It affords sedative, anxiolytic, and analgesic effects without causing excessive drowsiness.[3]

In our study, we used the oral administration route as the children are less likely to resist receiving the pre-medication itself. This is in contrast to what is seen in other routes like intranasal which required a separate drug delivery system and resistance offered by the children to this route. In our study, we diluted the drug in a *5 ml* syringe to maximum of *0.4 ml/kg* with 5% dextrose solution and was given orally by the parents. This technique was acceptable by the child and was comfortable to the parents also. The only limitation being the bio availability of the drug and the cost of dexmedetomidine.

Conclusion

Dexmedetomidine is superior than Midazolam as pre-medication in pediatric patients with excellent child-parent separation, favorable mask acceptance score. It also provides equally effective sedation with comparable hemodynamic parameters and no adverse effects as of midazolam.

To conclude Dexmedetomidine is a superior pre-medication compared to Midazolam when given by oral route. Dexmedetomidine may find a regular place for pre-medication in children pre-operatively.

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Original Research Article

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Comparison of the Efficacy of 2% Viscous Lignocaine Gargle Over 5% Ketamine Gargle for Prevention of Postoperative Sore Throat in Patients Undergoing General Anesthesia with Endotracheal Intubation: A Randomized Control Trial

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Abstract

Post-operative Sore Throat (POST), is unavoidable following endotracheal intubation. In our study, we compared the efficacy of 2% viscous lignocaine gargle over 5% ketamine gargle for the prevention of Post-operative Sore Throat (POST) in patients undergoing general anesthesia with endotracheal intubation. *Methodology:* 80 patients undergoing general anesthesia with endotracheal intubation were allocated into two groups lignocaine (Group L) and ketamine (Group K). Both the Groups were made to gargle five minutes with respective solutions before pre-medication. Group K were made to gargle 50 *mg* ketamine with 29 *ml* normal saline and in Group L gargling was done with 30 *ml* of 2% viscous lignocaine undiluted. The primary objective was to assess the incidence and severity of POST. Secondary objectives were, response to intubation every three minutes for initial 15 *minutes*, and cough in the post-operative period. *Results:* Incidence and severity of POST was signifiacantly high at the end of 2nd, 4th, 6th, 12th in Group L. (p = < .07) (< .001) (< .001) (< .04). There was a significant increase in heart rate and mean arterial pressure in group at the end of 1st, 3rd and 6th *minute* after intubation in Group K. 4% in Group K and 12% in Group L had post-operative cough of Score 1.

Keywords: Gargle; Post-operative sore throat; Ketamine; Lignocaine.

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Introduction

POST is rated as the eighth most adverse effect in post-operative period.[1] With the incidence after ET intubation between 15–90%.[2,3] sore throat is a common post-operative complaint, occurring most often following tracheal intubation. There are umpteen factors such as tracheal-tube size, cuff design, duration of surgery that have been predicted to cause POST. Routine tracheal intubation for elective surgical procedures can result in pathological changes, trauma and nerve damage which may also account for post-operative throat.[4]

POST has to effectively taken care to prevent post-operative morbidity and patient dissatisfaction. There are numerous studies involving pharmacological and non-pharmacological agents to allievate POST. These include dexamethasone,[5] lignocaine[6] magnesium,[7] tramadol.[8] There is increasing amount of experimental data showing that NMDA receptors are found not only in the CNS but also in the peripheral nerves. Anti-nociceptive and anti-inflammatory property of ketamine helps in prevention of POST.[9]

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Materials and Methods

After obtaining written and informed consent, and CTRI registration (REF/2017/07/014933) 80 patients (seven dropouts) were included in the study and randomized into two Groups (40 in each Group), Group K and Group L via a computer generated random number sequence and group allocation was done by principle investigator, (Fig. 1). Along with pre-anesthesia check up all patients were screened for sore throat. Inclusion criteria includes ASA 1–2, age 18–60 years old, Mallampatti Grade 1 and 2, patients undergoing surgery under general anesthesia with endotracheal intubation. The exclusion criteria were ASA greater than threee, predicted difficult intubation and patients who required more than two intubation attempts and sore throat.

Patients were kept nil per oral for *six hours* and antacid pre-medication was given as per institute protocol. All patients in the study were instructed regarding the procedure for gargling in the pre-operative holding area, that it should be done for *30 seconds* and they should not swallow or spit it immediately. Patients were instructed on the four point grades of post-operative throat pain,[10] where Grade 0 was no pain, Grade 1, mild pain, Grade 2, moderate pain and Grade 3, severe pain. Patients were shifted to operation room and all standard monitors were connected. Both group patients were made to sit and do the gargling for *30 seconds, five minutes* before anesthesia pre-medication according to the group allocated. Gargle preparation was done by the OT anesthesiologist, who was blinded about the group. Group K were made to gargle with *50 mg* ketamine with *29 ml* normal saline using a measuring jar (Aneket^{r} Neon Laboratories Limited) (total volume *30 ml*). In Group L patients were made to gargle with *30 ml* of 2% viscous lignocaine undiluted. (Lox 2% Neon Laboratories Limited).

General anesthesia was induced and maintained according to departmental protocol. Intubation was done by a Senior Anesthesiologist to minimize airway trauma. If the patients required more than two intubation attempts they were excluded from the study. Polyvinyl endotracheal tube (high volume and low pressure cuff) was used for intubation and standard size of *7 mm* for female patients and *8 mm* for male patients were used. After intubation cuff was injected with air until a minimal audible leak was heard in the suprasternal area. Following Parameters were recorded by the OT anesthesiologist during intra-operative period. Heart rate and Mean Arterial Pressure (MAP) were recorded at the base line and then every *3 min* till *15 min* after the intubation. After surgery, all patients were extubated and shifted to Post-operative Ward (POW). Total duration of intubation time was noted. Post-operative staff was instructed regarding the grade of POST and they noted it in the proforma. POST with 4 point scale (0 to 3) was assessed every *2 hrs* interval for first *6 hours* then every *6 hour* interval till *24 hrs*, by the staff who was not a the part of the study. Post-operative cough was assessed using three point scale (No cough at any time since the operation-0, Minimal-1, Moderate-2 Severe-3).[11] Patients were observed for cough at the end of *2, 4, 6, 12, 24 hours*. Those with moderate to severe sore throat were given Normal saline gargle.

Statistical Analysis

The collected data were entered in master sheet in Microsoft excel and analysed using Statistical Package for Social Sciences (SPSS Inc, Chicago, IL, USA, version 19.0 for windows). Normality for age, weight, duration of surgery was checked with Kolmogorov-Smirnov test. Hemodynamic variables (heart rate and mean arterial pressure) between the groups were compared with *t*-test differences in the incidence of POST were compared with Fisher's exact test or Chi-square test. Mann-Whitney *U*-test was used to assess severity of POST. $p < 0.05$ was considered statistically significant.

Results

We included 87 patients in the study and seven were excluded. Four patients had sore throat, two patients had partially swallowed during gargling and two patients there were more than three intubations attempts. There were no significant differences between the two groups regarding age, body weight, gender distribution, duration of surgery (Table 1). Surgeries in both the groups included epigastric hernia, lymph node excision, fibroadenoma breast, and axillary lipoma.

Table 1: Demographic data

Sl. No	Characteristics	Group L (Mean ± SD)	Group K (Mean ± SD)
1	Age (*years*)	37.7 ± 8.8	35 ± 10.7
2	Weight (Kg)	61.28 ± 15.11	62.18 ± 10.42
3	Male (Female)	28:22	24:26
4	Duration of intubation (*mins*)	45 ± 12.75	48 ± 14.52

Sample size calculation

Based on a previous study by Aigbedia[10] considering the incidence of the moderate POST in patients who received katamine gargle as compared to control group (44.1 *vs* 23.5%), with 95% confidence interval and 80% power, minimum sample size to obtain statistically significant result was calculated as 35 in each Group. Considering the dropouts we recruited 40 in each Group.

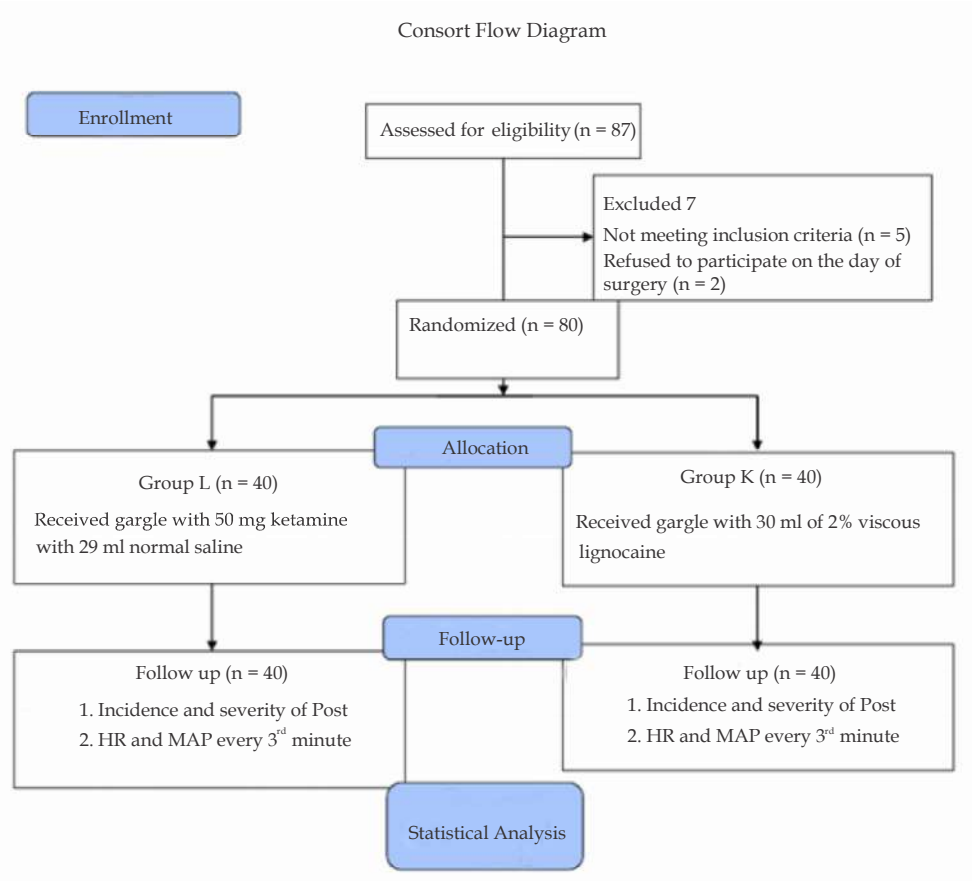

Fig. 1: Consort Flow Diagram

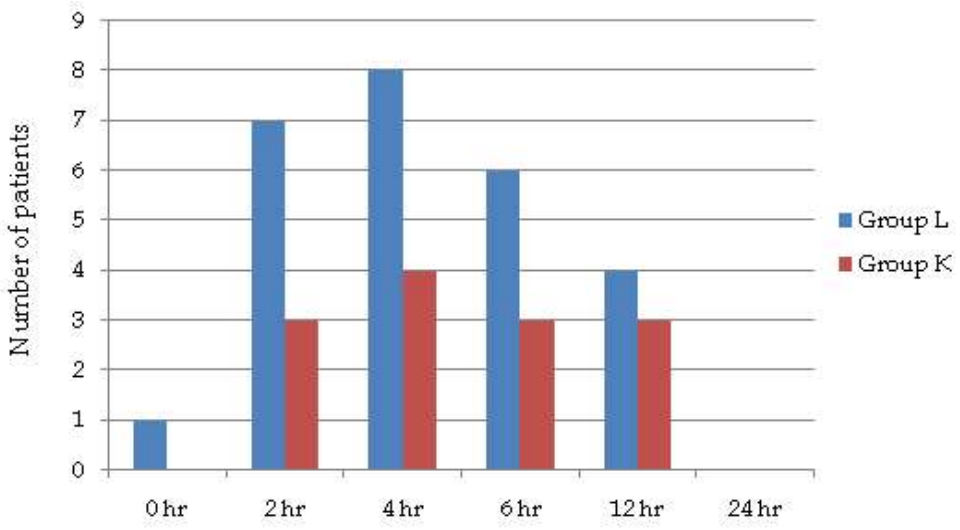

Fig. 2: Incidence of post-operative sore throat at *0, 2, 4, 6, 8, 12* and *24 h* post-operatively in both the groups

Discussion

Ketamine hydrochloride is an intravenous induction agent and a potent NMDA receptor antagonist. It has been recently studied in attenuating POST because of its ant nociceptive property and anti-inflammatory property. The incidence of POST in lignocaine group was 62% (24 patients) and in Group K was 33% (13 patients) (Fig. 2). Of 24 patients in Group L, 15 had POST score one, nine had score two. In Group K, 11 had a POST score of one and two patients had a score of 2, (Table 2). None of the patients in both Group had severe sore throat. (Score 3). This was similar to the study done by Aigbedia, KU Tobi, FE Amadasun[11] who compared ketamine gargle and lidocaine jelly application for the prevention of POST with endotracheal Intubation and proved that ketamine gargle had more protection against moderate to severe post-operative pain compared to topical lidocaine jelly. Rudra, Suchanda Ray, and S Ghosh *et al*.[12] Shrestaet *et al*.[13] in their study proved that gargling with ketamine attenuates the Post-operative Sore Throat without any drug related adverse effects. Ahuja V, Mitra S, Sarna R[14] had justified that nebulized ketamine decreases incidence and severity of post-operative sore throat. All the above studies are concordant with our study that ketamine is more potent in attenuating POST.

Table 2: Grading of POST between Groups

Time		Group L (n = 40)	Group K (n = 40)	p - value
0 hr	0	1	0	< .07
	1			
	2			
	3			
2 hr	0	3	3	** < .001
	1	4		
	2			
	3			
4 hr	0	5	3	** < .001
	1	3	1	
	2			
	3			
6 hr	0	5	2	** < .001
	1	1	1	
	2			
	3			
12 hr	0	4	3	** < .04
	1	1		
	2			
	3			
24 hr	0	6	1	** < .04
	1			
	2			
	3			

** p - value significant

There was a significant increase in heart rate and in Group K at 1st (*114 ± 28.5 min*), 3rd (*112 ± 24.50*) 6th *102 ± 14.55*) *minute* after intubation compared with

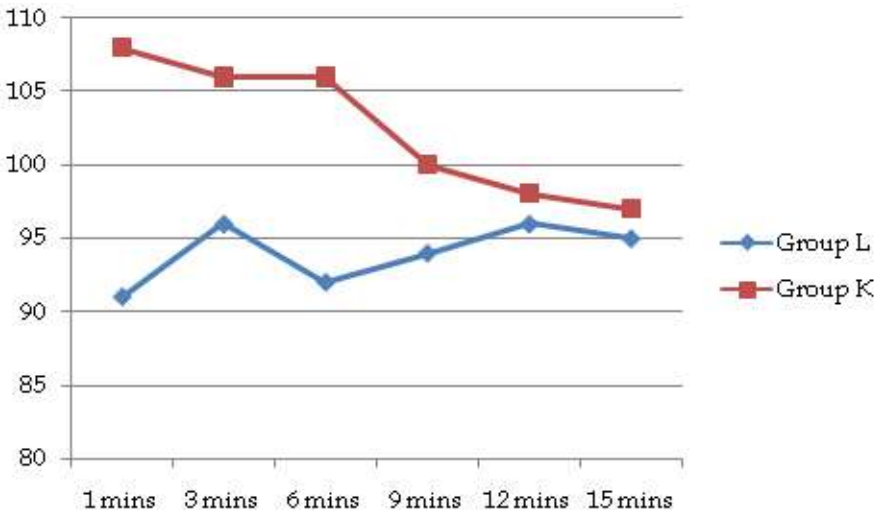

Fig. 3: Change in mean arterial pressure between groups

Group L at 1 (*96 ± 18.5 min*), 3rd (*94 ± 22.45*) 6th (*96 ± 12.5*), (Table 3). There was a significant increase in mean arterial pressure in Group K at 1st (108 ± 8.5), 3rd (106 ± 11.50), 6th (106 ± 14.50) minute compared to Group L at 1st (91 ± 5.5), 3rd (93 ± 7.50), 6th (92 ± 16.50), (Fig. 3). We hypothesize that is increase in heart rate and MAP might be due to prominent action of ketamine on the sympathetic nervous.[15]

There are established studies proving that lignocaine in various forms such as nebulization,[16] intravenous,[17,18] spray[19] have been used for obtunding intubation response which was also observed in our study. 4% in Group K and 12% in Group L had post-operative cough of Score 1.

Table 3: Change in heart rate between groups

Time	Group L (Mean ± SD)	Group K (Mean ± SD)	p - value
1 mins	96 ± 18.5	114 ± 28.5	** < .003
3 mins	94 ± 22.45	112 ± 24.50	** < .002
6 mins	96 ± 12.5	102 ± 14.55	** < .05
9 mins	90 ± 10.5	94 ± 14.5	< .057
12 mins	88 ± 11	92 ± 12.0	< .061
15 mins	88 ± 9	90 ± 10.5	< .12

** *p* - value significant

Limitations of the study

Cuff pressure was not monitored during the study which plays an important role in POST. Systemic effect of ketamine might have contributed towards analgesia which might be compounding factor for ketamine gargle.

Conclusion

Ketamine gargle remarkably lessened the incidence and severity of POST but less effective in obtunding the intubation response compared to lignocaine gargle.

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Presentation at a meeting: Nil

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A Comparison of Ease of Intubation with Direct Laryngoscopy and Video Laryngoscopy in Patients with Anticipated Difficult Airway

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Abstract

Introduction: Difficult airway remains a frequent cause of anesthesia related morbidity and mortality due to difficulty with tracheal intubation. Around 30% of deaths attributable to anesthesia is mainly due to inability to manage difficult airways. For intubation in cases of difficult direct laryngoscopy many alternatives have been developed such as video laryngoscopes. *Objectives:* To Compare the ease of intubation by direct laryngoscopy and video laryngoscopy in patients with difficult airway. *Outcome variables:* Time taken for intubation, Number of Attempts of laryngoscopy for intubation and Cormack Lehane view. *Methodology:* 100 patients with difficult airway (Mallampatti class III, Upper lip bite test Score II and III, Neck mobility Score III) are divided into two groups of 50 each:

Group A - Video Laryngoscopy group;

Group B - Direct Laryngoscopy group.

Time taken for intubation, number of attempts of laryngoscopy for intubation and glottic view were assessed in both Groups.

Results: The time taken for tracheal intubation was shorter with Direct Laryngoscopy compared with Video Laryngoscopy. Number of attempts for tracheal intubation and laryngoscopic views were better with Video Laryngoscopy than with Direct Laryngoscopy. *Conclusion:* Video Laryngoscopy eases tracheal intubations in patients with difficult intubating conditions. The glottic view for guiding endotracheal tube is significantly improved, with a decreased number of optimizing manoeuvres resulting in a significantly higher success rate of tracheal intubations.

Keywords: Direct Laryngoscopy; Video Laryngoscopy; Cormack Lehane view; Mallampatti class.

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Introduction

The primary responsibility of Anesthesiologist as a peri-operative physician is to safeguard the airway *i.e.* to protect and preserve it during induction, maintenance and recovery from anesthesia. In the event of loss of the airway, prompt management is mandatory before the individual suffers irreversible injury from inadequate or compromised oxygenation. Of the various methods available to secure an airway like orotracheal, nasotracheal and tracheostomy, orotracheal intubation is most commonly used. On occasions when considerable technical difficulty is encountered, orotracheal intubation is attempted under direct vision for securing airway. Unusual anatomic configurations

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may be encountered when the airway itself is difficult. Unanticipated difficult airway remains a frequent cause of anesthesia related morbidity and mortality due to difficulty with tracheal intubation.

Direct laryngoscopy using a Macintosh blade introduced by Sir Robert Macintosh in 1941 remains the standard technique to facilitate tracheal intubation during routine anesthesia.[1,2] However, this method has some limitations.

Aligning the three axes of airway (oral, pharyngeal and laryngeal axes) which is achieved by 'Sniffing the morning air position is needed for successful direct laryngoscopy.[3,4] Although "sniffing the morning air position" is successful for intubation in a large number of cases, laryngoscopy may still be difficult due to other causes like anatomical problems. Another limitation is that this view is available only to the laryngoscopist, making it a difficult to train and teach laryngoscopy effectively to novices. Additional manoeuvres such as increased neck flexion, external laryngeal manipulation or the use of gum elastic bougie or stylet are required in most intubations with poor Cormack and Lehane grades and are also often effectively blind. To facilitate intubation in cases of difficult direct laryngoscopy many alternatives have been developed such as video laryngoscopes.

Video laryngoscopes are essentially indirect laryngoscopes and have several advantages like providing a wider viewing angle, showing magnified images on a display screen where they can then be viewed or recorded. All have exactly the same view on the video monitor which allows operator and assistant to co-ordinate their movements when assistance is required. It is not essential to create a line-of-vision by aligning oral, pharyngeal and laryngeal axis.[3,5]

Video laryngoscopes have a specific role in difficult airway scenarios where Macintosh has failed but it remains unclear if intubation success is improved in routine difficult airway management. This study compared the time taken for intubation, success rates for tracheal intubation and Cormack Lehane view with the video laryngoscope and with conventional direct laryngoscopy in patients with anticipated difficult airway.

Materials and Methods

This study was conducted at a tertiary care institution after obtaining approval from Institutional Ethics Committee and written informed consent from the participants.

Study design

Randomised Controlled Trial.

Study population

Patients with ASA Grade I and II, aged *18–65 years*, of both sex scheduled for surgery under general anesthesia, with difficult airway condition.

Inclusion criteria

Patients with difficult airway (Mallampatti Grade III, Upper lip bite test Score II and III, Neck mobility Score III).

Exclusion criteria

Patients below *18 years* of age, patients with huge thyroid swelling, patients with valvular and ischemic heart disease.

Study variables

- Time taken for intubation;
- Number of attempts;
- Glottic view.

Following routine pre-anesthetic check up by the attending anesthesiologist, Patients was categorised using Modified Mallampatti scoring, neck extension and upper lip bite test.

In turn, ease or difficulty of laryngoscopy was assessed while the patient isfully anesthetized.

After establishing venous access, standard monitoring, pre-medication and pre-oxygenation, general anesthesia was induced using propofol (mean dose *2.0 mg/kg*), fentanyl (mean dose *2.0 μg/kg*), and vecuronium (mean dose *0.1 mg/kg*).

After mask ventilation with the patient in the sniffing the morning air position, laryngoscopy was performed with a Macintosh direct laryngoscopy blade or Video laryngoscopy according to the allocation, by an Anesthesiologist who is blinded to the results of pre-operative airway assessment. Glottic view was assessed and noted with either direct laryngoscopy or video laryngoscopy with the Cormack and Lehane classification.

After evaluation, if needed external laryngeal pressure was permitted forendotracheal tube insertion in difficult cases. Time taken for intubation, number of attempts and glottis view on both groups were assessed and recorded.

Statistical Analysis

The collected data were coded and entered into Microsoft excel. Then data was analyzed using SPSS software. Between groups comparison of quantitative variables were analysed by '*t*' test and that of qualitative variables analyzed by Chi-square test.

A '*p*' value of < 0.05 was considered as the level of significance;

A '*p*' value of > 0.05 was considered as not significant.

Results

Table 1: Comparison of sample based on time taken for intubation

Group	n	Time taken for intubation in seconds		t	*p*
		Mean	SD		
Video Laryngoscopy	50	37.82	5.216	2.783	0.006
Direct Laryngoscopy	50	35.18	4.217		

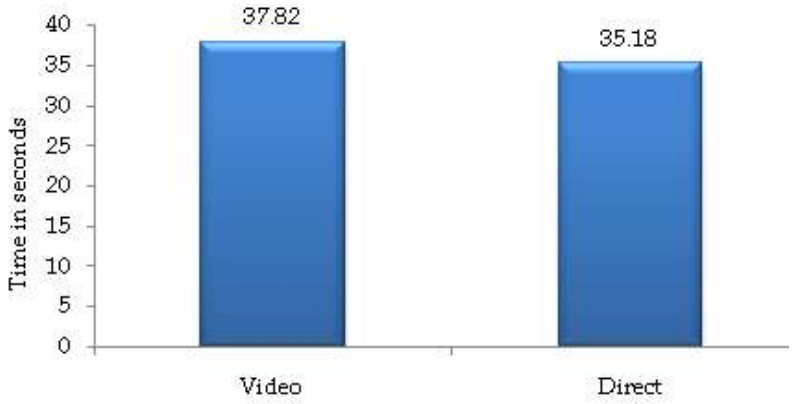
The time taken for tracheal intubation (from opening of the mouth to inflating the cuff) was shorter for Direct Laryngoscopy compared with Video Laryngoscopy, shown as Table 1 and Graph 1.

Number of attempts needed for tracheal intubation with Video Laryngoscopy compared with Direct Laryngoscopy is significantly better. Out of the 50 cases second attempt was need or Video Laryngoscopy only in 5 cases, (Table 2 and Graph 2).

While intubating in difficult airway scenarios Laryngeal manipulations was applied on 10 cases with Video Laryngoscopy, which is significantly better comparing with Direct Laryngoscopy, (Table 3 and Graph 3).

Regarding the Laryngeal view comparing in both Groups, Video Laryngoscopy has significantly better view than Direct Laryngoscopy.

Out of the 50 patients of each Group, Video Laryngoscopy had Grade I Cormack Lehane view on almost more than 95% cases excluding the laryngeal manipulation given for the better view, (Table 4 and Graph 4).



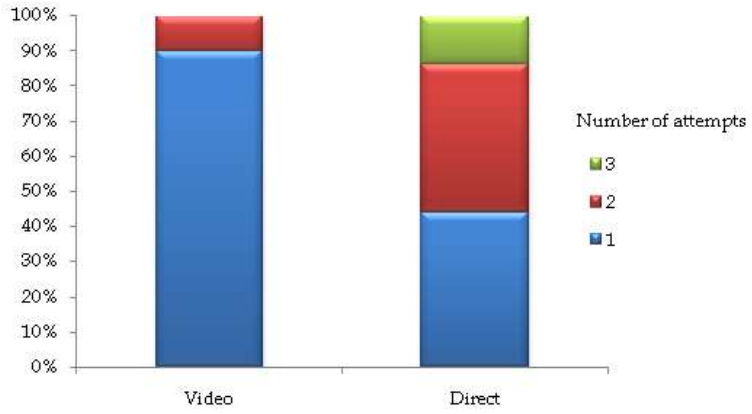
Graph 1: Comparison of Time taken for Intubation

Table 2: Comparison of Number of Attempts needed for intubation

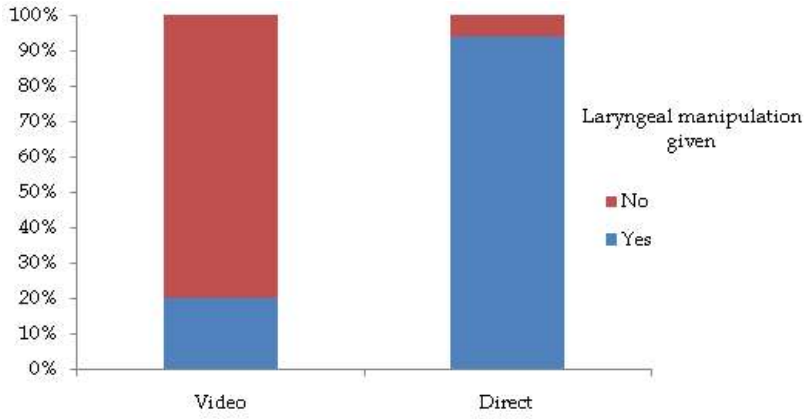
Number of attempts	Device				Total		χ^2	df	*p*
	Video		Direct						
	n	%	n	%	n	%			
1	45	90	22	44	67	67	24.742	2	0
2	5	10	21	42	26	26			
3	0	0	7	14	7	7			
Total	50	100	50	100	100	100			

Table 3: Comparison of Laryngeal manipulation applied on each group

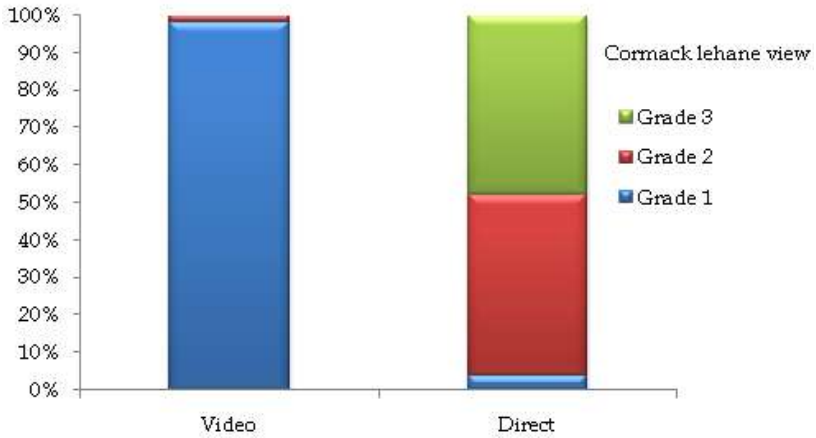
Laryngeal manipulation given	Device				Total		χ^2	df	*p*
	Video		Direct						
	n	%	n	%	n	%			
Yes	10	20	47	94	57	57	55.855	1	0
No	40	80	3	6	43	43			
Total	50	100	50	100	100	100			



Graph 2: Comparison of number of attempts for intubation



Graph 3: Comparison of Laryngeal manipulation given for intubation



Graph 4: Comparison of Cormack Lehane View in both groups

Table 4: Comparison of both groups in terms of Cormack Lehane View

Cormack lehane view	Device				Total		χ^2	df	*p*
	Video		Direct						
	n	%	n	%	n	%			
1	49	98	2	4	51	51	88.474	2	< 0.001
2	1	2	24	48	25	25			
3	0	0	24	48	24	24			
Total	50	100	50	100	100	100			

Discussion

Depending on the management, tracheal intubation in patients with difficult airways can lead to airway trauma or even a life threatening disaster.[2] Therefore, on the one hand, difficult airway management guidelines have been developed, while on the other hand video assisted devices which facilitates easy tracheal intubation have been developed. The rationale behind the development of these devices is to abandon the need for the alignment of the optical axis to receive a direct view of the glottis.[2]

Difficult Airway

Difficult airway is defined as the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with facemask ventilation of the upper airway, difficulty in tracheal intubation or both.[6]

Difficult Laryngoscopy is defined as not being able to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy.[7] Difficult laryngoscopy is most commonly defined as presence of a Grade 3 or 4 view on laryngoscopy.

Difficult intubation[7] is defined as tracheal intubation requiring multiple attempts in the presence or absence of tracheal pathology.

Failed intubation[7] is failure of placement of the tracheal tube after multiple intubation attempts.

Attempt[7] of intubation is defined as physical placement and removal of the laryngoscope blade.

Anesthesia in a patient with a Difficult Airway (DA) can lead to direct airway trauma and morbidity from hypoxia and hypercarbia which can lead to increased incidence of brain damage, cardiac arrest and death.

The inability to manage a difficult airway is responsible for a large proportion of deaths and morbidity directly attributable to anesthesia.

Table 5: Predictors of difficult Intubation

Criteria	Suggestion of difficult intubation
History of difficult intubation	Positive history
Length of upper incisors	Long
Inter incisor distance	Less than two finger breadths (< 3 cm)
Overbite	Maxillary incisors override mandibular incisors
Temporomandibular joint translation	Inability to extend mandibular incisors anterior to maxillary incisors
Mandibular space	Small, indurated, encroached upon by mass
Cervical vertebral range of motion	Inability to touch chin to chest or extend neck
Thyromental distance	Less than three finger breadth (< 6 cm)
Mallampati-Samsoon classification	Mallampati III/Samsoon IV — relatively large tongue: uvula not visible
Neck	Short, thick

Special situations of difficult intubation include morbid obesity, pregnancy, lingual tonsil hypertrophy, burns, epiglottitis, ludwig's angina and rheumatoid arthritis, (Table 5).

Airway Examination

The airway examination and prediction of intubation difficulty can be assisted by mouth opening, Upper lip bite test, Mallampati classification, Atlanto-occipital joint extension, mandibular space (includes thyromental distance and the horizontal length of the mandible), mento-sternal distance and hyomental distance.

Upper lip bite test — (Fig. 1)

Class 1: Lower incisor can bite upper lip above the vermilion line;

Class 2: Lower incisor can bite upper lip below the vermilion line;

Class 3: Lower incisor cannot bite the upper lip.

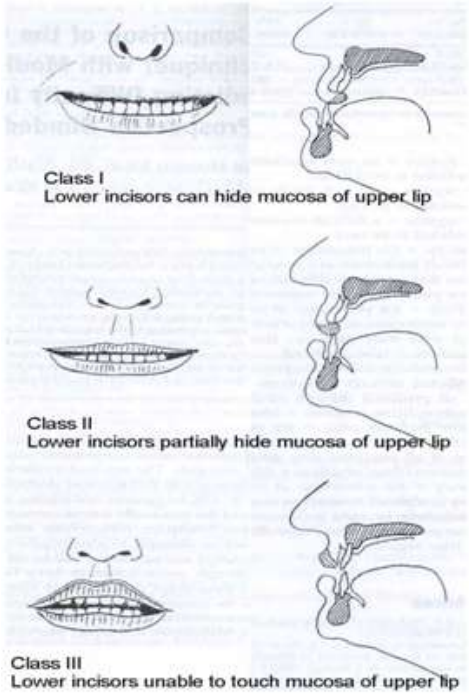


Fig. 1: Upper lip bite (ULB) Test

Modified Mallampatti test

Shown as in (Fig. 2), Mallampatti classification denotes tongue size relative to pharyngeal size. This test is performed with the patient in the sitting position, head in neutral position, the mouth wide open and the tongue protruding to its maximum. Patient should be instructed not to phonate as it can result in contraction and elevation of the soft palate leading to a spurious picture. Classification is assigned according to the extent the base of tongue is able to mask the visibility of pharyngeal structures. There are four classes:

Class I: Visualization of the soft palate, fauces, uvula, anterior and the posterior pillars;

Class II: Visualization of the soft palate, fauces and uvula;

Class III: Visualization of soft palate and base of uvula;

Class IV: Only hard palate is visible. Soft palate is not visible.

To avoid false positive or false negative results, this test should be repeated twice. It is very difficult to measure the size of the posterior part of the tongue relative to the capacity of the oropharynx, this method of assessment gives an indirect means of evaluating their relative proportionality. The exposure of the glottic inlet will be relatively easy, if base of the tongue is proportional to the oropharynx, and there is no other confounding factors. A disproportionately large base of the tongue overshadows the larynx and makes the angle between the two more acute, preventing easy exposure of the larynx.

Fig. 2: Mallampati classification (Class I–IV)

Videolaryngoscopy[8–14]

In recent years, indirect videolaryngoscopy plays an increasingly more important role in the management of patients with an unanticipated difficult airway. Video Laryngoscope intubation blades incorporate optics in their tip used for video imaging on a monitor. The view angle is increased from *15 degrees* during direct laryngoscopy into *60 degrees* during videolaryngoscopy. This distal point of viewing has been proven advantageous in improving glottic view and upgrading of Cormack and Lehane (C and L) grades compared to Direct Laryngoscopy (DL), (Fig. 3).

Fig. 3: Video Laryngoscope

Video laryngoscopes resemble traditional laryngoscopes and have a micro chip embedded in the tip of laryngoscope blade. This transmits magnified images to a display screen where they can then be viewed or recorded. The alignment of the oral, pharyngeal and laryngeal axes for a line-of-sight is not essential for video laryngoscope as the camera is positioned a few millimeter from the vocal cords. This enables the operator to "look around the corners" which previously was not possible with conventional direct laryngoscopy. The laryngoscope tipis inserted into the mouth in the midline, superior to the tongue, and later rotated towards the larynx in a sagittal plane to make the epiglottis visible. The blade is inserted into the mouth under direct vision till the uvula to avoid trauma. After this the operator looks into the screen or the view piece to see the further course of the blade tip and the tube. As in direct laryngoscopy the tip of the video laryngoscope blade is inserted up to the vallecula. For getting glottic view further rotation, and a minimal force may be given along the long axis of the handle, to lift the epiglottis. After getting a good view the endotracheal tube is inserted from the right side of the mouth looking at its tip as far as it is visible directly to avoid trauma. Once out of sight the operator looks in the screen to see the tube tip as it is passed under vision between the cords. The black line can be ascertained to be at the cords. There is a blind spot at which the tube tip cannot be seen. Chances of trauma is there while the endotracheal tube traverses the "blind spot"

after passing through the oral cavity, before being visible on the screen.[15] Confirmation of the correct placement of the tracheal tube should be both visual, and by the use of capnography, (Fig. 4).

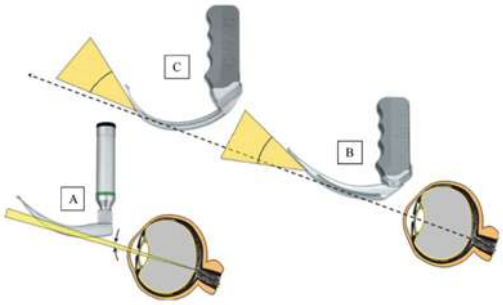


Fig. 4: Angles of different laryngoscopes

A. Direct laryngoscopy **B.** Video Laryngoscopy (60°) with Macintosh blade **C.** C Mac with D blade

Our results show that video laryngoscopy provided an enhanced view of the cords, increased intubation success and slightly increased time for tracheal intubation {from opening of the mouth to inflating cuff} in difficult airway scenarios. Failed intubations in our scenarios we found is most commonly because of maneuvering the endotracheal tube through the vocal cords. It is a technology quickly learned, but requires some practice. We chose the three techniques together to predict the difficult intubations. According to the conclusions of Leopald HJ Eberhart *et al*.[16] single predictors like Modified Mallampatti Score or Upper lip bite Test won't be sufficient enough to correctly predict the difficult airway in all the patients. So, we chose Modified Mallampati Test, Upper Lip Bite Test and Neck Extension Grade all together to predict the difficult airway.

Optimising manoeuvres were the external manipulation of the larynx (BURP manoeuvre), use of gum elastic bougie and changes in head positioning. According to A Jungbauer, M Schumann *et al*., optimizing manouevre needed with Video Laryngoscopy was significantly lower than Direct Laryngoscopy.[2] This lack of experience using video Laryngoscopy may account for the increase in time to intubation.

Though an equal or improved view of the cords are screen, intubation time is increased in neck immobility scenarios in ours as well as other studies.[17–20] One study noted that maneuvering the tube was the barrier to successful intubation, as 14 of 26 the failures in a large series occurred with CL Grade I view.[17] The manufacturer suggests curving the endotracheal tube over a stylet at a *60 degree* angle to match that of the blade.[17] Other suggested methods to ease the procedure include using a more rigid stylet, using a "hockey stick" configuration with *90 degree* distal curvature or rigid stylet with flexible tip.[17,21–23]

During our study, we also find difficulty in guiding the endotracheal tube to the vocal cords, with Cormack Lehane Grade I view. The structures like arytenoid cartilages, the inter-arytenoid soft tissues, anterior commissure of the glottis or the anterior wall of the cricoid cartilage sometimes interfere with guiding the ETT into the trachea.

By regular practice we found the method of insertion through bending the stylet along with the curvature of blade. Later on there was significant reduction in time compared to the earlier cases. Even though our study got Decreased time for Direct Laryngoscopy than Video Laryngoscopy, we found on regular practice with Video Laryngoscope, it not only improved laryngeal exposure and first attempt success rate but also shorten tracheal tube insertion time. In a study by Stroumpoulis[24] the rate of failed intubation using Video Laryngoscopy in 112 patients with predictors of a difficult airway was only 2%. A 99% intubation success rate was reported by Jungbauer and colleagues,[2] in their study in which Macintosh video laryngoscope was used in patients with a Mallampati score of 3 or 4. Kaplan *et al*., found an improvement in laryngoscopic view by video laryngoscopy with a Macintosh blade in 865 unselected patients. They also reported a rate of failed intubation of only 0.3%.[25]

It is more distinct in difficult airway scenarios where the video Laryngoscopes are most beneficient regarding successful intubation. One group of students studied had greater ease of intubation and successful intubation using the Video Laryngoscope in simulated Cormack Lehane Grade III airways.[20] Another study showed that anesthetists using the Video Laryngoscope took less time to intubate, had a slightly higher success rate and found intubation easier in the simulated difficult scenarios (Grade III view) when compared with the Macintosh Laryngoscope in patients with simulated difficult airways by using in-line manual stabilization of the head and neck.[26]

Conclusion

In our opinion Video Laryngoscope will become the "gold standard" for all intubations, not limited to those predicted to be "difficult airway". It is an ideal tool in institutions, Operation Theatres, Emergency Departments and Intensive Care Units for learning and teaching endotracheal intubation.

Video Laryngoscope is far superior to the exclusive 'look over my shoulder' training available with Direct Laryngoscope alone. Additionally, Video Laryngoscope can be used as a research tool in airway management. Hemodynamic responses post Laryngoscopy also significantly decreased with Video Laryngoscopy, because of the first attempt success. Airway trauma related to repeated laryngoscopy is avoided by Video Laryngoscopy. Even though our study shows increases time for Video Laryngoscopy, it may be due lack of experience with the gadget. Regular practice in difficult airway scenarios with Video Laryngoscopy will decreases the time for intubation than that of Direct Laryngoscopy and ultimately this can significantly decrease the anesthesia related morbidity and mortality.

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Comparison of Injectable Aceclofenac Vs Injectable Diclofenac in Post-operative Analgesia Following Laparoscopic Abdominal Surgeries

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Abstract

Introduction: To date various modalities of treatment are available ranging from opiods, multimodal therapy and Non-steroidal Anti-inflammatory Drugs (NSAIDs). Still NSAIDs are popular choice as they are easy to administer and their effects can easily be monitored. *Aims:* The aim of the present study is to "Compare intramuscular administration of Injectable Aceclofenac with Injectable Diclofenac in Post-operative Analgesia in patients undergoing Laparoscopic Abdominal Surgeries the efficacy and duration of action. *Materials and Methods:* It is a double blind prospective randomized study was conducted on 50 patients divided into two Groups of 25 each. Group I aceclofenac, Group II Diclofenac. Study done to compare the relative efficacy of injection aceclofenac and injection Diclofenac by intramuscular route for post-operative analgesia in patients undergoing laparoscopic abdominal surgeries. *Results:* The quality of analgesia with injection aceclofenac is better than that of injection Diclofenac post-operatively. Both the Groups exhibited hemodynamic stability. Incidence of rise inpulse rate and MAP in the post-operative period was higher with injection Diclofenac than Injection Aceclofenac. Injection aceclofenac in our study scores over injection Diclofenac in providing better quality of analgesia injection consistent with the pharmacokinetic profile of all the patients in Group II Diclofenac required for an additional dose of analgesic after 8 *hours*. Early ambulation was possible in both the Groups. The analgesia with injection aceclofenac is sustained over longer periods of time upto 24 hours. A single dose is required. *Conclusion:* We conclude that there is definite place for long acting NSAIDs like Injection Aceclofenac 150 *mg*/3 *ml* in the post-operative analgesia for patients undergoing laparoscopic abdominal surgeries in view of its good quality of analgesia, sustained and prolonged duration action upto 24 *hours* and better gastrointestinal tolerance.

Keywords: Aceclofenac; Diclofenac; Laparoscopic Abdominal Surgeries.

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Introduction

Optimal pain relief is a prerequisite for early post-operative recovery especially in patients undergoing Laparoscopic abdominal surgeries as these patients suffer from considerable pain most intense during the first *24 hours*. To date various modalities of treatment are available ranging from opiods, multimodal therapy and Non-steroidal Anti-inflammatory Drugs (NSAIDs). Still NSAIDs are popular choice as they are easy to administer and their effects can easily be monitored.[1]

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Aceclofenac is good and safe NSAID with negligible side effects on the kidney, liver and GIT. It is more popular than Diclofenac when used orally and can also be used for two to four weeks safely without any deleterious side effects. Earlier it was launched in the injectable form for intramuscular use as *1 ml* ampoules containing *150 mg* of Aceclofenac. The drug was intended only for deep intragluteal, intramuscular injection. In view of the severe pain caused due to the intramuscular injection, the drug never became popular and had a poor acceptance from both the doctor and patient.

Relief from pain is by far the most frequent indication for surgical intervention, regardless of the nature of the operation. The incidence of post-operative pain varies with the individual patients, but is largely governed by the site and nature of the operation. Pain after surgery is largely result of direct injury caused to the tissues, but may be further aggravated by associated reflex muscle spasm or visceral distension. Its manifestation of autonomic, psychological and behavioral responses results in unpleasant sensory and emotional experience. It is of two characteristic types, a dull steady pain at rest or more severe stabbing pain associated with movement.[2] Post-operative pain is self limiting phenomenon, most intense during the first *24 hours* and diminishes during the next *24 hours*. Pain is minimal after *3–4 days* following surgery. Post-operative pain is often associated with increased incidence of other unpleasant symptoms like nausea, vomiting, sweating and can be cause of post-operative hemodynamic alterations.

Benefits from adequate pain control includes improvement of Post-operative pulmonary function, decreased length of post-operative stay in hospital, accentuation of the stress response to surgery, Improvement in recovery after surgery, maintenance of immune competence and earlier mobilization, which may lead to a decreased incidence of thrombotic sequel. NSAIDs are an important component in pharmacological management of post-operative pain.

NSAIDs are mainly used for chronic inflammatory painful conditions. Acute pain over short-periods of time like mild to moderate post-operative pain is usually controlled by injectable preparations. Diclofenac and Aceclofenac have already proven their worth in osteoarthritis and rheumatoid arthritis. Injectable Diclofenac is being used for intra-operative and post-operative analgesia for many years now as part of balanced multimodal analgesia.

Injectable Aceclofenac is the newer non-steroidal/non-narcotic agent with good analgesic potency extending up to *twenty four hour* duration. Recently *150 mg/3 ml* stable lyophilized aqueous injections have been developed. However, there has been no proper evaluation of this drug for the treatment of post-operative pain. The present study is undertaken to evaluate the efficacy and duration of action of intramuscular injectable Aceclofenac in comparison to intramuscular injectable Diclofenac.

Materials and Methods

The present study to compare the relative efficacy of injection aceclofenac and injection Diclofenac by intramuscular route for post-operative analgesia in patients undergoing laparoscopic abdominal surgeries was undertaken at Osmania General Hospital in the *year 2014*. After approval from Departmental Ethics committee and written informed consent, a double blind prospective randomized study was conducted on 50 patients divided into two Groups of 25 each. Group I Aceclofenac, Group II Diclofenac.

Inclusion Criteria

ASA Grade I and II, Age group: *25* to *55 years* of either sex in Patients undergoing Elective Laparoscopic Abdominal Surgeries (Cholecystectomy, Inguinal Hernia Repair and Appendectomy under general anesthesia.

Exclusion Criteria

Patients with history of Hypersensitivity to NSAIDs, Peptic Ulcer Disease < GI bleeding or other bleeding disorders, Patients with abnormal liver or renal function tests, Patients on concomitant medication–Aspirin corticosteroids anticoagulants or antihistamines, Any significant abnormality in preclinical trial screening and Patients with Motion sickness and migrane.

All the patients were assessed clinically pre-operatively and presence of any medical disorder and history of drug intake was ruled out. All the patients underwent the following investigation. Hemogram, blood chemistry, μ complete urine examination, *X*-ray chest and pre-operative ECG.

The patients were randomly allocated into two Groups. Night before surgery Group I was advised to take Tablet Aceclofenac *100 mg* orally and Group II was advised to take Tablet Diclofenac *50 mg* orally. Uniform standard

technique of general anesthesia with endotracheal intubation and controlled ventilation was planned for all patients.

On the day of surgery after shifting the patient in to the waiting area of the operation theatre intravenous canulation was done with 18 G cannula and connected to a drip of ringer lactate solution. Pre-medication with glycopyrrolate *4 µg/kg*, ondansetron *15 µg/kg*, ranitidine *1 mg/kg* fentanyl *2 µg/kg* were given slowly intravenously *20 minutes* before induction.

On arrival into operation theatre patient was connected to non-invasive blood pressure monitors, pulse oximeter probe and electrocardiographic leads, (limb lead II). Baseline PR, BP, SpO_2 were recorded. After pre-oxygenating the patient with 100% oxygen for *3 minutes*, patients were induced with IV Thiopentone Sodium *5 mg/kg*. Intubation was facilitated by using vecuronium bromide *0.1 mg/kg*. The lungs were ventilated for 180 seconds. Intubation was achieved with an appropriate size oral cuffed, portex endotracheal tube by the aid of Macintosh Laryngoscope blade. After intubation Group I was given injection aceclofenac *150 mg/3 ml* intramuscularly, Group II was given injection Diclofenac *75 mg/3 ml*.

Anesthesia was maintained with IV vecoronium bromide *0.08 mg/kg* top up doses and intermittent positive pressure ventilation with nitrous oxide and oxygen in the ratio of 66%: 33% and 0.5% isoflurane using circle absorber system connected to the Boyle's Anesthetic workstation. Adequate IV fluids were given, vitals monitored and maintained. At the end of the surgery neuromuscular blockade was reversed with IV neostigmine *60 µg/kg* and IV glycopyrrolate *10 µg/kg*. After satisfying the extubation criterion, trachea was extubated and patients were transferred to Post-anesthesia Care Unit, (PACU). In the post-operative period, oxygen with polymask was given to all patients, vital parameters–PR, BP, degree of analgesia by visual analog score at intervals *of 2, 4, 6, 8, 12,* and *24 hours* was recorded.

In the post-operative period patients were observed for any side effects, or complications. No rescue analgesia was given to either Groups for *8 hours*. After, *8 hours* rescue analgesia of injection Diclofenac *75 mg/3 ml* was given to Group II on demand by the patient or when the visual analog score was more than *5 cm*. At the end of study, all data is compiled and analysed statistically.

Three frequently considered aspects of pain are:

1. Subjective (measured by self report);
2. Behavioral (measured by observation and coding of behavior);
3. Biological (measured by sampling of physiological fluids and electrical potentials).

IASP emphasizes that pain is always subjective and self report measures should be regarded as "Gold Standard".

Subjective pain assessment

Visual analogue scale

VAS is a simple and reliable measure of subjective pain (for adults and children above *8 yrs*). It consists of a *10 cm* horizontal or vertical line with two end points. Requires certain level of cognitive function to co-operate with it.

Visual Analogue Scale

0-No pain

1, 2, 3-Mild pain

4, 5, 6-Moderate pain

7, 8, 9-Severe pain

10-Worst ever felt pain

The data obtained was analyzed using SPSS software version 17.0. Appropriate statistical tests were used to determine the efficacy of drug. Descriptive results are expressed as mean and SD of various parameters in different Groups. Probability value (*p* - value) was used to determine the level of significance *p* - value < 0.05 was considered as significant, *p* - value < 0.01 was considered as highly significant.

Results

Table I: Demographic details in study

Parameter	Group I		Group II		*p* - value
	Mean	SD	Mean	SD	
Age (*yrs*)	38.12	7.84	38.8	8.9	0.77
Pre-OP PR (*min*)	79.7	5.96	80.8	5.03	0.47
Pre-OP MAP (*mm* of *Hg*)	89.2	6.36	89.8	5.64	0.68
Gender					
Male	13	52	13	52	
Female	12	48	12	48	
Type of surgery					
Cholecystectomy	10	40	10	40	
Inguinal hernia repair	9	36	10	40	
Appendectomy	6	24	5	20	

Shown as in (Table 1), the mean age in Group I was 38.2 compared to Group II where the mean age was 38.8 there was no statistical difference in mean ages in either Group ($p > 0.05$). The mean Pre-operative PR in Group I was 79.7 compared to Group II 80.8 ($p > 0.05$). The mean Pre-operative MAP in Group I was 89.2 compared to Group II 89.8 ($p > 0.05$). there was no statistically significant difference in the pre-operative PR and MAP in either Groups. In the present study male to female ratio was same in either Groups, shows in (Table 2).

Table 2: Pulse rate (*per min*) comparison in two Groups at different time interval post-operatively

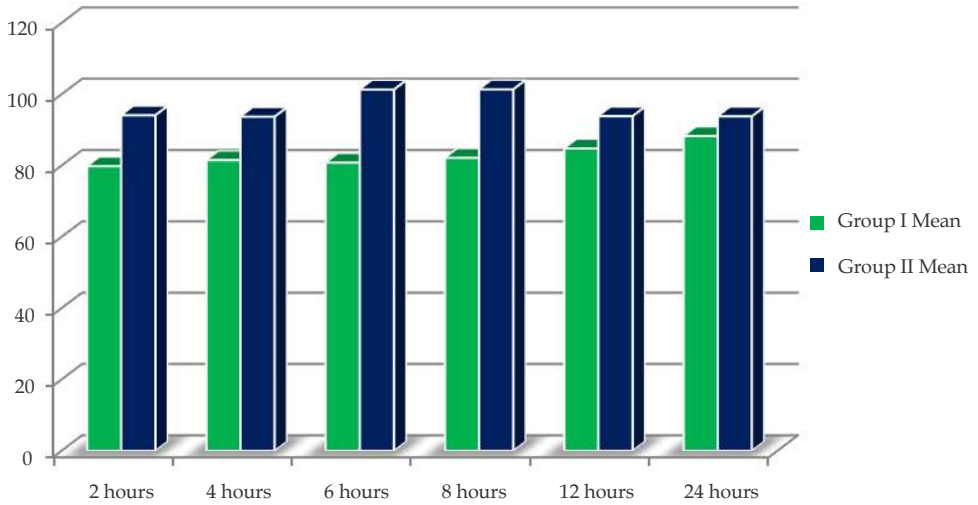
Time	Group I		Group II		t - value	*p* - value
	Mean	SD	Mean	SD		
2 hours	78.44	6.04	80.72	5.51	1.39	0.17
4 hours	77.84	5.91	81.3	5.88	2.08	0.04
6 hours	78.24	5.75	86.04	4.24	5.45	< 0.001
8 hours	78.3	5.43	88.56	3.76	7.7	< 0.001
12hours	79.5	5.09	80.8	5.4	0.86	0.39
24 hours	83.4	6.11	82.7	5.35	0.41	0.67

Pulse rate was compared at different time interval post-operatively it was observed that, Mean pulse rate at *2 hours* in Group I was *78.44/min* compared to Group II *80.72/min* there was no statistical difference in the mean pulse rates at *2 hours* ($p > 0.05$). Mean pulse rate at *4 hours* was significantly lower in Group I *77.84/min* compared to Group II *81.3/min* ($p = 0.04$). Mean pulse rate at *6 hours* was significantly lower in Group I *78.24/min* compared to Group II *86.04/min* ($p < 0.001$). Mean pulse rate at *8 hours* was significantly lower in Group I *78.3/min* compared to Group II *88.56/min* ($p < 0.001$). There was no statistical significance in the mean pulse rates at *12 hours* between Group I *79.5/min* and Group II 80.8, ($p > 0.05$). There was no statistical significance in the mean pulse rates at *24 hours* between Group I *83.4/min* and Group II 82.7, ($p > 0.05$).

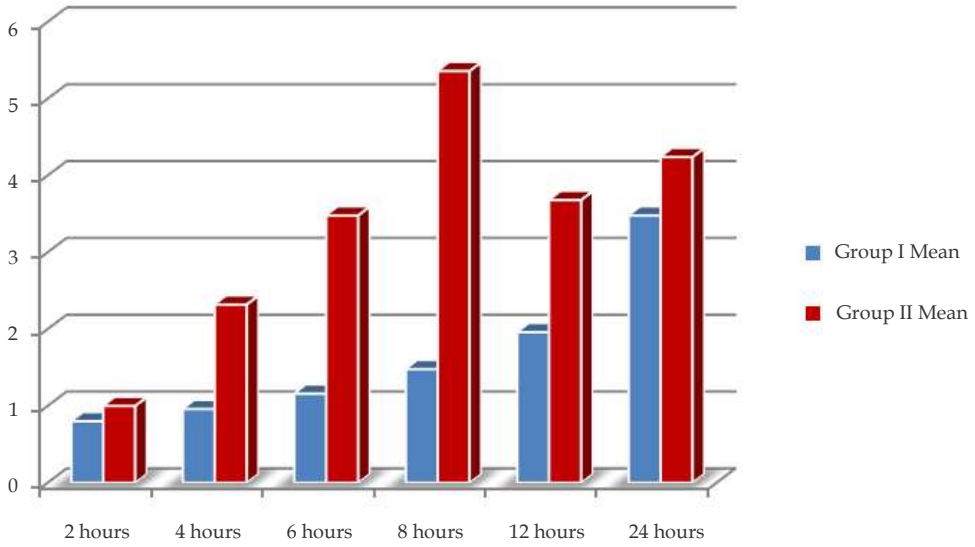
Shown in (Graph 1), mean arterial Pressure was compared at different time interval post-operatively it was observed that, Mean arterial pressure at *2 hours* was significantly higher in Group II *94.1 mm Hg* compared to Group I *79.8 mm Hg* ($p < 0.001$). Mean arterial pressure at *4 hours* was significantly higher in Group II *93.7 mm Hg* compared to Group I *81.5 mm Hg* ($p < 0.001$). Mean arterial pressure at *6 hours* was significantly higher in Group II *101.3 mm Hg* compared to Group I *80.8 mm Hg* ($p < 0.001$). Mean arterial pressure at *8 hours* was significantly higher in Group II *101.3 mm Hg* compared to Group I *82.1 mm Hg* ($p < 0.001$). Mean arterial pressure at *12 hours* was significantly higher in Group II *93.8 mm Hg* compared to Group I *84.8 mm Hg* ($p < 0.001$). Mean arterial pressure at *24 hours* was significantly higher in Group II *93.8 mm Hg* compared to Group I *88.2 mm Hg* ($p = 0.005$).

Table 3: VAS (pain score) comparison in two groups at different time interval post operatively

Time	Group I		Group II		*t* - value	*p* - value
	Mean	SD	Mean	SD		
2 hours	0.8	0.4	1	0	2.44	0.018
4 hours	0.96	0.2	2.32	0.74	8.77	< 0.001
6 hours	1.16	0.37	3.48	1.04	10.44	< 0.001
8 hours	1.48	0.5	5.36	0.63	23.7	< 0.001
12 hours	1.96	0.78	3.68	0.62	8.52	< 0.001
24 hours	3.48	1	4.24	0.96	2.72	0.009



Graph 1: MAP (in *mm Hg*) comparison in two Groups at different time interval post-peratively



Graph 2: VAS score comparison in two groups at different time interval post-operatively

Shown in (Table 3), Pain scoring at different time interval post-operatively was measured using VAS score it was observed that the mean VAS score at *2 hr* in Group I was 0.8, significantly lower than Group II 1.0 (p = 0.018). The mean VAS score at *4 hrs* was significantly lower in Group I, 0.96 compared to Group II, 2.32 p (< 0.001). The mean VAS score at *6 hrs* was significantly lower in Group I, 1.16 compared to Group II, 3.48 p (< 0.001). The mean VAS score at *8 hrs* was significantly lower in Group I, 1.48 compared to Group II, 5.36 p (< 0.001). The mean VAS score at *12 hrs* was significantly lower in Group I, 1.96 compared to Group II, 3.68 p (< 0.001). The mean VAS score at *24 hrs* was significantly lower in Group I, 3.48 compared to Group II, 4.21 p (p = 0.009), displays in (Graph 2).

Discussion

To date various modalities of treatment are available to address the issue of post-operative pain ranging from opiods, multimodal therapy and NSAIDs. Still NSAIDs are popular choice as analgesia for post-operative pain as they are easy to administer and their effects can easily be monitored. The present study was undertaken to compare the relative efficacy and safety of injection Aceclofenac *150 mg/3 ml* with injection Diclofenac *75 mg/3ml* by intramuscular route in post-operative pain relief in patients undergoing laparoscopic abdominal surgeries.

There have been many studies conducted on these two drugs Diclofenac and Aceclofenac. Diclofenac is being used for intra-operative and post-operative analgesia for many years now. It is found to be an effective analgesic and having opioid sparing effect. This fact is supported by various studies such as a study conducted by Anirban Pal *et al*. which concluded Diclofenac to be more effective for post-operative analgesia in patients undergoing lower abdominal gynecological surgeries.[3] Another study by Ozcan S *et al*. concluded that Diclofenac sodium was found to be safe and effective analgesic with lower side-effects.[4]

Newer NSAIDs like Aceclofenac (tablet and injectible form) has been preferred therapy for pain relief in various studies as in the study by Lemmel Em *et al*. Acecloefenac was considered by the patients to be highly efficacious treatment with excellent and fast analgesic activity, well tolerated and low incidence of side effects in the management of inflammatory pain.[6]

Aceclofenac was earlier launched in the injectable form for intramuscular use as *1 ml* ampoules containing *150 mg* of Aceclofenac. The drug was intended only for deep intragluteal, intramuscular injection. In view of the severe pain caused due to the intramuscular injection, the drug never became popular and had a poor acceptance from both the doctor and patient.

The present parenteral form of Aceclofenac is an improvised intramuscular version containing 150 *mg* of Aceclofenac in 3 *ml*, each ml contains 50 *mg*. The ampoule contains urea and sodium citrate as an additive to make it a stable lyophilized aqueous solution thereby minimizing the pain on intramuscular injection, so also, can be given into the Deltoid which is an advantage. It is sustained release injection with improved efficacy, 24 *hours* duration of action and good tolerability profile.

This is supported by the study of Formulation and Evaluation of Aceclofenac Injection Made by Mixed Hydrotropic Solubilization Technique by Rajesh Kumar Maheshwari and Arpna Indurkhya.[6]

Mean pain scores by VAS showed significantly less pain scores in Group I - Aceclofenac when compared to Group II Diclofenac at *2, 4, 6, 8, 12* and *24 hours*. After *8 hours* all the Group II patients were given Injection Diclofenac in *75 mg/3 ml* as rescue analgesia by patient demand or VAS scores more than *5 cm*. This can be explained by the pharmacokinetic properties of both the drugs. The onset of action of injection aceclofenac is *10 minutes* and injection diclofenac is *20 minutes*.

The peak action of Dicloenac being *2 hours*. The peak action of aceclofenac is *1 hour*. Because of sustained release of injection aceclofenac its duration of action is prolonged.

There was no statistical difference in pulse rate at *2 hours*. Both the drugs were have reached the peak action by then. Mean pulse rate was significantly lower at the 4^{th}, 6^{th} *hours* in Group I suggesting the superior analgesia provided by injection Acelclofenac. There was no statistical significance in the mean pulse rate at *12* and *24 hours* between Group I and Group II. This can be explained as rescue analgesia was given to Group II after *8 hours*. Mean arterial pressures were significantly higher in Group II compared to Group I compared to Group I suggesting the excellent analgesia provided by the injection aceclofenac up to *24 hours*. Injection Aceclofenac is better tolerated in the present study. There were almost negligible complications in patients treated by Aceclofenac like pain at injection site. The results of this study shows that patients were treated with Aceclofenac *150 mg/3 ml* tended to have a greater overall percentage reduction in pain intensity and achieved a larger peak pain intensity difference score and prolonged action than by injection Diclofenac *75 mg/3 ml*.

In a study of efficacy and safety of aceclofenac in the treatment of osteoarthritis: A randomized double-blind comparative clinical trial versus diclofenac - An Indian experience by Pareek A *et al*. concluded that Aceclofenac is an effective and well-tolerated drug in osteoarthritis, statistically superior to Diclofenac in terms of compliance.[7]

Another study by V Sharma *et al*. concluded that Aceclofenac in injectable form is superior to Diclofenac in providing post-operative pain relief of severe intensity in patients with lower limb fractures.[8] Furthermore, it possesses a more favorable tolerability profile. It has a long half-life, Therefore, frequency of administration is less. Hence, Aceclofenac represents a better alternative to Diclofenac in patients with severe post-operative pain.[9,10]

Conclusion

Injection aceclofenac in our study scores over injection Diclofenac in providing better quality of analgesia injection consistent with the pharmacokinetic profile of all the patients in Group II Diclofenac required for an additional dose of analgesic after *8 hours*. Early ambulation was possible in both the Groups. Good patient compliance in both the Groups were found. The analgesia with injection aceclofenac is sustained over longer periods of time upto *24 hours*. A single doe is required. From the study we conclude that there is definite place for long acting NSAIDs like Injection Aceclofenac *150 mg/3 ml* in the post-operative analgesia for patients undergoing laparoscopic abdominal surgeries in view of its good quality of analgesia, sustained and prolonged duration action upto *24 hours* and better gastrointestinal tolerance.

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Original Research Article

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Evaluation of Safety and Efficacy of Quick Penetrating Heparin Solution (1000 IU/ml) in Prevention of Intravenous Cannula Related Thrombophlebitis: A Prospective, Randomized, Comparative, Parallel Group Clinical Study

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Abstract

Background and Aims: To evaluate the safety and efficacy of marketed heparin sodium topical solution (1000 *IU/ml*) compared to no heparin topical treatment group for prevention of infusion associated thrombophlebitis. *Methods:* A prospective, randomized, parallel group, comparative, single centre, clinical study. A total 100 patients undergoing intravenous cannulation that has been planned to remain in situ for at least 48 hours indoor period were enrolled. Patients were randomized in Group A (Heparin Topical solution) vs Group B (No Heparin Topical solution). Investigational product was applied on skin around dressing covering intravenous cannulation site approximately every 8 *hours* for the treatment period of 48 *hours*. Patients were evaluated for incidences of infusion phlebitis, first signs of phlebitis and treatment emergent application site reactions and were statistically analyzed for statistical significance, *p* - value below 0.05 levels was considered to be significant. *Results:* Incidences of infusion phlebitis Grade 2 was found to be higher in "no treatment group" than in "Topical Heparin Group" (20 vs 6 patients; $p = 0.00205$). Incidences of first sign of phlebitis grade was found to be higher in "no treatment group" than in "Topical Heparin Group" (48 vs 25 patients; $p = 0.000$). Time to develop first sign of phlebitis was lesser in "No Treatment Group" than in Topical Heparin Group (26 *hr* vs 36 hr; $p = 0.0023$). Also, none of the patient in the Heparin Group develop the thrombophlebitis (Grade IV- advance stage of phlebitis). *Conclusions:* Topical solution of Heparin Sodium 1000 *IU/ml* was found to be effective and safe in preventing infusion related phlebitis.

Keywords: Heparin Topical solution; Superficial thrombophlebitis; Infusion associated thrombophlebitis.

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Introduction

The use of intravenous cannulation is an integral and has become an indespensible part of patient care in hospitals. Peripheral Venous Cannulation (PVC) is a common procedure carried out in hospital to allow rapid and accurate administration of medication.[1] However, the placement of an intravenous cannula can have undesirable effects that can have an adverse impact on the clinical outcome of patients, the most common of which is phlebitis (mechanical, chemical and bacterial) is a common local complication of peripheral intravenous therapy administered through a

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peripheral venous cannula. Among hospitalized patients, 5% to 70% of patients receiving IV therapy develop phlebitis.[2]

Phlebitis is painful, can permanently damage affected veins, requires additional venipunctures at added cost, and can result in an extended hospital stay. Phlebitis symptoms include pain, edema, and erythema (which usually appears as a red streak along the vein), and in severe instances, thrombus formation and "cording" of the vein. There are three different types of phlebitis including mechanical, chemical and infectious. Chemical phlebitis is caused by irrigating medication or solutions such as antibiotics, blood products, glucose containing fluids and rapid infusion rates. Mechanical phlebitis is results from long periods of cannulation, cannula in flexed areas, catheter gauges larger than the vein lumen and poorly secured catheters. Bacterial phlebitis results from poor hand hygiene, lack of aseptic technique, failure to check all equipment before use and failure to recognize early sign and symptoms of phlebitis.[3]

Minimizing a patient's risk of developing phlebitis and early identification and treatment of the condition when it does occur improve patient outcomes and help minimizing the costs. The different modalities for prevention of phlebitis, includes the discontinuation of intravenous catheter and restarting it in another site, applying a warm moist compression to the affected site, administration of analgesics and local application of anticoagulant. Evidence suggests that the addition of drugs such as heparin can reduce the incidence of phlebitis.[4]

Heparin which is a non-uniform mixture of straight chain mucopolysaccharides reduces the superficial thrombophlebitis. It acts by its anti-inflammatory actions and by preventing coagulation rather than lysing a formed clot. So, if topical heparin is started prophylactically even before thrombophlebitis sets in, *i.e*. from *day 1* of intravenous cannula insertion it can prevent or postpone thrombophlebitis more effectively.[5]

In our study, the efficacy and safety of Heparin Sodium Topical solution (*1000 IU/ml*) compared to No Heparin Topical Treatment Group in preventing infusion associated phlebitis was evaluated.

Materials and Methods

This study was conducted at Department of Anesthesiology, Parul Sevashram Institute of Medical Science and Research Hospital, Waghodia-Gujarat ethical clearance from Parul University Institutional Ethics Committee for Human Research. The trial was registered in Clinical Trial Registry-India (CTRI) with the registration number CTRI/2017/10/010089.

The study was conducted in accordance with the Good Clinical Practice (GCP) guidelines issued by the Central Drugs Standard Control Organization (CDSCO), Ministry of Health, Government of India, and the ethical standards laid down in declaration of Helsinki 1975 as revised in 2013; and Ethical guidelines for biomedical research on human participants issued by Indian Council of Medical Research (2006), New Delhi.

This prospective, randomized, evaluator blind, parallel group, comparative safety-efficacy clinical study was conducted on 100 patients of either sex undergoing cannulation of peripheral vein that has been planned to remain in situ for at least *48 hours* of indoor period, belonging to age group of *18* to *65 years*.

All patients were explained the procedure clearly and written informed consent was obtained from each patients before their participation in the study. During screening, medical history was obtained; Physical examination and laboratory investigations were performed.

Patients with known hypersensitivity or contraindications to heparin were excluded. Patients who are on anticoagulants and required topical anti-inflammatory agent were also excluded. The women of child bearing age underwent the urine pregnancy test; the pregnant and lactating women were excluded from the study.

The patients were enrolled after verification of eligibility criteria. Enrolled patients were equally randomized using computer generated simple randomization sheet to receive either topical heparin QPS *1000 IU/ml* (Phlebotroy QPS, manufactured by Troikaa Pharmaceuticals Ltd, Ahmedabad, India) or no topical heparin.

Group A included 50 patients who received topical heparin *1000 IU/ml* and Group B included 50 patients who did not receive topical heparin.

All patients enrolled in the study were cannulated on back of the hand with intravenous cannula no. 18 supplied by same manufacturer as far as possible. For intravenous infusion through the cannula infusion set of the same manufacturer was used in all enrolled patients as far as possible. Treatment with any of the following was started immediately on cannulation. In Group A Heparin Sodium Topical QPS (*1000 IU/ml*) was applied

around intravenous cannula insertion site immediately after cannulation and thrice daily thereafter, for a period of *48 hrs* in addition to standard care for prevention of thrombophlebitis as per Hospital Protocol. 6 to 8 drops of topical solution was applied on skin over the cannulated vein approximately every *8 hours* for the treatment period of *48 hours* (total 7 doses). Group B did not receive application of any Heparin Topical solution. However, Patients received the standard care for prevention of thrombophlebitis as per Hospital Protocol.

The grade of the lesion using Phlebitis Scale as per "Standards for Infusion Therapy" by Royal College of Nursing IV Therapy Forum, July 2003 was noted at baseline and on every *8 hours* for *48 hours* after initiation of treatment. In this phlebitis scale, Grade 0 indicates no sign of phlebitis; Grade 1 indicates possibly the first sign of phlebitis; Grade 2 indicates early stage of phlebitis; Grade 3 indicates medium stage of phlebitis; Grade 4 indicates advance stage of phlebitis or stage of thrombophlebitis; Grade 5 indicates advanced stage of thrombophlebitis.[6]

Patient found to have infusion phlebitis Grade II or above as per visual infusion phlebitis scale, were discontinued from the study.

The Primary efficacy end point were proportion of patients found with infusion phlebitis (Grade II and above) during *48 hours* of treatment period and the mean time to reach infusion phlebitis grade in hours. The Secondary efficacy end point was the incidence of first signs of phlebitis (Grade I). The Safety endpoints evaluated for the proportion of patients with application site reaction.

Statistical Analysis for statistical significance was carried out with the help of Chi-square Test and student *t* - test. *p* - value below 0.05 levels was considered to be significant.

Results

The number of patients screened in both Group A (topical solution of heparin *1000 IU/ml*) and Group B (No treatment group) were 50 each. Out of these screened patients, 2 patients from Group A were dropped due to non-eligibility. Hence, 48 patients were enrolled in Group A and 50 patients were enrolled in Group B. Demographic data showed equal distribution of patients in both the arms in terms of age and sex, shows as in (Table 1).

Table 1: Demography of the patients

Parameter	Group A (Topical Solution of Heparin *1000 IU/ml*)	Group B (No Treatment)	*p* - value
Age in *Years*	38.29 ± 14.14	38.16 ± 14.14	0.9633*
Gender (M/ F)	29/19	31/19	0.87224**

*Data analyzed by unpaired '*t*' test

**Data analyzed by Chi-square test

Primary Efficacy Evaluation

Incidence of infusion thrombophlebitis (Grade II and above) during 48 hours of treatment period: The patients who were treated with Topical Heparin solution 1000 IU/ml had significantly lesser incidence of Grade II or above thrombophlebitis as compared to no treatment Group ($p < 0.05$), shows in (Table 2).

Table 2: Between group comparison for incidence of thrombophlebitis (Grade II or above) as determined by Visual Infusion Phlebitis Scale

Incidence of Thrombophlebitis (Grade II or above)	Yes	No	Proportion of patients with thrombophlebitis	*p* - Value
Group A (*n* = 48)	6	42	0.125	0.00205*
Group B (*n* = 50)	20	30	0.4	

Group A: Topical Heparin Solution *1000 IU/ml*

Group B: No Treatment

* Data analyzed by Chi-square test

Secondary Efficacy Evaluation

Incidence of Grade I phlebitis during *48 hours* of treatment period: The patients who were treated with Topical Heparin solution *1000 IU/ml* had significantly lesser incidence of Grade I phlebitis as compared to no treatment Group ($p < 0.05$), shows in (Table 3).

Table 3: Between group comparison for incidence of Grade I phlebitis as determined by Visual Infusion Phlebitis Scale

Incidence of Grade I Phlebitis	Yes	No	Proportion of patients	*p* - Value
Group A (n = 48)	25	23	0.521	0.00*
Group B (n = 50)	48	2	0.96	

Group A: Topical Heparin Solution 1000 *IU/ml*

Group B: No Treatment

* Data analyzed by Chi-square test

Meantime to develop infusion phlebitis (Grade I or above) in hours: The patients who were treated with topical heparin solution *1000 IU/ml* took significantly more time to develop infusion phlebitis (Grade I or above) as compared to no treatment

Group ($p < 0.05$). For patient's not reaching Grade I by *48 hours*, it was taken as *48 hours*, (Table 4).

Table 4: Between group comparison for meantime to develop infusion phlebitis (Grade I or above)

Mean ± SD Time to Develop Phlebitis (In hours)		t - value	p - value
Group A (Topical Heparin Solution 1000 IU/ml)	Group B (No Treatment)		
36.167 ± 16.41	26.24 ± 14.90	3.13	0.0022

Safety Evaluation

Incidence of treatment emergent adverse events was not reported in any groups during the treatment period.

Discussion

The topical formulation of Heparin Sodium *1000 IU/ml* was found to be effective and safe in preventing incidence of cannula related phlebitis. Topical solution of Heparin Sodium *1000 IU/ml* was found to significantly better than "No Treatment" in both the primary and secondary efficacy endpoints. The statistical analysis revealed that the patients who were treated with Topical Heparin Sodium *1000 IU/ml* has significantly lesser incidence of thrombophlebitis (Grade II or above) as determined by Visual Infusion Phlebitis scale.

Furthermore, it was also revealed that the patients who were treated with topical Heparin Sodium *1000 IU/ml* had significantly lesser incidence of phlebitis (Grade I) as compared to other Group. It has been observed that patients treated with Heparin Sodium *1000 IU/ml* took significantly greater time to develop first sign of phlebitis as compared to no treatment Group. No treatment emergent adverse event has been reported in any Groups.

Conclusion

Topical solution of Heparin Sodium *1000 IU/ml* is effective and safe in preventing cannula related phlebitis in comparison with No Treatment Group.

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Original Research Article

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Ketamine 0.5 mg.kg^{-1} as Co-induction Agent with Propofol 2.5 mg.kg^{-1} Vs Propofol 3.5 mg.kg^{-1} for Laryngeal Mask Airway Insertion in Children: A Clinical Comparative Study

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Abstract

Introduction: Propofol is the widely used induction agent for smooth insertion of laryngeal mask in children who require a larger dose compared to adults[1–3] and hemodynamic and respiratory effects like hypotension,[2,4] bradycardia, apnoea, hypoventilation[4] may be exaggerated. The present study was undertaken with the objectives to assess (i) effectiveness of ketamine as a co-induction agent in lowering the induction dose of propofol while producing favorable insertion characteristics for Laryngeal Mask Airway insertion in children (ii) safety in producing hemodynamic stability (iii) recovery of the patient. *Methods:* ASA I and II, aged 3–10 years children posted for elective short surgical procedures were allocated randomly into two groups of 30 each. Patients in Group P received propofol 3.5 mg.kg^{-1} and Group KP received intravenous ketamine 0.5 mg. kg^{-1} two minutes prior to propofol 2.5 mg.kg^{-1}. LMA insertion characteristics assessed in the next 30s using (1) "mouth opening" graded on a three-point scale-full, partial and impossible (2) "the ease of LMA insertion" graded on a four-point scale-easy, some difficulty, difficult and impossible. The hemodynamic parameters recorded immediately after ketamine, propofol (0 min), thereafter at 1 minute interval for 5 minutes. At the end of surgery, LMA removed once the child was adequately recovered. Statistical evaluation done using Frequencies and Crosstabs, Paired Sample *t* - test and Repeated measure ANOVA. *Results:* Ketamine as a co-induction agent with propofol produced favorable conditions for smooth insertion of laryngeal mask in children while providing greater hemodynamic stability.

Keywords: Co-induction; Ketamine; Propofol; Laryngeal mask airway.

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Introduction

Various induction methods are available for induction of anesthesia and Laryngeal Mask Airway (LMA) insertion. The widely used intravenous induction agent Propofol facilitates smooth insertion of laryngeal mask in children who will require a larger dose of propofol compared to adults when used as the sole agent[1–3] and the hemodynamic and respiratory effects like bradycardia, hypotension,[2,4] hypoventilation,[4] apnoea may be exaggerated. The addition of a small dose of other anesthetic agent (in sub-anesthetic doses) or a sedative *viz*. ketamine, propofol (auto co-induction), midazolam, fentanyl,

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alfentanil greatly reduces these side effects by reducing the requirement of the induction agent[4–11] and is known as co-induction.[7] Ketamine *via* additive action[4,6–9] reduces the dose of Propofol required for induction**.** The hemodynamic stability provided thereby improves the ratio of desired *vs* adverse effects with variable effect on recovery.

Hence, the present clinical comparative study was undertaken to study the effectiveness of ketamine as co-induction agent with propofol *vs* propofol alone for laryngeal mask insertion in children with objectives to assess (i) the effectiveness of ketamine as a co-induction agent in lowering the induction dose of propofol while producing favorable insertion characteristics for Laryngeal Mask Airway insertion (ii) the safety in producing hemodynamic stability (iii) the recovery of the patient.

Materials and Methods

This clinical study was conducted on sixty children of age *3 years* to *10 years* of either gender scheduled for elective short surgical procedures like circumcision, herniotomy, hydrocele disconnection, orchidopexy and rectal polyp excision under general anesthesia, belonging to ASA Grade I and II admitted at McGann Teaching Hospital attached to Shivamogga Institute of Medical Sciences, Shivamogga during *June 2015* to *May 2017*. The institution scientific and ethical committee approval obtained for the conduct of study and informed consent from child's parent/ guardian was also taken.

Children of age less than *3 years* or more than *10 years*, belonging to ASA Grade other than I and II and subjects with full stomach, allergy to egg or lignocaine, hyper reactive airway disease, epilepsy, head injury/raised ICP and neuromuscular diseases were exclusion criteria.

The children were allocated randomly by a computer generated random table into two Groups of 30 patients each:

Group P (n = 30): Received intravenous propofol *3.5 mg.kg*$^{-1}$

Group KP (n = 30): Received intravenous ketamine *0.5 mg.kg*$^{-1}$ *two minutes* prior to intravenous injection propofol *2.5 mg.kg*$^{-1}$

All children were assessed for pre-anesthetic fitness on previous day and the subjects were pre-medicated with Syrup Promethazine *0.3 mg.kg*$^{-1}$ orally at night before surgery and EMLA cream with occlusive dressing applied over identified peripheral line on the dorsum of both hands *1 hour* before surgery.

The child received in the operating room, an intravenous line secured and multi-channel monitor for heart rate, Non-invasive Blood Pressure (NIBP), oxygen saturation and continuous ECG monitoring connected.

All the basal parameters noted and pre-oxygenated for *3 minutes* using appropriate size facemask and breathing circuit, induced with propofol *3.5 mg.kg*$^{-1}$ given intravenously over *30 seconds* in Group P or ketamine *0.5 mg.kg*$^{-1}$ intravenously and *2 minutes* later, propofol *2.5 mg.kg*$^{-1}$ given IV over 30 seconds in Group KP. Inj 1% lignocaine *0.5 mg.kg*$^{-1}$ was added to propofol to prevent the pain on injection. The appropriate size laryngeal mask airway (#2 if child weighed *10–20 kg*, #2.5 if child weighed *20–30 kg*) was inserted after another *30 seconds* as per standard insertion technique advocated by Archie Brain.

The insertion characteristics were compared among the two Groups using:

1. Extent of Mouth opening graded on three point scale;
2. Ease of laryngeal mask airway insertion graded on four point scale as given under assessment.

A bolus of *0.5 mg.kg*$^{-1}$ propofol was given, if failed on first attempt. LMA use abandoned and alternative technique considered if insertion graded impossible.

Patients allowed to breath spontaneously under anesthesia maintained using 66% nitrous oxide and 33% oxygen, assisted if in apnoea. No stimulus was allowed during *5 minute* study period. Halothane 0.5% to1.5% added later as per requirement. LMA was removed once the child adequately recovered *i.e.*, being awake and breathing spontaneously with adequate tidal volume. The child was observed for *30 min* in the recovery room for any post-operative undesirable responses before transfer to post-operative ward.

Assessment of LMA insertion characteristics

1. Extent of mouth opening graded on Three Point Scale;
   - Full (fully relaxed jaw);
   - Partial (some resistance);
   - Impossible.
2. Ease of insertion of laryngeal mask graded on Four Point Scale:
   - Easy (placement at first attempt);
   - Some difficulty (placement at second attempt);

– Difficult (more than two attempts);
– Impossible.

Hemodynamic monitoring

Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP), Oxygen saturation (SpO_2) were recorded at basal, immediately after ketamine, *zero minute* (immediately after propofol), *one, two, three, four, five minutes* after propofol and the readings compared within the group and between the Groups P and KP.

- Hypotension was defined as > 20% fall in systolic blood pressure compared to basal value;
- Bradycardia was defined as heart rate less than *60 bpm*;
- Duration of anesthesia–from induction to removal of LMA;
- Duration of surgery–from surgical incision to closure.

Statistical evaluation of the observations done using Frequencies and Crosstabs, Paired Sample *t* - test and Repeated measure ANOVA.

Results

The demographic data: Mean age, mean weight and gender distribution of the children in two groups were comparable (Table 1) and $p > 0.05$.

Table 1: Demographic data

Demographic data	Group P (n = 30)	Group KP (n = 30)
Gender (Male/Female) *(%)	76/24	82/18
Mean Age (*years*)	7	7.5
Mean Weight (*kgs*)	18	18.5

The LMA insertion characteristics assessed: The mouth opening was full in 93.3% of patients in Group P and 96.7% of patients in Group KP while the mouth opening was partial in 6.7% and 3.3% in Group P and KP respectively (Table 2). The mouth opening was not found to be impossible in either groups. The extent of mouth opening was not statistically significant between Groups P and KP ($p > 0.05$).

Table 2: Showing Extent of Mouth opening for LMA Insertion

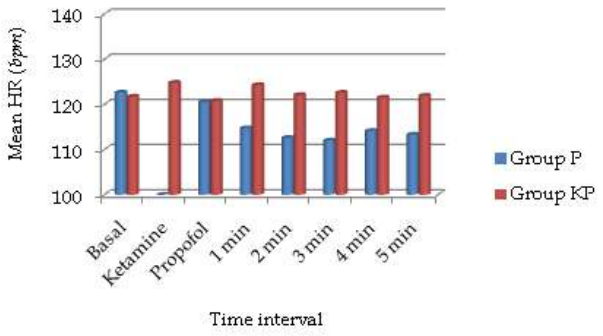
Scale	Group P n (%)	Group KP n (%)
Full	28 (93.3)	29 (96.7)
Partial	2 (6.7)	1 (3.3)
Impossible	0	0

The LMA insertion was Easy in 93.4% in Group P and 96.7% in Group KP. Some difficulty was observed in 3.3% in both the Groups and was Difficult in 3.3% of cases in Group P and none in Group KP. The insertion of LMA was not impossible in both the Groups (Table 3).

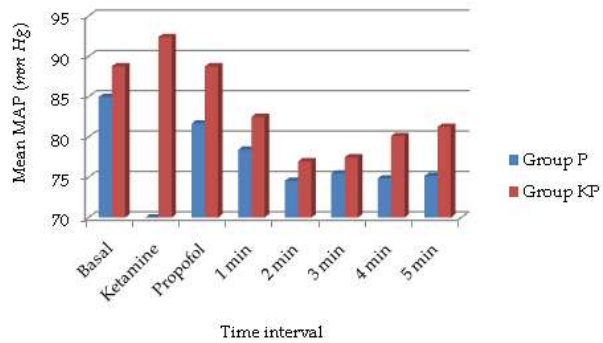
Table 3: Showing ease of insertion of Laryngeal Mask Airway

Scale	Group P n (%)	Group KP n (%)
Easy	28 (93.4)	29 (96.7)
Some difficulty	1 (3.3)	1 (3.3)
Difficult	1 (3.3)	0
Impossible	0	0

The mean heart rate and the mean arterial pressure showed significant decrease in comparison to its basal in Group P while they were not significantly different from the baseline in Group KP (Graphs 1 and 2). The difference was statistically significant between the groups though not amounted to bradycardia, hypotension.



Graph 1: Graph showing changes in Mean Heart Rate



Graph 2: Graph showing changes in Mean MAP

The undesirable responses like coughing, gagging and involuntary movements were observed in 3.3% of patients in Group KP while laryngospasm or desaturation was not encountered during insertion or removal of LMA in Group KP. None of the above undesirable responses were seen in Group P.

No statistically significant difference in mean

duration of surgery (*16 min* and *17 min*) and anesthesia (*26 min* and *31 min*) was observed between Groups P and KP ($p > 0.05$).

Discussion

Patel DK *et al*.[12] reported that children aged *1–12 yrs* both pre-medicated and unpremedicated, satisfactory anesthesia can be achieved with propofol in a larger dose of *2.5–3.5 mg.kg*$^{-1}$ as an induction agent. Allsop E *et al*.[13] also reported that a laryngeal mask airway can be immediately inserted after induction of anesthesia with propofol *3.5 mg.kg*$^{-1}$ which is safe and effective dose in children aged *4–9 yrs*. Propofol is needed in higher doses for induction in children is consistent with the larger volume of distribution as suggested by Saint-Maurice C *et al*.[14] in their study. Goel S *et al*.[4] used propofol *3.5 mg.kg*$^{-1}$ in propofol alone group and in co-induction groups used propofol *2.5 mg.kg*$^{-1}$ with either midazolam *0.05 mg.kg*$^{-1}$ or ketamine *0.5 mg.kg*$^{-1}$ IV *2 min* before propofol, both mixed with lignocaine *0.5 mg.kg*$^{-1}$, and inserted LMA 30s after propofol injection in children aged 1–8 yrs; found midazolam or ketamine improved conditions for laryngeal mask insertion while providing stable hemodynamics. Similarly, Riham Hussein[9] reported that ketamine *0.5 mg.kg*$^{-1}$ as coinduction agent with propofol provides better LMA insertion conditions in children aged *4–11 yrs*. R Latif Mohamad *et al*.,[6] Z Begec *et al*.,[8] Riham Hussein[9] reported that ketamine due to its antagonism on NMDA receptors acts additively with propofol. Thus, in the present study, we chose propofol *3.5 mg.kg*$^{-1}$ as optimal dose in Group P while in Group KP, ketamine *0.5 mg.kg*$^{-1}$ was administered as the co-induction agent *2 min* before propofol *2.5 mg.kg*$^{-1}$.

The LMA insertion characteristics assessed by grading mouth opening on three point scale as full, partial and impossible, and ease of LMA insertion graded on four point scale as easy, some difficulty, difficult and impossible by Driver IK *et al*.,[15] Driver I *et al*.[16] 30s after propofol bolus. Goel S *et al*.[4] assessed the insertion characteristics 30s after propofol bolus as excellent, satisfactory and unsatisfactory depending on the relaxation of jaw, presence or absence of coughing, gagging, swallowing, limb movement and laryngeal spasm. They reported excellent insertion conditions in 27.8% and 60% of patients, satisfactory in 50% and 40% of patients and unsatisfactory in 22.2% and nil in propofol and propofol-ketamine groups respectively. Similarly, Z. Begec *et al*.[8] and Latif Mohamad *et al*.[6] scored insertion conditions of PLMA using 6 variables on 3-point scale. In our study, we assessed the insertion characteristics based on mouth opening and ease of insertion of laryngeal mask airway similar to observations by Driver IK *et al*.[15] and Driver I *et al*.[16] Our findings on LMA insertion characteristics were similar to that reported by Goel S *et al*.,[4] Srivastava U *et al*.,[5] Z Begec *et al*.[8] indicating significant improvement in insertion characteristics in Group KP compared to Group P. In the present study, 3.3% patients in Group KP had undesirable responses like coughing, gagging, involuntary movements at insertion of LMA and our findings are similar to study by Z Begec *et al*.[8]

The hemodynamic parameters were stable and maintained close to baseline in Group KP compared to Group P. Our findings are similar to the observations made by Goel S *et al*.,[4] Srivastava U *et al*.,[5] Z Begec *et al*.[8] and Riham Hussein[9] who used ketamine as co-induction agent.

There was no undue delay in recovery in Group KP compared to Group P as the mean duration of surgery and anesthesia were comparable.

Conclusion

Ketamine as a co-induction agent used in combination with propofol produces most favorable conditions for smooth insertion of laryngeal mask airway in children with preservation of baseline hemodynamic parameters and undelayed recovery times when compared to propofol alone.

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Original Research Article

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A Comparative Study on Pre-emptive Analgesic Effect of IV Paracetamol on Reducing the Use of Opioid in Post-operative Pain Management

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Abstract

Background: Present study was undertaken to see the pre-emptive efficacy of IV paracetamol and reduction in the use of opioid for post-operative pain management. *Aim and Objective:* To study pre-emptive analgesic effects of 1 *gm* paracetamol infusion on the total requirement of tramadol in the post-operative period including rescue analgesia. *Methods:* After ethical approval present study was carried out NSCB Medical College, Jabalpur from October 2009 to September 2010, 90 patients of ASA class I and II between the age group of 20–60 *years* undergoing elective abdominal surgery were included in the study. Patients were divided into 3 Groups of 30 patients each. Group I was given IV paracetamol infusion 1gm for 15–20 *minutes*, 30 *minutes* prior to induction. Group II was IV paracetamol infusion 1 *gm* for 15–20 *minutes* prior to skin closure, and Group III received normal saline as placebo. Post-operatively pain (VAS) scores, sedation scores, post-operative tramadol doses, side effects were recorded. *Results:* Group III, VAS score was significantly higher ($p < 0.01$) as compare to Group I. Consumption of tramadol in Group III was significantly higher ($p < 0.01$) compared to Groups I and II. *Conclusion:* IV paracetamol infusion pre-emptive ensure effective analgesia and decreases tramadol consumption and side effects.

Keywords: IV Paracetamol; Pre-emptive; Tramadol.

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Introduction

Pain is the most common complaint after abdominal surgery which can lead to long-term complications like hypoxemia, atelectasis, pneumonia, deep vein thrombosis, pulmonary embolism, psychological trauma, and delay in improvement of bowel function, myocardial ischemia and infarction.[1,2] Opioids are commonly used to relieve post-operative pain but have significant adverse effects including nausea and respiratory depression.[3]

In pre-emptive pain control before the start of surgical procedure, regional or systemic analgesics are applied which prevent central sensitization of pain pathways and reduce the amount of analgesic required.[4] The purpose of this study is to find out to what extent pre-emptive IV paracetamol reduces the amount and frequency of post-operative opioid need.

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Materials and Methods

The present study was done in NSCB Medical College Jabalpur, Madhya Pradesh from *October 2009* to *September 2010*. After ethical committee's approval, informed written consent was taken from all the 90 patients of ASA class I, II between age group (*20–60 years*) undergoing elective abdominal surgeries. A detailed history, thorough physical examination, routine investigation or any special investigation if required done for the study.

Exclusion Criteria

Allergic to paracetamol, use of paracetamol, opiods, or NSAIDs *48 hours* before surgery, Chronic alcoholics, liver/kidney disease, Cardiovascular illness, Bleeding diathesis, contraindication to tramadol use, American society of Anesthesiologist (ASA) class III and IV. Patients were divided into 3 Group I, II and III of 30 patients each:

Group I was given IV paracetamol infusion *1 gm* for *15–20 minutes*, *30 minutes* prior to induction.

Group II was given IV paracetamol infusion *1 gm* for *15–20 minutes* prior to skin closure.

Group III serves as a control group and receives normal saline as placebo.

Post-operatively pain scores, sedation scores post-operative tramadol doses and side effects were recorded. All the patients were induced with IV Propofol *2 mg/Kg* and Fentanyl *3 mcg/Kg* and then vecuronium *0.12 mg/Kg*. Following intubation maintenance of general anesthesia accomplished by using halothane and if required vecuronium *0.01 mg/Kg*. No additional analgesics were given over the entire course of the operation.

Group I, patients receive *1 gm* (*100 ml*) infusion of IV paracetamol over *15–20 minutes*, *30 minutes* prior to induction and received normal saline (*100 ml*) as infusion over *15–20 minutes* prior to skin closure.

Group II, patients received normal saline (*100 ml*) as infusion over *15–20 minutes*, *30 minutes* prior to induction and received *1 gm* (*100 ml*) IV paracetamol infusion over *15–20 minutes* prior to skin closure.

Group III, patients received normal saline (*100 ml*) as infusion over *15–20 minutes*, *30 minutes* prior to induction and prior to skin closure.

IV tramadol *100 mg* was given to all the patients post-operatively. For post-operative pain assessment, VAS score was used (VAS: 0–10; 0-no pain, 10-worst pain imaginable).[5] The sedation level of patients was defined in accordance with the modified Ramsey sedation scale.[4]

VAS scores, modified Ramsay sedation score and total tramadol consumption of all the patients in post-operative period at *2 hr* interval till *24 hours* were recorded. After first dose of tramadol, if patient complained of pain with VAS score > 4 tramadol *50 mg* IV was given, with *4 hours* interval between two doses. Rescue analgesia IM diclofenac *75 mg* given within *4 hours* of receiving IV tramadol if pain persists.

Results

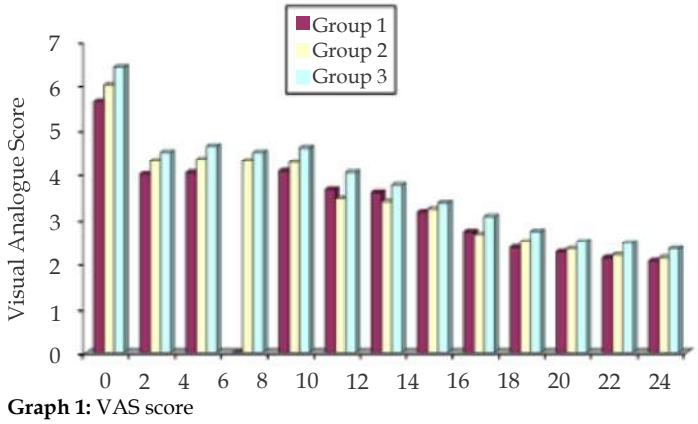
There were no significant differences between the groups with regard to demographic variables, (Table 1), (Graph 1).

Table1: Demographic data

	Group 1	Group 2	Group 3
Age (*year*)	38.5 ± 13.8	38.7 ± 13.3	38.7 ± 11.2
Operation time (*min*)	98 ± 19.2	98 ± 13.5	107 ± 23.2
Weight (*kg*)	52.2 ± 7	52.6 ± 8	51.5 ± 8.8

Table 2: Post-operative Tramadol consumption

	Group 1	Group 2	Group 3
Total tramadol consumption	118.73 ± 24.50	135 ± 23.30	163.33 ± 21.32



Graph 1: VAS score

The VAS score of Group III was significantly higher ($p < 0.01$) for first *6 hrs* post-operatively as compared to Group I and Group III. The sedation scores of the groups showed no statistical difference between the groups. Tramadol consumption of the cases, shown in (Table 2) was significantly higher in Group III ($p < 0.01$) than in Group I and Group II. Number of patients requiring rescue analgesia were more in Group III than in Group I and Group II, shows in (Table 4). The incidence of side effects such as post-operative nausea, vomiting, pruritus is showing in (Table 3) according to patient groups. When the treatment-dependent side effect incidences were compared, nausea, vomiting, and itching were found to be higher in the control group. No respiratory depression requiring naloxone usage occurred in any patient.

Table 3: Side effect

	Group 1	Group 2	Group 3
Side effect like nausea vomiting, pruritus	3	3	5

Table 4: Rescue analgesia required

	Group 1	Group 2	Group 3
Patient require rescue analgesia	4	8	8

Discussion

In the present study, IV paracetamol *1g* was used to assess its effectiveness as post-operative analgesia, Tramadol consumption and frequency of side effects. It was observed that administration of paracetamol *1g*, *30 min* before induction resulted in decreased post-operative VAS values and reduced total Tramadol consumption over *24h*. Furthermore, we observed fewer side effects and the negative effects caused by post-operative pain can be diminished. Post-operative pain can lead to complications like atelectasis, pneumonia, deep vein thrombosis, pulmonary embolism, psychological trauma, elongated intestinal distension, urine retardation, myocardial ischemia, and infarction.[1,2] Proper pain management prior to pain initiation can reduce anxiety, morbidity, cost, and length of hospital stay, our findings were consistent with the findings of Speranza R *et al*. and Vaideanu D *et al*.[7,8]

Conclusion

From the present study, it is concluded that pre-emptively administered IV paracetamol *1 gm* in patients undergoing elective lower abdominal surgery:

- Has no adverse effect;
- Ensure effective analgesia post-operatively;
- Decrease tramadol consumption and side effects;
- Decrease need for rescue analgesia.

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A Comparative Evaluation of Dexmedetomidine and Tramadol for Control of Post-spinal Anesthesia Shivering

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Abstract

Study Objective: Primary aim was to compare and study the efficacy of intravenous dexmedetomidine (1 *µg/kg*) and tramadol (1 *mg/kg*) when used for the control of post-spinal anesthesia shivering. We also compared and studied the hemodynamic changes, complications and adverse effects, in both study groups. *Design:* Prospective randomised double blind study. *Setting:* Operating room. *Patients:* Sixty American Society of Anesthesiologists Grade I and II patients of either gender, aged between 18 and 60 years, scheduled for various surgical procedures under sub-arachnoid block. *Interventions:* The patients were randomised in two Groups of 30 patients each to receive either 1 *µg/kg* dexmedetomidine (Group D) or 1 *mg/kg* tramadol (Group T) as a slow intravenous bolus over 10 minutes, once shivering commenced. *Measurements:* Grade of shivering, onset of shivering, time for cessation of shivering, recurrence, response rate (complete. Incomplete or failure to control shivering), duration of surgery and spinal anesthesia, axillary temperature, hemodynamic parameters (heart rate, systolic, diastolic and mean arterial pressure, ECG) and adverse effects were observed at scheduled intervals. *Results:* The mean time taken for cessation of shivering in Group D was 2.55 ± 1.06 minutes, whereas that in Group T was 4.15 ± 1.68 minutes. The difference between the two Groups was analyzed quantitatively and found to be highly significant ($p < 0.001$). In dexmedetomidine Group, 2 patients had recurrence; whereas, in tramadol Group, 5 patients had recurrence. *Conclusion:* Both dexmedetomidine (1 *mg/kg*) and tramadol (1 *mg/kg*) are effective in treating patients with post-spinal anesthesia shivering. However, dexmedetomidine is more effective as time taken for complete cessation of shivering is shorter with dexmedetomidine as compared to tramadol and incidence of recurrence of shivering is also lower. Furthermore, dexmedetomidine does not cause adverse effects like nausea and vomiting as are seen with tramadol. Sedation caused by dexmedetomidine provides additional comfort to the patient.

Keywords: Shivering; Tramadol; Dexmedetomidine; Anesthesia; Spinal.

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Introduction

Shivering is known to be a frequent complication, reported in 40 to 70% of patients undergoing surgery under spinal anesthesia.[1,2] Spinal anesthesia significantly impairs the thermo regulatory system by inhibiting tonic vasoconstriction which plays a significant role in temperature regulation. It is associated with greater heat loss than general anesthesia which is attributed to various reasons like abnormal heat loss due to vasodilatation, impairment of shivering in the area of block and rapid intravenous (IV) infusion of cold fluids.[3]

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Shivering is a very unpleasant and physiologically stressful experience for the patient undergoing surgery, and some patients find the accompanying cold sensation to be worse than post-operative surgical pain. Excessive shivering creates an imbalance between oxygen demand and supply ratio. The resultant increased demand, (sometimes up to six times the normal) and relative deficit of oxygen supply can lead to various metabolic derangements such as hypoxemia, lactic acidosis and hypercarbia, thereby, hampering smooth recovery from anesthesia.[4] This can be detrimental in certain groups of patients; including those with raised intraocular pressure, intracranial tension, and patients with limited cardiovascular reserve.[5,6]

There are various pharmacological and non-pharmacological methods available to control shivering during anesthesia. During the last decade, tramadol, a synthetic opioid, has become a favored and commonly used drug for post-spinal shivering. The anti-shivering action of tramadol is probably mediated via its serotonergic reuptake inhibition and noradrenergic activity or both.[7-9] However, it has some adverse effects like nausea, vomiting and dizziness.

Dexmedetomidine, is a highly selective α2 adrenoceptor agonist which exhibits anti-shivering property by binding to α2 receptors that mediate vasoconstriction. It is also postulated that it lowers shivering threshold through its centrally mediated action on the hypothalamus.[10,11] It is devoid of adverse effects like nausea and dizziness, but has been reported to cause bradycardia, hypotension and sedation in some patients.

This study compared the efficacy of dexmedetomidine and tramadol in the treatment of postspinal anesthesia shivering as well as their sideeffect profile.

Materials and Methods

This was a prospective, randomised, doubleblind study, which was conducted at a tertiary care centre after taking approval from Institutional Ethics Committee. All subjects gave written informed consent to participate in the study. The study protocol followed the guidelines stated by the Consort criteria.

Taking a significance level of 5%, power of 80%, and using the time to disappearance of shivering after medication, from a similar study,[12] sample size was calculated using Winpepi Statistical Package.

Sixty American Society of Anesthesiologists (ASA) Grade I and II consenting patients of either gender aged 18–60 *years* scheduled for elective as well as emergency lower abdominal, lower limb, orthopedic and plastic surgeries under spinal anesthesia were included in the study. Patients with known hypersensitivity to dexmedetomidine or tramadol, significant medical comorbidities, known history of substance or alcohol abuse, patients receiving any premedication, and patients with initial body temperature > 38 °C or < 36 °C were excluded from the study.

All patients who fulfilled the inclusion criteria and developed postspinal anesthesia shivering were enrolled and randomised using computer generated chart with allocation ratio of 1:1 into either of the two Groups. Group D (n = 30) were administered dexmedetomidine 1 *μg/kg* intravenous (IV) and Group T (n = 30) received tramadol 1 *mg/kg* IV as per randomisation by an anesthesiologist (not a part of the study) who prepared either of the drugs, at the onset of shivering. The anesthesiologist conducting the case as well as recording the data were unaware of the drug being administered.

After thorough pre-anesthetic checkup, patients were taken into the operation theatre. IV access was secured with 20-gauge cannula, monitoring devices were attached (these included heart rate, pulse oximeter, ECG, non-invasive BP, temperature probe), and baseline parameters were recorded. The subjects were pre-loaded with 10 *ml/kg* Ringer's Lactate fluid and maintained on IV fluids throughout the procedure.

Spinal anesthesia was given in the sitting position with due aseptic precautions. After painting and draping of the lumbar area, a 26 G Quincke's spinal needle was introduced in L3-L4 inter-vertebral space. CSF free flow was confirmed and sub-arachnoid block was administered with 0.5% heavy bupivacaine (3–3.5 *ml*) to achieve the desired level at T5-T6 dermatome, in accordance with the surgical procedure. All operation theatres were maintained at an ambient temperature of around 24°C–25°C. Supplemental oxygen was administered to all the patients at the rate of 2 l *min* with Hudson's face mask and patients were covered with drapes but not actively warmed. IV fluids and drugs were administered at room temperature.

After induction of spinal anesthesia, patients were observed for the occurrence of shivering until the post-operative period. Shivering was graded using a four point scale as per Wrench:[13]

- Grade 0: No shivering;
- Grade 1: One or more of the following:

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 1 muscle group;
- Grade 4: Gross muscle activity involving the whole body.

Patients who developed either Grade 3 or 4 shivering lasting for a minimum period of 2 *minutes*, were included in the study. Injection Dexmedetomidine 1.0 *mcg/kg* or Injection Tramadol 1.0 *mg/kg* were diluted to a volume of 10 *ml* in a 10 ml syringe and presented as coded syringes as per randomisation list by an anesthesiologist who was unaware of the group allocation. This was then administered to the patient as a slow IV injection over a period of 10 *minutes*. The attending anesthesiologist recorded the time in minutes at which shivering started after spinal anesthesia (onset of shivering), time of administration of the test drug, and time to the disappearance of shivering.

Shivering control was defined as 'complete' when post-treatment, the shivering score declined to 0; 'incomplete' when the scores decreased, but did not abolish the shivering completely; and 'failed' if no change in scores was observed.

Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, oxygen saturation, ECG, axillary temperature and Wrench's shivering grades were recorded at 0, 1, 2, 5, 10, 15 and 30 *minutes* after administering the test drug.

Duration of surgery was recorded and duration of spinal anesthesia was noted by assessing spontaneous recovery of sensory block using the pin-prick method and observing spontaneous movements of limbs in the post-operative period. Recurrence of shivering was also noted.

In case, there was recurrence of shivering, patients were treated with an additional dose of dexmedetomidine (0.5 *µg/kg* IV) or tramadol (0.5 *mg/kg* IV) in the respective groups and/or active warming measures using convection heaters or infusing moderately warm IV fluids.

Adverse effects such as nausea, vomiting, dizziness, sedation, bradycardia (heart rate < 50 *beats/minute*) and hypotension (fall in systolic blood pressure > 20% of baseline) were watched for and recorded.

Nausea and vomiting were treated with injection metoclopramide 10 *mg* IV as and when required. Bradycardia, if it occurred, was treated with a bolus dose of Inj Atropine 0.6 *mg* intravenously. Whereas, hypotension was treated with intravenous Inj Mephenteramine 6 *mg* increments.

Sedation was assessed as per the modified Ramsay Sedation Scale:[14]

- Grade 1: Patient anxious or agitated or both;
- Grade 2: Patient co-operative, oriented and tranquil;
- Grade 3: Patient response to commands only;
- Grade 4: A brisk response to light glabellar tap;
- Grade 5: A sluggish response to a light glabellar tap;
- Grade 6: No response.

Sedation score > Grade 3 was termed as sedation.

The coding was opened after completion of the study to compile results. Data was collected, compiled and tabulated. The statistical analysis was done using parametric test and the final interpretation was based on Z - test (standard normal variant) with 95% level of significance.

Quantitative data was analysed by Student '*t*' test. Qualitative data was analyzed by Chi-square test.

Results

In the present study, a total of 60 patients out of 85 consecutive patients met the inclusion criteria and consented for study. These 60 patients were randomized into two Groups of 30 each. As it was an intraoperative study, no patient was lost to followup, (Diagram 1).

Both groups were comparable with respect to age, gender, weight, ASA grade, duration of surgery and the duration of spinal anesthesia, (Table 1).

Table 1: Demographic profile of patients of both groups

Parameter	Group D (n = 30)	Group T (n = 30)	*p* - value
Gender (Male/ Female)	14/16	15/15	
Age (years)	37.43 ± 11.09	37.33 ± 11.33	0.97
Weight (kilograms)	63.43 ± 12.71	61.07 ± 11.57	0.45
Duration of surgery (minutes)	64 ± 6.35	63.1 ± 5.05	0.55
Duration of spinal anesthesia (minutes)	232.77 ± 13.58	226.97 ± 11.94	0.08

There was no statistically significant difference in time for the onset of shivering between the two groups.

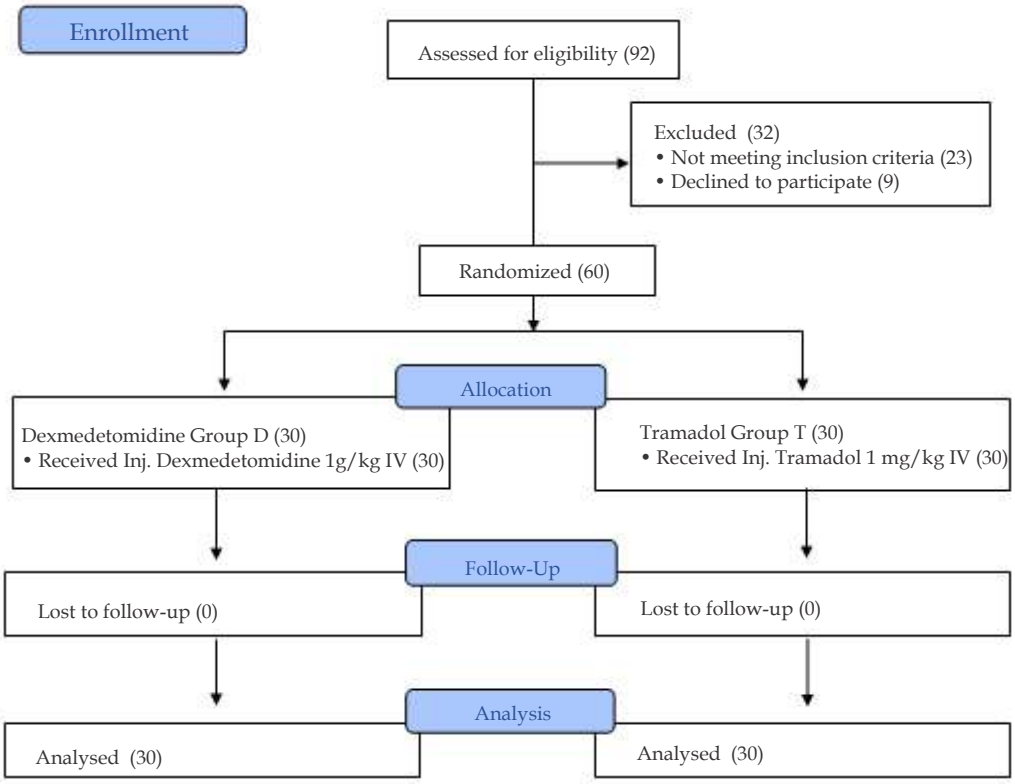

Diagram 1: Participant Flow Diagram

The mean time taken for cessation of shivering in Group D was 2.55 ± 1.06 *minutes*, whereas that in Group T was 4.15 ± 1.68 *minutes*. The difference between the two Groups was analyzed quantitatively and found to be highly significant ($p < 0.001$), thereby, proving that dexmedetomidine gave faster control of shivering than tramadol.

Also, in dexmedetomidine Group, 26 patients had complete cessation of shivering; 3 had incomplete control, and in 1 patient the drug failed to control shivering. In tramadol Group, 22 subjects had complete control of shivering; 5 had incomplete control, and 3 failed.

In dexmedetomidine Group, 2 patients had recurrence; whereas, in tramadol Group, 5 patients had recurrence. The incidence of recurrence of shivering with dexmedetomidine was lower than that with tramadol, (Table 2).

Table 2: Parameters for post-spinal anesthesia shivering

Parameter	Group D	Group T	*p* - value
Onset of shivering (*minutes*)	29 ± 6.33	29.7 ± 5.98	0.66
Time for control of shivering after medication (*minutes*)	2.55 ± 1.06	4.15 ± 1.68	< 0.001
Response rate (%)			
Complete	86.67	73.33	
Incomplete	10	16.67	
Failed	3.33	10	
Recurrence (number of patients)	2	5	

A different set of side effects was seen in each Group. In dexmedetomidine Group, out of 30 patients, 4 patients had hypotension, 3 patients had bradycardia, 3 patients were sedated (modified Ramsay Sedation score > 3) and 1 patient developed dryness of mouth. None of the subjects in tramadol Group developed these side effects. In tramadol Group, 11 patients had nausea, 3 patients had vomiting and 6 patients had dizziness following administration of test drug. In dexmedetomidine Group, none of the patients had nausea, vomiting or dizziness, (Table 3).

Table 3: Pattern of side effects in both groups

Side Effect	Group D (Number of patients)	Group T (Number of patients)
Hypotension	4 (13.33%)	0
Bradycardia	3 (10%)	0
Sedation	3 (10%)	0
Dry Mouth	1 (3.33%)	0
Nausea	0	11 (36.67%)
Vomiting	0	3 (10%)
Dizziness	0	6 (20%)

Respiratory depression, allergic reaction or itching were not seen in any of the patients of either group.

Discussion

Shivering is defined as an involuntary, repetitive activity of skeletal muscles. It is a common post-anesthesia adverse event with an incidence of 40–70% following spinal Anesthesia.[15]

Spinal anesthesia impairs the thermoregulation by inhibiting vasomotor and shivering responses and by redistribution of heat from core to periphery of the body resulting in hypothermia.[16] It is a physiological response to a fall in core temperature in an attempt to raise the metabolic heat production. It increases oxygen demand, heart rate, cardiac output, causes lactic acidosis, increased intraocular pressure, increased intracranial pressure, increased carbon dioxide production, increased hemodynamic changes and increased pain perception. Thus, it may lead to adverse outcomes in patients with low cardio pulmonary reserve.

Non-pharmacological methods to prevent and treat shivering include warming blankets, warm operation theatre, warmed intravenous fluids, heated and humidified inspired gases, and increasing ambient air temperatures.

The neurotransmitter pathways involved in shivering are multiple and involve opioids, Alpha-2 adrenergic, serotonergic, and anticholinergic receptors. Hence, drugs acting on these systems which include opioids (pethidine, nalbuphine, or tramadol), ketanserin, propofol, doxapram, clonidine, ketamine and nefopam are utilized in the treatment of shivering. However, adverse effects such as hypotension, hypertension, sedation, respiratory depression, nausea and vomiting limit their use. Hence, the hunt for an ideal anti-shivering agent is continuing.

Tramadol is a synthetic 4-phenyl-piperidine analogue of codeine. Tramadol is an opioid analgesic with opioid action mediated via μ receptor with minimal effect on kappa and delta binding sites; tramadol also activates the mononergic receptor of the descending neuraxial inhibiting pain pathway. The anti-shivering action of tramadol is probably mediated via its opioid or serotonergic and noradrenergic activity or both. During the last decade, tramadol has become a favored and commonly used drug for post-spinal anesthesia shivering. However, it has adverse effects like nausea, vomiting, dizziness etc., which cause further discomfort to the patient.[17]

Dexmedetomidine, a congener of clonidine, is a highly selective α_2 adrenoceptor agonist. It has been used as a sedative agent and is known to reduce the shivering threshold. Few studies which have explored its anti-shivering potential have inferred that dexmedetomidine is an effective drug without any major adverse effect and provides good hemodynamic stability.[18–20]

The anti-shivering effects of alpha adrenoceptor agonists are mediated by binding to alpha-2 receptors that mediate vasoconstriction and the anti-shivering effect. In addition, it has hypothalamic thermoregulatory effects.[21] Dexmedetomidine comparably reduces the vasoconstriction and shivering thresholds, thus suggesting that it acts on the central thermoregulatory system rather than preventing shivering peripherally.[10]

The desired properties of a drug to prevent shivering include easy availability and minimal side effects. Till now, no ideal drug is known that can be used to treat post-spinal anesthesia shivering.

In our study, in Group D, 26 patients (86.67%) had complete cessation of shivering; 3 (10%) had incomplete control, and in 1 patient (3.33%) the drug failed to control shivering. In Group T, 22 subjects (73.33%) had complete control of shivering; 5 (16.67%) had incomplete control, and 3 (10%) failed. These findings differed from those of Kundra *et al*. who found that shivering disappeared in all patients who were given dexmedetomidine or tramadol.[12]

Venkatraman *et al*. compared tramadol, clonidine and dexmedetomidine for the treatment of post spinal anesthesia shivering using a lower dose of dexmedetomidine than that in our study. Dexmedetomidine gave the fastest results (5.7 ± 0.79 *minutes*), followed by tramadol (6.76 ± 0.93 *minutes*) and clonidine being the slowest (9.43 ± 0.93 *minutes*).[22]

The findings of Mittal G *et al*. correlate well with those of our study, in that, there was recurrence of shivering in 1 patient out of 25 (4%) in dexmedetomidine Group and 2 patients out of 25 (8%) in tramadol Group.[23]

Bradycardia and hypotension is a frequently reported adverse effect of α_2 adrenoceptor agonists. Verma NK *et al*. reported that hypotension was observed in highest number of patients (33.33%) in Clonidine, 20% of Dexmedetomidine Group, but only 10% of Tramadol Group, which is significant.[24]

We observed that while heart rate and mean arterial pressure were lower following administration of dexmedetomidine than

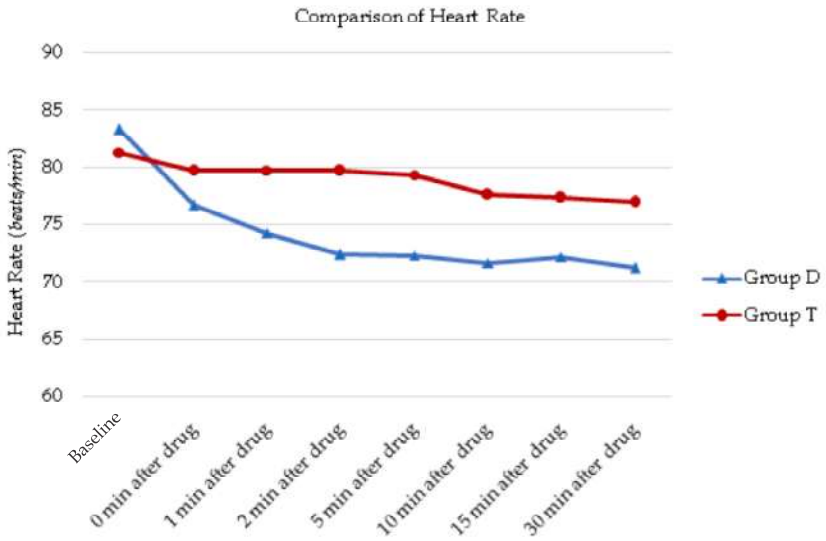

Figure 2: Line diagram showing comparison of heart rate in study groups

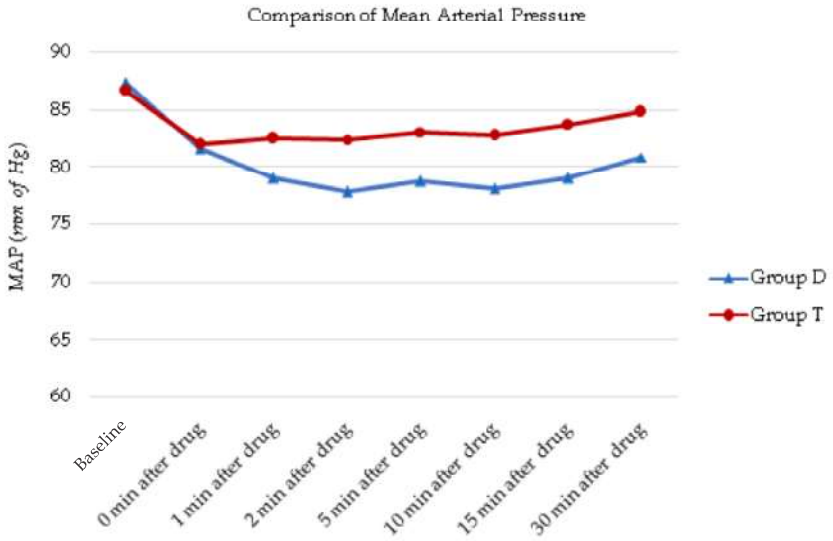

Figure 3: Line diagram showing comparison of diastolic blood pressure in study groups

those following tramadol, clinically significant bradycardia and hypotension requiring intervention was observed only in a minority of the patients, (Graph 2 and Graph 3).

Sedation with dexmedetomidine provided additional comfort to the patients and all patients could be woken up easily with verbal command or with light glabellar tap. These findings corroborate with those of Kundra *et al*.[12]

The incidence of nausea and vomiting with tramadol in our study was 37% and 11%, respectively. The results correspond with that of other studies by Reddy and Chiruvella, Tsai and Chu; Bansal and Jain.[17,9,25] However, in the study by Shukla *et al*.,[15] the incidence of nausea was quite high (77.5%), whereas Wason *et al*. have reported the incidence of nausea as only 4%.[26] These variations could be explained by the peculiar patient characteristics in different studies.

Limitations

- Sample size was small due to a limited number of people willing to participate in the study;
- Our study was conducted on ASA-I and II class patients. Further studies on elderly and compromised cardiac function patients are

required to recommend the use of tramadol and dexmedetomidine for post spinal anesthesia shivering in high risk patients.

- In our study, we used 1 *mg/kg* tramadol and 1 *μg/kg* dexmedetomidine. More studies of different dose ranges of dexmedetomidine and tramadol need to be conducted to define the ideal anti-shivering dose.

Conclusion

Both dexmedetomidine (1 *μg/kg*) and tramadol (1 *mg/kg*) are effective in treating patients with post-spinal anesthesia shivering. However, dexmedetomidine is more effective as time taken for complete cessation of shivering is shorter with dexmedetomidine as compared to tramadol and incidence of recurrence of shivering is also lower. Furthermore, dexmedetomidine does not cause adverse effects like nausea and vomiting as are seen with tramadol. Sedation caused by dexmedetomidine provides additional comfort to the patient.

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Original Research Article

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Randomized Controlled Study of Comparison between Intrathecal Isobaric Ropivacaine 0.75% with Hyperbaric Bupivacaine 0.5%

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Abstract

Introduction: A number of clinical studies suggest that spinal anesthesia may be superior to general anesthesia for certain surgical procedures. *Aim:* To compare the duration, density of motor blockade, cephalad spread of sensory anesthesia and intra-operative hemodynamic instability between the both Groups. *Method:* This prospective, randomised, double blind study was conducted in 60 ASA Grades I & II patients of either sex in the age range of 20–60 *years* undergoing elective lower abdominal and lower limb surgery. The patients were randomly divided into two equal Groups. The hemodynamic parameters like ECG, NIBP, SpO_2, adverse effects and duration of surgery were monitored and recorded. Anesthesia assessed by Modified Bromage scale and bilateral loss of sensation to pin prick. The data was analysed using SPSS 20. *Results:* The maximum cephalad spread of sensory level was significantly lower in Ropivacaine Group (T 5.70 ± 1.055) than Bupivacaine Group (T 4.93 ± 0.828). The Grade IV motor block by Bromage scale after 3 *minutes* of intra-thecal injection was seen in 24 (80%) of bupivacaine group compared to 4 patients (13.7%) in ropivacaine group with statistical significance (X^2 = 26.786). There were highly significant incidence of intra-operative hypotension in bupivacaine group (17) than ropivacaine (7 patients). No significant differences in hemodynamic variables like bradycardia and arrhythmia. *Conclusion:* Isobaric ropivacaine as mean of providing less motor block, early ambulation and causes less hypotension when compared with bupivacaine.

Keywords: Bupivacaine; Intrathecal ropivacaine.

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Introduction

Spinal anesthesia, also called spinal analgesia or Sub-arachnoid Block (SAB), is a form of regional anesthesia involving injection of a local anesthetic into the cerebrospinal fluid (CSF) through a fine needle. Central neuroaxial blockade is the most widely used form of regional anesthesia today. Spinal anesthesia is one of the commonly used anesthetic technique for lower abdominal and lower limb surgeries. It is a safe, inexpensive and easy-to-administer technique which also offers a high level of post-operative satisfaction with good pain relief to the patients. The technique is simple, has rapid onset and is reliable. The risk of general anesthesia including mishaps due to

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airway management are avoided by this technique. A number of clinical studies[1] suggest that spinal anesthesia may be superior to general anesthesia for certain patients of surgical procedures. The endocrine-metabolic response to surgery is blunted when spinal anesthesia is employed compared to the response during General Anesthesia (GA).[1]

Bupivacaine, an amide compound, the most widely used drug for spinal anesthesia presently, its advantages compared to lignocaine being long duration of action and differential sensory-motor block.[2] But it is associated with some adverse cardiac effects like arrhythmias and central nervous system toxicity,[3] prolonged duration of sensory and motor blockade requiring a need to overcome these problems. However, with time a number of deaths from cardiac arrest were reported in association with regional anesthesia using bupivacaine. All deaths appeared to be caused by accidental intravenous injection of bupivacaine. These deaths, and subsequent recommendations of the United States Food and Drug Administration (FDA) provided the impetus to develop a safer drug. It was possible that a less fat soluble drug than bupivacaine would be less cardiotoxic.[4]

The identification of optically active isomers of the mepivacaine family led to the selection of ropivacaine, a pure S-(-) enantiomer, whose toxicology was selectively and extensively studied before its introduction on the market in 1996.[5] Ropivacaine, structurally resembling bupivacaine, with a propyl group on the piperidine nitrogen atom of the molecule is a relatively new amino-amide local anesthetic agent. It has various advantages like early onset and shorter duration of action and having lesser cardio toxicity as compared to bupivacaine.[6]

The present study was undertaken to determine clinical efficacy of ropivacaine over bupivacaine.

Aim and Objectives

1. To compare the duration, density of motor blockade produced by equal volume (*3 ml*) of equipotent doses of isobaric ropivacaine (0.75%) with hyperbaric bupivacaine (0.5%) when administered intrathecally.
2. To assess the height of sensory level or maximum cephalad spread between the groups.
3. To evaluate the intra-operative hemodynamic instability produced between the two drug groups.

Materials and Methods

A randomized control, double blind study was conducted in tertiary-care institute over *2 yr* after obtaining approval of the institutional ethical committee. Total 60 patients belonging to both sex coming for elective surgical procedures, orthopedics and gynecological procedures lasting less than *3 hours* under spinal anesthesia at our center during the period of *Jan 2011–Feb 2012*, were enrolled. The informed written consent of patient was taken. The study patients were selected after thorough assessment of their hemodynamic status. All the patients were ASA Gr 1 and 2 and aged between *20 and 60 years*. Our study included 35 males and 25 females.

Exclusion Criteria

Patient refusal, any contraindication for spinal anesthesia, combined spinal and general anesthesia, pregnancy and patchy or failed spinal anesthesia.

All patients were pre-medicated orally with Tab Pantoprazole *40 mg* and Alprazolam *0.25 mg* the previous night and *2½ hours* before surgery. In the receiving room an 18 G intracath was inserted and an infusion of Ringer's lactate solution started at *2 ml/kg/hr*. On arrival in the operation theatre ECG, NIBP and SpO_2 were applied for monitoring. Patients were then assigned randomly into two Groups namely: Group A (*3 ml* of 0.75% ropivacaine) and Group B (*3 ml* of 0.5% bupivacaine), according to the sealed envelope method by the anesthetic team not participating in the study but the researcher and the patient were unaware of their group. Under all aseptic and antiseptic precautions lumber puncture was performed with 26 gauge Quincke spinal needle in L3-L4 space in sitting position and drug was given over a period of *30 seconds*. Soon after the injection, time is noted and patient was made supine. No tilt was given to any patient. Onset of sensory blockade is the time between induction and bilateral loss of pin prick sensation up to T10 level, checked by every *30 second* after injection. Motor blockage was assessed with modified bromage scales shows in Table 1.[7] Supplementary oxygen was given during surgery. The hemodynamic parameters were monitored for complications and side-effects which were treated as and when required. Hypotension (systolic BP < *90 mm hg*) was treated with IV fluids ± vasopressors-Inj. Ephedrine/Mephentremine *6 mg* IV bolus SOS. Bradycardia (Heart rate < *50/mt*) was treated with Inj. Glcopyrrolate *0.02 mg/kg* IV bolus SOS. Motor blockade assessment was

done till surgery completed and continued every *15 minutes* till the patient completely recovers. Post-operatively duration of sensory blockade (regression up to L1 dermatome) was noted. Highest level of sensory blockade noted in each patient. In post-operative period Pulse, BP, Respiration, SpO_2, Cardiac monitoring (ECG) were observed were recorded at intervals of *15 min*, *30 min*, *1 hr*, *11/2 hr*, *2 hr*, *3 h*, *4 hr*, *5 hr*, *6 hr*, *12 h* & *24 h*. Post-operative complication and side effects like nausea, vomiting, dryness of mouth, sedation, respiratory rate, desaturation, hypotension, bradycardia, neurological deficit, headache, etc. were noted and treated accordingly. Statistical Analaysis was done with SPSS and data was expressed as mean (standard deviation) for continous variables and proportion for qualitative variables. Student's *t* - test was used to test the statistical significance for quantitative variables and Chi-square or fisher exact test for qualitative variables. $p < 0.05$ was considered statistically significant.

Table 1: Grading according modified Bromage Scale

Grade	Criteria	Degree of block
I	Free movement of legs and feet	Nil (0%)
II	Just able to flex knees with free movement of feet	Partial (33%)
III	Unable to flex knees, but with free movement of feet	Almost complete (66%)
IV	Unable to move legs or feet	Complete (100%)

Results

Table 2 shows distribution of the demographic data like age, weight, height, (t - test) and Table 3 shows distribution according to sex, ASA (Chi-square test) in general, are comparable between both groups and there was no statistically significant difference (p – value > 0.05). Mean duration of surgery in Group A was *48.17 ± 19.49* and in Group B was *57.67 ± 34.16 minutes*, which is statistically non-significant (p - value = 0.191).

Table 2: Demographic data according to Age, Weight, Height

	Group A		Group B		*p* - value	*t* - value
	Mean	SD	Mean	SD		
Age	38.37	10.5	37.7	11.91	0.230	0.819
Weight	66.13	9.06	64.33	10.26	0.720	0.474
Height	164.27	6.96	163.07	7.85	0.627	0.533

Table 3: Distribution of patient according to gender and ASA Grading

	Sex		ASA Grading	
	Male	Female	I	II
Group A	17 (56.7%)	13 (43.3%)	21 (70%)	24 (80%)
Group B	18 (60%)	12 (40%)	9 (30%)	6 (20%)

$\chi^2 = 0.069$ $\chi^2 = 0.800$

Table 4 summarizes, thorasic level of sensory block in Group A was T4.93 ± 0.828 while in Group B was T5.70 ± 1.055 which was significant (*t* - test value = 3.131, *p* - value = 0.003).

Table 4: Cephalad spread of sensory level

	Group A	Group B
Mean	4.93	5.70
SD	0.828	1.055

p - value = 0.003, *t* - value = 3.131

Shows in Table 5 summarizes, Bromage score (Grade III & IV) after 3 minutes of intra thecal injection between two. In Group A, Grade IV of motor block is seen in 24 patients (80%) which is higher compared to 4 patients (13.3%) in Group B. This result is highly significant as Chi-square value is 26.786, p - value is 0.000. Table 6 illustrates, the total duration of motor block was *228* and *220 minutes* for Group A and Group B respectively. There was no statistically significant difference. Table 7 summarizes incidence of adverse events in both Group. The observed incidence of adverse events was significant for hypotension and vomiting as both were more in Group A. Hypotension is seen in 17 (56.7%) patients of Group A while 13 (43.3%) patients doesn`t had it. In Group B, hypotension was observed in 7 (23.3%) patients and 23 (76.7%) patients does not had hypotension. 9 patients in bupivacaine Group had intra-operative nausea/ vomiting compared to 1 patient in ropivacaine group and was found to be statistically significant ($p < 0.05$). While bradycardia and ventricular arrthymias were found to be non-significant. Incidence of bradycardia is similar between two Groups. 9 patients in each Group had bradycardia and who were treated with anti-cholinergics. Intra-operative arrhythmias, were seen in only 2 patients of bupivacaine group and no patient of ropivacaine group had it.

Table 5: Bromage Score after *3 minutes*

	Group A	Group B
Grade III	6 (20 %)	26 (87.3%)
Grade IV	24 (80%)	4 (13.7%)

$\chi^2 = 26.786$, $p = 0.000$

Table 6: Total duration of Motor Block in minutes

	Mean	SD
Group A	228	32.09
Group B	220	27.67

p - value = 0.305, *t* - value = 1.034

Table 7: Incidence of Adverse Events

Adverse Event		Group A	Group B	*p* - value	Chi-square value
Hypotension	Present	17 (56.7%)	7 (23.3%)	0.017	6.994
	Absent	13 (43.3%)	23 (76.7%)		
Nausea/Vomiting	Present	8 (26.7%)	1 (3.3%)	0.026	6.405
	Absent	22 (73.3%)	29 (96.7%)		
Bradycardia	Present	9 (30%)	9 (30%)	1	0.000
	Absent	21 (70%)	21 (70%)		
Ventricular Arrythamias	Present	2 (6.7%)	0 (0%)	0.492	2.069
	Absent	28 (33.3%)	30 (100%)		

Discussion

As practice of modern medicine focuses increasingly on day care surgical procedures, spinal anesthetics should provide short-acting and adequate anesthesia without compromising early ambulation and discharge from the day surgery unit. The risk of general anesthesia including mishaps due to airway management are avoided by this technique. Ropivacaine could have potential in this area. It was demonstrated that the significantly faster onset and regression of sensory block was seen with intrathecal bupivacaine and opioids, however, significantly shorter motor block duration with intrathecal ropivacaine might be advantageous because it allowed a faster discharge, and or early recognition of any neurologic complications. Ropivacaine is a local anesthetic with lower cardiotoxic potential than racemic bupivacaine. The majority of published data on ropivacaine concerns its use in the epidural space.

Present study was undertaken to compare isobaric ropivacaine and hyperbaric bupivacaine. In humans, ropivacaine has been shown to be effective in providing intrathecal anesthesia for patients undergoing THR,[8] TURP[9] and lower abdominal and lower limb surgery.[10,11]

Sensory level/Maximum cephalad spread

In our study maximum cephalad spread is assessed after *3 minutes* of injection of drug by using loss of sensation to pinprick. In bupivacaine Group (A) the mean sensory level was T-4 to T-6 (4.93 ± 0.828) which is higher when compared to ropivacaine Group (B) where the mean level was T-5 to T-8 (5.70 ± 1.055). The following studies agreed with our result and it shows bupivacaine level was higher than ropivacaine Group. A study by Koltka k *et al*.[12] reported spread of sensory block was higher in bupivacaine than ropivacaine. This is in contrast with the study conducted by Jean-Marc Malinovsky *et al*.[13] [Mean level for Bupivacaine: T-7 & Ropivacaine:T-9], Whiteside *et al*.[14] [Mean level for Bupivacaine:T-5 & Ropivacaine:T-7] had higher sensory level in bupivacine group.

Motor block after 3 minutes of injection

After *3 minute* of injection, Grade IV (complete motor block) is seen in 24 patients (80%) of bupivacaine Group (A) while seen in 4 patients (13.7%) of ropivacaine Group (B). Rest 26 patients (76.3%) of ropivacaine Group (B) attained Grade III of Bromage score. This difference was statistically significant since $p < 0.05$. This score was comparable with the study by Mantouvalou *et al*.[15] & Erturk E *et al*.[16] which report onset of motor block was significantly faster in bupivacaine group. Whiteside *et al*.[14] in 2003 compared the clinical efficacy of hyperbaric ropivacaine with that of the commercially available hyperbaric preparation of bupivacaine. They observed that time to peak motor blockade was delayed in the Ropivacaine Group (*20 min*) as compared to Bupivacaine Group (*15 min*), $p < 0.001$.

Total duration of motor block

In our study total duration refers to the time after intra-thecal injection to the complete recovery of the

patients from motor block. In bupivacaine Group (A) the mean duration was *228 minutes* whereas in ropivacaine Group (B) it was *220 minutes*. Which non-significant (*p* - value = 0.305). Same observations seen in studies of Gautier PE *et al*.,[17] Jean-Marc Malinovsky *et al*.[13] and Kessler P *et al*.[18] compared isobaric ropivacaine and bupivacaine, which showed similar motor blockade between the two Groups. Sanchez *et al*. in 2009 compared the effects of intrathecal Isobaric Ropivacaine (IR) *vs* Isobaric Bupivacaine (IB) in a dose ratio of 3:2 in non-ambulatory urologic and orthopedic surgery. 117 patients scheduled for surgery were randomized and assigned in a double-blind fashion to receive either *15 mg* of IR (*n* = 58) or *10 mg* of IB (*n* = 59). They concluded that the motor blockade was longer in the IB Group (*266.5 + 29.5*) compared to the IR Groups (*226.4 ± 22.3 min*), $p < 0.001$. We found the duration of motor blockade to be prolonged with bupivacaine when compared with ropivacaine.

Hemodynamic parameters

Hypotension: In our study, there was a significant incidence of hypotension in bupivacaine Group (A) compared to ropivacaine Group (B). 17 patients (56%) of bupivacaine group has hypotension which is higher when compared to 7 patients (23%) of ropivacaine group ($p < 0.05$). This is consistent with the study conducted by Lopez-soriano F *et al*.,[19] Whiteside *et al*.,[14] Mantouvalou *et al*.[15] & Erturk E *et al*.[16] In their studies it is shown that there is increased incidence of hypotension and higher requirements of vasoactive drugs in bupivacaine group than in ropivacaine group of patients. This can be attributed to the higher cephalad spread of hyperbaric bupivacaine causing more sympathetic blockade than isobaric ropivacaine. Mehta V, Gupta R, Wakhloo, *et al*.[20] compared intrathecal administration of isobaric bupivacaine (*15 mg*) and ropivacaine (*15 mg*) undergoing lower limb surgery. They found that, there was slight decrease in mean heart rate and arterial blood pressure over *30 minutes* after anesthesia which was statistically non-significant. Mac Namee, McClelland, S. Scott *et al*.[21] studied isobaric ropivacaine *5 mg/ml* (*3.5 ml*) and isobaric bupivacaine *5 mg/ml* (*3.5 ml*) for major orthopedic surgery.

Nausea/Vomiting: In our study, 8 patients of bupivacaine group had intra-operative nausea/ vomiting compared to 1 patient of ropivacaine group which was significant ($p < 0.05$). The increased incidence of nausea/vomiting in Group B can be explained due to higher incidence of hypotension and maximum cephalad spread. The study by Mantouvalou *et al*.[15] showed occurrence of nausea/ vomiting is equally distributed between the two groups, thereby not agreeing with our study.

Bradycardia and Arrhythmia: In our study, incidence of bradycardia is similar between two groups. 9 patients in each group had bradycardia and who were treated with anti-cholinergics. This is in contrast with the study done by Kessler P *et al*.,[18] Boztug N *et al*.,[22] and Koltka k *et al*.[12] which reported lower incidence in ropivacaine but no significant bradycardia between the two groups. (bupivacaine and ropivacaine). Regarding intra-operative arrhythmias, only 2 patients in bupivacaine group had ectopics and no patient of ropivacaine group had it. Though it was not statistically significant.

Conclusion

From our study it was shown that:

1. The maximum cephalad spread or height of sensory level was significantly lower in ropivacaine group;
2. After *3 minutes* of injection, motor block was denser in bupivacaine group than ropivacaine group with statistical significance;
3. There was no significant difference in the total duration of motor blockade;
4. Incidence of hypotension is higher in bupivacaine group compared to ropivacaine group;
5. Nausea/vomiting is more pronounced in bupivacaine group.

Although the onset of motor blockade was denser in bupivacaine group, the total duration of motor blockade was similar between the groups. Hence, we conclude that 0.75% isobaric ropivacaine produces similar duration of motor blockade with stable hemodynamics, as compared to 0.5% hyperbaric bupivacaine.

Key massage: Ropivacaine has lower cardiotoxic potential than bupivacaine.

Conflict of Interest: None.

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Effect of Combined Spinal Epidural Analgesia on the Progress of Labor and Outcome

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Abstract

Background: The Combined Spinal Epidural (CSE) technique is used with increasing frequency in labor analgesia, because of its rapid onset of excellent analgesia. *Aim:* Aim of the present research was to study the effect of combined spinal epidural analgesia on the progress of labor and its outcome. *Material and Methods:* Present study was performed in the Department of Anesthesia and Gynecology at tertiary care institute of Gujarat. History taking and clinical examination was done. A total of 100 parturients receiving combined spinal epidural analgesia was compared with 100 parturient receiving the usual anesthetic used in our labor ward that is tramadol. Progress of labor was recorded in a partogram. The outcome of labor in the form of normal vaginal delivery, instrumental delivery or cesarean section was noted. The indications for cesarean section or instrumental delivery were noted. Neonatal outcome in the form of Apgar scores at 1 *minute* and 5 *minutes* and need for intensive care facilities was noted. *Results:* In cases in nulliparas the mean duration of first stage of labor was significantly reduced in the combined spinal epidural group (339.58 + 70.11 *minutes*) as compared to controls (400.01 + 109.12 *minutes*). (*p* - value 0.011). There was no significant difference in the duration of first stage of labor in multiparous parturients. 92.0% of parturients had a pain score of < 10 in the group receiving combined spinal epidural analgesia and the remaining 8.0% had scores between 11 and 40. In the control group none of the parturients had a pain score of < 70. *Conclusion:* Labor pain is associated with biochemical and physiological changes that may have adverse effects on both the mothers and the fetus. Combined spinal epidural analgesia is an excellent method of relieving labor pain.

Keywords: Cesarean section; Labor pain; Neonatal; Spinal epidural technique.

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Introduction

Pain is the single most predominant sentinel of the beginning of labor. It is also the single most fearful thought regarding normal delivery amongst pregnant women. The control of pain should ideally form any integral part of labor management at any level.[1,2] An effective analgesia takes away the disadvantages and helps for better maternal and fetal outcome. Relief of pain during labor endeavors to make the journey of labor safe and pleasant for both the mother and the baby.[3]

The epidural analgesia technique was used to maintain analgesia for parturients in the epidural analgesia group, which involved placing a thin catheter through a needle inserted into the epidural

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space. First, the investigator injected a test dose of *5 ml* 1% lidocaine through it. If not adverse effects were observed *10 minutes* after the test dose, the parturient then received a bolus injection of an initial dose of *8–10 ml* mixed liquids of 0.075% ropivacaine and *0.2 ug/ml* sufentanil citrate. We then connected the catheter with a Patient-controlled epidural Analgesia (PCA) pump, which provided patients the same local anesthetic and opioid mixture at *8–10 ml/h* to optimize their pain relief until the delivery of neonates.

It was observed that parturients who received combined spinal epidurals form of analgesia had more rapid deliveries, although this may have resulted from the common practice of administering CSE analgesia to parturients who were multiparous or in more advanced stages of labor. In contrast, some authors have suggested that epidural analgesia may prolong labor in nulliparas, especially if administered early in labor, although the effect is probably modest.[4]

Over the centuries many methods have been tried for pain relief in labor. Of all, neuraxial blockade (epidural, spinal, combined spinal epidural, continuous spinal) provides the most effective analgesia. They are also the least depressant. The combined spinal epidural analgesia combines the benefits of spinal anesthetic including rapid onset and very low failure rates with the benefits of epidural analgesia like the use of catheter for continuous infusion. It causes minimal motor blockade allowing for maternal ambulation. It has also been associated with faster progress of labor. Hence, the aim of the present research was to study the effect of combined spinal epidural analgesia on the progress of labor and its outcome.

Materials and Methods

Present study was performed in the Department of Anesthesia and Gynecology tertiary care institute of Gujarat. History taking and clinical examination was done. A total of 100 parturients receiving combined spinal epidural analgesia was compared with 100 parturient receiving the usual anesthetic used in our labor ward that is tramadol. Inclusion criteria include Singleton pregnancy, Presentation of vertex, Term gestation and Patient in active labor with cervical dilation 3–5 *cm*, with intact membranes and with satisfactory uterine contractions.

Exclusion criteria include presence of Malpresentation, Preterm labor, Presence of any fetal anomalies, Medical disorders complicating pregnancy, Obstetric complications, Contraindications for regional analgesia. For parturients who met the above criteria, valid consent was taken. Parturients were randomly allocated to case and control group.

Spinal analgesia was given using sufentenyl *5 micrograms* & bupivacaine *2.5 mg* and later continued with epidural technique using sufentanil *0.3 micrograms* and bupivacaine 0.125% till completion of labor. Parturients were pre-loaded with *1 liter* or Ringer lactate. Parturients were put in left lateral position.

Under all aseptic precautions, combined spinal epidural analgesia was performed. In the midline approch (L2-L3 or L3-L4), lumbar epidural space was identified with an 18 G Touhy needle using loss of resistance to saline technique. After negative aspiration for blood and CSF, epidural catheter was threaded in through the Touhy needle and the needle was slowly withdrawn carefully. Spinal analgesia was instituted using a 25 G Whitacare needle by lateral approach in the same space as of the epidural.

On identification of the subarachnoid space, *1 cc* of drug containing *0.5 cc* of 0.5% bupivacaine hydrochloride (*2.5 mg*) and *0.5 cc* of sufentanil containing *5 μg* was injected after negative aspiration of the blood. The patient was turned supine immediately after subarachnoid block and the uterus given a left displacement using a wedge under the right buttock.

When the patient complained of pain, epidural top up was given with *11 ml* of local anesthetic and opioid mixture containing *10 ml* of 0.125% bupivacine and *1 ml* of sufentanil containing *3 μg*, After first confirming proper placement of the epidural catheter by negative aspiration for blood and CSF. The maternal parameters were monitored at *0.5, 10, 15, 30 minutes* and thereafter, every *30 minutes* till the woman delivered. Fetal heart rate was continuously monitored using an electronic fetal monitor & any variations were noted. The control group received injection tramadol *100 mg* intramuscularly.

Labor was managed by active management of labor for both cases & controls. In the first stage of labor ARM was done as a part of active management of labor protocol and to note the color of the liquor. Oxytocin was administered if contractions were not satisfactory. Third stage was managed by administration of an oxyticic drug within one minute of delivery of the baby and delivery of the placenta by controlled cord traction.

Progress of labor was recorded in a partogram. The outcome of labor in the form of normal vaginal

delivery, instrumental delivery or cesarean section was noted. The indications for cesarean section or instrumental delivery were noted. Neonatal outcome in the form of Apgar scores at *1 minute* and *5 minutes* and need for intensive care facilities was noted. The patient was monitored for *2 hours* following delivery and the epidural catheter was removed. The patients were followed up on the next day to enquire about their views on the procedure and their satisfaction. Patients were also enquired about any symptoms related to post-dural-puncture headache. Data was analyzed using appropriate statistical analysis.

Statistical analysis

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

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

Results

The present study was done to assess the effect of combined spinal epidural analgesia on the progress of labor and its outcome, to evaluate it efficacy as an analgesic technique and to study the maternal and fetal outcome. A total of 100 parturients in the control group were compared with 100 healthy parturients receiving combined spinal epidural analgesia. Maximum number of parturients in both groups (82% in cases and 74% in controls) belong to the age group of *20 to 30 years*.

In cases in nulliparas the mean duration of first stage of labor was significantly reduced in the combined spinal epidural group (*339.58 + 70.11 minutes*) as compared to controls (*400.01 + 109.12 minutes*). (*p* value 0.011) There was no significant difference in the duration of first stage of labor in multiparous parturients, shows in (Table 1).

Table 1: Duration of first stage labor

Group	Parity	Mean	*p* - value
Nullipara	Case	339.58 + 70.11	0.011
	Control	400.01 + 109.12	
Multipara	Case	325.40 + 108.12	0.30
	Control	322.10 + 79.60	

There was no significant prolongation of the second stage of labor in cases as compared to controls in both the nulliparous and multiparous parturients, shows in (Table 2). Whereas, the duration of third stage of labor was similar for both cases and controls, (Table 3).

Table 2: Duration of second stage labor

Group	Parity	Mean	*p* - value
Nullipara	Case	31.97 + 13.11	0.30
	Control	28.19 + 11.93	
Multipara	Case	17.19 + 10.93	0.92
	Control	16.12 + 79.60	

Table 3: Duration of third stage labor

Group	Mean	*p* - value
Case	4.93 + 1.10	0.40
Control	5.20 + 2.92	

Ninty-two percent of parturients had a pain score of < 10 in the group receiving combined spinal epidural analgesia and the remaining 8.0% had scores between 11 and 40. In the control group none of the parturients had a pain score of < 70, shows in (Table 4).

Table 4: Visual analogue scale score in control and cases

Visual Analog scale score	Case	Control
< 10	92	None
11–20	4	None
21–30	2	None
31–40	2	None
70–80	None	38
81–90	None	62

Discussion

The effect of neuraxial analgesia in labor and obstetric outcomes has been studied extensively over the years. Among the endpoints studied were duration of first and second stages of labor, oxytocin augmentation, rate of instrumental and cesarean deliveries, maternal satisfaction and neonatal outcome.[5–8] As noted by ASA and ACOG, 'there is no other circumstance where it is considered acceptable for a person to experience severe pain amenable to safe intervention while under a physician's care.[9] Unfortunately, labor represents one of few circumstances in which provision of effective analgesia is alleged to interfere with parturients and obstetricians' goal. Neuraxial block technique is currently the gold standard for labor analgesia.

In our study, the mean duration of first stage and active phase of first stage of labor was reduced by *60 minutes* and *33 minutes* respectively minutes in cases as compared to controls in nulliparuos parturients. This is statistically significant. No significant decrease in the duration of active phase of first stage of labor was seen in multiparous parturients. This is an agreement with other reports. Ji X *et al*.[10] reported a significant decrease ($p < 0.05$) in the duration of first stage of labor and total duration of labor in the combined spinal epidural group as compared to controls. Previous studies comparing epidural analgesia with systemic opioids have shown inconsistent results. Epidural analgesia was either implicated in prolonging or showed no effect on the first stage of labor.[11–15] Interestingly, Tsen *et al*. demonstrated that CSE was associated with an increased cervical dilatation rate in nulliparous patients.[16] The authors postulated that the spinal analgesia of a CSE technique allowed, at least initially and potentially during the course of labor, for a reduction in local anesthetic dosage when compared with conventional epidural analgesia. Another postulate was that painful labor resulted in an increase in maternal adrenaline level, which may be tocolytic in itself. There is evidence to demonstrate that epidural analgesia may accelerate labor as the provision of effective analgesia reduces maternal catecholamines, and hence, minimizing its inhibitory effect on uterine contractility.[17] The use of CSE analgesia with its rapid onset and similar analgesic efficacy would thus be expected to have a similar effect on the duration of labor.

The mean duration of second stage of labor was not significantly prolonged in cases as compared to controls. This shows that combined spinal epidural analgesia does not interfere with the descent or internal rotation of the presenting part or the maternal expulsive forces.[18] In our study, no difference was found in the duration of third stage of labor and the amount of blood loss between cases and controls. Ji X *et al*. also reported no difference in the amount of blood loss between the combined spinal epidural group and the control group.[19]

More than 90% of the parturients reported excellent pain relief with combined spinal epidural analgesia. Collis RE *et al*.[20] reported complete satisfaction with analgesia and mobility by 95% of the mothers. The onset of analgesia was less than *5 minutes* in all cases. Abouleish A *et al*.[21] also reported onset of analgesia in < *5 minutes* in all cases. Norris MC *et al*.[22] reported mean onset of tine to first pain free contraction as *7.8 + 4.3 minutes*.

Conclusion

Labor pain is associated with biochemical and physiological changes that may have adverse effects on both the mothers and the fetus. Combined spinal epidural analgesia is an excellent method of relieving labor pain.

Conflict of Interest: None

Source of Support: Nil

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Efficacy of Low-dose Succinylcholine and Low-dose Atracurium in Facilitating I-gel Insertion: A Randomised Comparative Study

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Abstract

Background: I-gel is being commonly used for safe day care surgeries in today's fast pace world. Muscle relaxants even in low-doses are superior to other agents in facilitating smooth I-gel insertion. *Aims and Objectives:* The present study, aims to compare I-gel insertion conditions with low-dose succinylcholine and low-dose atracurium by assessing jaw relaxation, ease of insertion, hemodynamic changes and complications. *Materials and Methods:* Randomised comparative study conducted on 86 patients of ASA physical status I and II divided into 2 Groups of 43 each by random number tables. Group S received 0.2 *mg/kg* of succinylcholine and Group A received 0.1 *mg/kg* of atracurium. I-gel was inserted by a single investigator and jaw relaxation, insertion conditions and complications were observed. *Results:* Jaw relaxation was comparable in 2 Groups (93.0% had full jaw relaxation in Group A while 97.7% had full jaw relaxation in Group S) with no statistically significant difference. Group A had better ease of insertion than Group S, although difference was not statistically significant (p = 1.00). Hemodynamic response was similar in both the Groups. Post-operative myalgia was seen in 1 subject in Group S (2.3%), and sore throat in 1 subject in Group A (2.3%), statistically being insignificant. *Conclusion:* Both low-dose succinylcholine and low-dose atracurium provide good insertion conditions for I-gel. Low-dose atracurium (0.1 *mg/kg*) is equally effective as low-dose succinylcholine (0.2 *mg/kg*) for I-gel insertion.

Keywords: I-gel; Low-dose succinylcholine; Low-dose atracurium; Insertion conditions.

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Introduction

Supraglottic Airway Devices (SAD) have changed the face of airway management and is now widely used in anesthesia across the globe. As ambulatory surgeries continue to grow over the world, the emphasis on day care anesthesia has increased which in turn has led to increasing use of SAD.[1]

Performing a successful smooth SAD insertion in first attempt may still be challenging at times.[2] Multiple insertion attempts may lead to insertion related morbidities including adverse hemodynamic changes, airway trauma and potential insertion associated reflexes such as coughing, gagging and laryngospasm.[3]

Propofol is considered as the induction agent of choice for SAD insertion as it obtunds oropharyngeal reflexes well.[1] Often though it

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has been seen that propofol as a sole agent is not sufficient to prevent patient movement, coughing, and gagging. Additional doses of propofol are required to prevent these undesirable movements and airway reflexes, hence, multiple insertion attempts may be needed.[4]

Using other agents like opioids, lignocaine, benzodiazepines and muscle relaxants facilitate ease of insertion and help in reducing the dose requirement of propofol and prevent some of its side effects like hypotension, and prolonged duration of apnea. Studies have shown that muscle relaxants even in low-doses are superior to other agents to facilitate I-gel insertion.

Existing data suggest that it may be possible to achieve a reasonable rapid onset time and shorter duration of action with small-dose of muscle relaxants as duration of action of muscle relaxant is dose dependent.[5] There are fewer studies comparing low-dose succinylcholine and low dose atracurium in facilitating I-gel insertion. Hence, in the present study we intend to compare low-dose succinylcholine and low-dose atracurium for facilitating I-gel insertion Aim of our study was to compare I-gel insertion conditions with low-dose succinylcholine and low-dose atracurium with objectives being to assess jaw relaxation and ease of insertion and also to assess hemodynamic changes and complications with low-dose succinylcholine and low-dose atracurium.

Materials and Methods

The institutional ethical committee clearance was obtained and study was registered with clinical trial registration of India. The study population consisted of *18–60 years*, ASA I and II patients of either sex who were scheduled for elective surgery under general anesthesia with I-gel at our hospital. Subjects with anticipated difficult airway, full stomach (pregnancy, hiatal hernia) and recent upper respiratory tract infections (within *4 weeks*) were excluded. Pre-anesthetic evaluation of patients satisfying inclusion criteria was done and informed written consent was taken. They were randomly allotted in two Groups by random number table: Group S (succinylcholine *0.2 mg/kg*) and Group A (atracurium *0.1 mg/kg*). On arrival in operating room, pulse oximetry, ECG monitor, NIBP monitor was instituted. Base line heart rate, systolic, diastolic and mean arterial blood pressure was recorded.

All patients were pre-oxygenated with 100% oxygen for *three minutes* and induced with fentanyl *2 mcg/kg* and propofol *2 mg/kg*. Relaxant was given according to the patient's group and ventilated by one of the investigator with 100% oxygen for *60 seconds* in Group S and 180 seconds in Group A. I-gel (according to patient's weight) was inserted with standard technique by another investigator (blind-unaware of the group) and also assessed the conditions during insertion. Successful insertion of I-gel was confirmed by chest rise, air entry and $EtCO_2$. Patients were ventilated with *6–8 ml/kg* of tidal volume and maintained on oxygen and air (1:1) and 2% sevoflurane.

In case of failed I-gel insertion during first attempt, additional dose of propofol (*0.5 mg/kg*) was given and another attempt was made after *60 seconds*. The same investigator inserted I-gel in all the patients and had assessed conditions during insertion. The parameters studied were jaw relaxation, ease of insertion, coughing and gagging and patient's movements. These were graded under 3 point scale based on Solanki *et al*.[6] study as follows;

Scores	3	2	1
Jaw relaxation	full	partial	nil
Ease of insertion	easy	difficult	impossible
Coughing and gagging	nil	mild	vigorous
Patient's movements	nil	moderate	vigorous

Ease of insertion was defined as no resistance to the insertion of device in the pharynx in single attempt.[7] Complications like post-operative myalgia and sore throat was scored according to severity from 1–4 based on Aghamohammadi *et al*.[1] study. Base line heart rate, systolic, diastolic and mean arterial blood pressure were noted down. These parameters were monitored and were recorded after induction and *5 minutes* after insertion. The number of attempts for successful I-gel insertion and additional doses of propofol used was also noted in all the patients.

Statistical Analysis

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance assessed at 5% level of significance. Student *t* - test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two Groups (Inter group analysis) on metric parameters. Chi-square/Fisher Exact test has been used to find the significance of study parameters on categorical scale between

two or more groups, non-parametric setting for Qualitative data analysis. The Statistical software namely SPSS 18.0, and R environment version, 3.2.2 were used for the analysis of the data.

Results

A total of 86 patients were included in data analysis. There were no dropouts. Majority of the subjects belonged to ASA 1 (62.8%) and I-gel size 4 (78%) was mostly used.

Table 1: Demographic data of the two studied groups

	Group A	Group S	Total	*p* - value
Age (*years*)	35.47 ± 12.93	37.28 ± 12.44	36.37 ± 12.64	0.509
Weight (*kg*)	66.93 ± 9.32	60.81 ± 8.47	60.87 ± 8.85	0.952
Height (*cm*)	156.60 ± 8.24	159.72 ± 7.08	159.66 ± 7.63	0.944
BMI (kg/m^2)	23.97 ± 3.46	25.04 ± 3.85	24.00 ± 3.63	0.930
Female	24 (55.8%)	25 (58.1%)	49 (57%)	1.00
Male	19 (44.2%)	18 (41.9%)	37 (43%)	1.00

The two Groups were comparable in regard to demographic data like age, weight, height, BMI and gender with p – value > 0.05 which is statistically insignificant, shown in Table 1.

Full jaw relaxation was seen in 40 subjects in Group A and 42 in Group S with p - value being 0.616. Ease of insertion was comparable between the two Groups. Complications were minimally noted when low-dose muscle relaxant was used. Coughing and gagging, patient movements, post-operative myalgia (POM) and sore throat were comparable in the two studied groups. Only 1 subject required second attempt for insertion in Group S with p value = 1.00 which is statistically insignificant, shown in Table 2.

Both the groups were comparable in terms of hemodynamic parameters like heart rate and MAP noted at baseline, post induction and post insertion with p - value of > 0.05, statistically insignificant. Results from our study shows that both the groups are comparable in terms of demographic data, hemodynamic parameters, insertion conditions and complications.

Discussion

Gentle and successful placement of SAD needs comfortable mouth opening, suppression of airway reflexes. I-gel being an innovative supraglottic airway device has advantages over other SAD.[9]

Sole use of propofol does not always guarantee the successful insertion of SAD. Propofol alone can lead to excessive patient's movements, coughing and gagging. 60% of patients had successful insertion in first attempt in Salem's study.[10] Stonheim found easy insertion of LMA in 62% of patients when only propofol was used.[11] In contrast, in our study 98.8% of patients had successful insertion as propofol was aided with low-dose muscle relaxant.

The use of low-dose neuromuscular blocking drugs is not new. Brain used thiopentone for induction and a small-dose of alcuronium (*0.2 mg/kg*) before LMA insertion.[12] Chui and Cheam found that low-dose mivacurium facilitated insertion of LMA after propofol induction.[13] There was lower incidence of swallowing, coughing, movement, laryngospasm and post-operative sore throat.

Table 2: Various parameters studied in two groups

	Grading	Group A	Group S	Total	*p* - value
Jaw relaxation	1 (nil)	0 (0%)	0 (0%)	0 (0%)	
	2 (partial)	3 (7.0%)	1 (2.3%)	4 (4.7%)	0.616
	3 (full)	40 (93.0%)	42 (97.7%)	82 (95.3%)	
Ease of insertion	1 (impossible)	0 (0%)	0 (0%)	0 (0%)	
	2 (difficult)	0 (0%)	1 (2.3%)	1 (1.2%)	1.000
	3 (easy)	43 (100%)	42 (97.7%)	85 (98.8%)	
Coughing and gagging	1 (vigorous)	0 (0%)	0 (0%)	0 (0%)	
	2 (mild)	1 (2.3%)	1 (2.3%)	2 (2.3%)	1.000
	3 (nil)	42 (97.7%)	42 (97.7%)	84 (97.7%)	
Patient's movements	1 (vigorous)	0 (0%)	0 (0%)	0 (0%)	
	2 (moderate)	7 (16.3%)	3 (7%)	10 (11.6%)	0.178
	3 (nil)	36 (83.7%)	40 (93%)	76 (88.4%)	
POM (Post Operative Myalgia)	1 (no)	43 (100%)	42 (97.7%)	85 (98.8%)	1.000
	2 (yes)	0 (0%)	1 (2.3%)	1 (1.2%)	
Sore throat	1 (no)	42 (97.7%)	43 (100%)	85 (98.8%)	
	2 (yes)	1 (2.3%)	0 (0%)	1 (1.2%)	1.000
No of attempts	1	43 (100%)	42 (97.7%)	85 (98.8%)	
	2	0 (0%)	1 (2.3%)	1 (1.2%)	1.000

Succinylchoiline, a depolarizing muscle relaxant has many advantages over NDMR like rapid onset of action, shorter duration of action. The Effective Dose (ED95) of succinylcholine is less than *0.3 mg/kg*.[14,15] A dose of *1 mg/kg* represents *3.5–4 times* the ED95.[16] Spontaneous recovery from the induced apnea with succinylcholine *1 mg/kg* may not develop fast enough to prevent hemoglobin desaturation in patients with unassisted ventilation in case of unanticipated difficult airway.[17] Smaller dose of succinylcholine may shorten this time of vulnerability.[18] Despite having many advantages succinylcholine is not devoid of side effects like bradycardia, hyperkalemia, masseter spasm, malignant hyperthermia, raised intraocular and itragastric pressure.

Atracurium's recovery time is long but is devoid of succinylcholine above mentioned side effects. A tracurium, particularly in high-doses, has been associated with histamine release, which can rarely lead to bronchospasm and cardiovascular collapse.[19]

Different studies have been conducted with different low-doses of muscle relaxants. Monem compared succinylcholine *0.35 mg/kg* with atracurium *0.06 mg/kg* under thiopentone induction.[20] Ho and Chui used *0.1 mg/kg* succinylcholine and found lesser insertion attempts and smoother insertion.[21] Similarly, Aghamohammadi used *0.1 mg/kg* succinylcholine and found smoother insertion conditions with this mini-dose of succinylcholine.[1]

From previous studies, we inferred that *0.1 mg/kg* of succinylcholine was adequate but higher-dose of propofol requirement was needed, although *0.1 mg/kg* of succinylcholine is effective in relieving laryngospasm. Keeping the day care setting in our mind, we compared $1/5^{th}$ of intubating dose of two muscle relaxants. We compared *0.2 mg/kg* of succinylcholine and *0.1 mg/kg* of atracurium in facilitating I-gel insertion.

Jaw relaxation in our study was similar to study conducted by Korula S., where it was found that jaw relaxation was better in succinylcholine Group (93.3% had good jaw relaxation) as compared to atracurium Group (90% had good jaw relaxation), though statistically being insignificant.[8] But, we observed less number of patients in Group A having partial jaw relaxation as compared to Korula S study. This could have resulted because they inserted the SAD after *1 minute* in both the groups however, we inserted after *1 min* in succinylcholine group and after *3 minutes* in atracurium group, giving time for muscle relaxant to act.

Insertion conditions depend not only on depth of neuromuscular blockade but also on premedication, depth of anesthesia, anatomical factors. It is well-recognized that inhalation agents potentiate the intensity of neuromuscular blockade, prolong the duration of block and may increase the speed of blockade.[22]

Aghamohammadi D. observed higher incidence of gagging in their study when *0.1 mg/kg* of succinylcholine was used.[1] Coughing and gagging are due to stimulation of posterior pharyngeal wall receptors. Low-dose relaxants not causing full muscle paralysis but causes suppression of upper airway reflexes and hence, can help in decreasing coughing and gagging.

In our study, 16.3% (7) subjects in atracurium group had moderate patient's movements while only 7% (3) had in succinylcholine group. This was similar to Solanki S study where moderate patient movements were seen in 13.33% (4 patients) who received *0.2 mg/kg* succinylcholine.[6] Muscle relaxants in low-dose does not cause full paralysis hence, moderate movements were noticed.

Complications like Post-operative Myalgia (POM) and sore throat were studied in both the groups on first post-operative day. In our study, one subject had POM on *day 1* in succinylcholine group. Korula S observed POM in 16.67% in succinylcholine group whereas, 3.3% had in atracurium group.[8] Lower number of POM seen in our study is attributable to lower-dose of Sch (*0.2 mg/kg*) used as compared to Korula S study where *0.35 mg/kg* of Sch was administered. It is possible that factors other than succinylcholine would have caused post-operative muscle pain like position of the patient during surgery as POM was also seen in atracurium group in Korula's study. Waters has hypothesized that post succinylcholine myalgia is due to shearing of soft tissues by asynchronous muscle contractions.[23] So, a lesser dose of the drug will cause less myalgia. Mild fasciculations were seen in 4 subjects in our study but POM was seen only in 1 subject.

Lower incidence of sore throat was observed in our study when compared to other studies, which could be accountable to use of I-gel in our study which is a cuffless SAD. The other reason might be reduced number of attempts and minimal manipulation of upper airway and pharynx.

Conclusion

The use of low-dose muscle relaxant helps in reducing upper airway reflexes and provides

adequate jaw relaxation, which help in easy and smooth insertion of I-gel. It also reduces propofol requirement and number of insertion attempts. From the results of our present study, we concluded that insertion conditions of I-gel were comparable with low-dose of succinylcholine (*0.2 mg/kg*) and low-dose of atracurium (*0.1 mg/kg*).

Low-dose atracurium is equally effective as low-dose succinylcholine and with fewer side effects. So, low-dose atracurium can be used as an alternative to low-dose succinylcholine in cases where succinylcholine is contraindicated. Low-dose muscle relaxant can be used in routine practice for I-gel insertion.

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Original Research Article

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Comparative Assessment of Analgesic Efficacy of TAP Block with Dexmedetomidine, Ropivacaine and with Ropivaciane Alone in Open Open Lower Abdominal Gynecological Surgeries

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Abstract

Background: Transversus Abdominis Plane (TAP) block is a simple and unique method for regional analgesia, especially for lower abdominal surgeries. The aim of this study was to compare the analgesic efficacy of TAP block on addition of 0.5 *mcg/kg* Dexmedetomidine to 0.2% Ropivacaine and 0.2% Ropivacaine alone in lower abdominal gynecological surgeries. *Patients and Methods:* Total of 60 female patients, scheduled for open lower abdominal surgery under general anesthesia, were recruited into two Groups: Ropivacaine (R) and Ropivacaine and Dexmedetomidine (RD). Group R received USG-guided TAP block with 30 *ml* of 0.2% Ropivacaine and saline. Group RD received USG-guided TAP block with 30 *ml* of 0.2% Ropivacaine and 0.5 *mcg/kg* of Dexmedetomidine. Post-operative pain scores, sedation score, time to first rescue analgesic, and total opioid requirement in first 24 *hours*, were calculated. *Results:* The difference between the duration of time to first rescue analgesic, between two groups, was statistically significant ($p = 0.018$). Further, it was observed that the VAS scoring was lower in group RD as compared to Group R, at al. the time intervals. The RD Group showed a significant difference between Modified Wilsons sedation score at first hour in both the groups, $p < 0.001$. All the patients in both the groups were oriented without sedation and with statistical significance ($p < 0.05$). *Conclusion:* The analgesic efficacy of Dexmedetomidine with 0.2% Ropivacaine in TAP block showed a positive result when compared to 0.2% Ropivacaine alone. The analgesic efficacy of Dexmedetomidine with 0.2% Ropivacaine was more pronounced when compared to the 0.2% Ropivacaine individually in TAP block procedure during Lower Abdominal Gynecological Surgeries.

Keywords: Analgesia; Dexmedetomidine; Ropivacaine; TAP block.

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Introduction

A significant number of patients experience pain following an abdominal surgery.[1] This pain is severe and causes physiological and psychological consequences which include patient dissatisfaction, prolonged hospital stay, and potential progression to the chronic pain. Transversus abdominis plane (TAP) block is a novel regional analgesia technique which is technically simple and provides reliable analgesia for both intra-operative and post-operative period for lower abdominal surgeries.

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This technique was first described as a landmark technique *via* lumbar triangle of petit in 2001 by Rafi *et al*.,[2] and it was further developed by McDonnell *et al*. (2008).[6]

In TAP block, local anesthetics cause blockade of the neural afferents which carries pain signalling from incisional site to the brain and spinal cord, leading to the sensory blocking of pain. The efficacy of TAP block has been proven to provide effective analgesia for lower abdominal surgery such as for open appendectomy,[3] hernia repair,[4] and cesarean section.[5] However, the prolonged duration of analgesic effect, after TAP block, may be related to the fact that TAP is poorly vascularized and therefore, the drug clearance may be slow by reduction of absorption into the blood stream.[6] Therefore, for correct assessment of needle placement and local anesthetic spread, a new approach ultrasound-guided TAP block has been established with increasing success rate and safety of TAP block.[7]

Local anesthetics reversibly inhibit the nerve impulses, thus causing prolonged sensory and motor block appropriate for anesthesia in different types of surgeries. Earlier studies were done using Bupivacaine but in recent studies, Ropivacaine has been used, which is a long acting regional anesthetic, and has less cardiotoxic, neurotoxic, and arrhythmogenic effect, along with having intrinsic vasoconstrictor effect, when compared to bupivacaine and lignocaine. It is, however, structurally related to Bupivacaine.

Dexmedetomidine is an alpha-2 agonist which has analgesia and sedation effect. It acts by inhibiting the substances of nociceptive pathway at the level of dorsal root neuron and further by activating alpha-2 adrenoreceptor in the locus coeruleus.[8] Dexmedetomidine, when added to local anesthetic drug, *i.e.,* 0.2% Ropivacaine, prolongs the duration of TAP block and reduces total opioid requirement post-operatively.[9]

Therefore, this study was undertaken to assess the analgesic efficacy of dexmedetomidine by comparing 0.2% Ropivacaine with Dexmedetomidine *vs* Ropivacaine only in ultrasound-guided TAP block for post-operative analgesia, after general anesthesia-induced open lower abdominal gynecological surgeries.

Materials and Methods

After getting approval from the Institutional Ethical and Scientific Committee and written informed consent from patients, 60 female patients, between *18* and *60 years* of age, with American Society of Anesthesiologists (ASA) Physical Status I and II, and scheduled for open lower abdominal gynecological surgeries under general anaesthesia, were enrolled in this prospective, double blind, randomized, comparative study. The study was carried out at Department of Anesthesiology in, KLE's Prabhakar Kore hospital and MRC, Belagavi.

Patients were randomized by using a computer-generated random number table provided to the interventional anesthesiologist using sealed envelopes on the day of surgery to ensure blinding. All patients were randomly allocated in two Groups—Group RD and R, with 30 patients in each group.

Group RD: Administered with 0.2% Ropivacaine (*15 ml*) + *0.5 mcg/kg* Body Weight (BW) Dexmedetomidine, diluted with normal saline to *1 ml*.

Group R: Administered with 0.2% Ropivacaine (*15 ml*) + *1 ml* normal saline only.

To maintain the double-blind design, an investigator, not involved in the study, mixed the anesthetic solution for the anesthetist who was performing the block and observing the result.

Methodology

A through pre-anaesthetic evaluation was done. Standard monitoring of Heart Rate (HR), Systolic Blood Pressure (BP), Diastolic Blood Pressure, Mean Arterial Pressure (MAP), respiratory rate, and peripheral capillary oxygen saturation (SpO_2) were performed. The patients were informed about the VAS pain scale for assessment of pain where 0 depicts 'no pain' and 10 depicts 'worst possible pain'. Additionally, history of co-existing diseases and allergies were also investigated. Patients enrolled in the study were not given any sedative. All patients were kept on fast—solid food fastfor *6h* and clear fluid fast for *2h* for clear fluids, before administering the anesthesia.

Anesthetic Technique

After the signing of the informed consent form, patients were brought to the operation theatre and an intravenous cannula (18 G) was secured in their peripheral forearm vein. Standard monitors including Non-invasive Blood Pressure (NIBP), ECG Lead, and pulse oximetry probe, were attached to the patient. Baseline MAP and HR were recorded and mean value of three readings of each

of the parameters was taken as the baseline value.

All patients received standardized general anesthesia with intravenous injection: Propofol *2 mg/kg* (BW), fentanyl *2 mcg/kg* (BW), and vecuronium *0.1 mg/kg* (BW), to facilitate tracheal intubation. Capnometer was attached to confirm the tube placement and monitor the $EtCO_2$ intra-operatively. Lungs were ventilated with volume control mode and oxygen/nitrousoxide/sevoflurane were used for the maintenance. The study drugs were prepared by an anesthesiologist who was not involved with the rest of the study. The drug mixtures, in two syringes, were made up to *16 ml* each by the same anesthesiologist.

Before skin incision, bilateral TAP block was performed using portable Sonosite Ultrasound and linear *6–13 Mhz* ultrasound transducer. The puncture area and the ultrasound probe were prepared in a sterile manner. The probe was placed at the level of the umbilicus along the anterior axillary line. A *23-gauge* Quincke's needle was attached to a *10-cm* extension. Using in-plane USG technique, tip of the needle was placed in space between internal oblique and transversus abdominis muscles. After negative aspiration, *15 ml* of 0.2% ropivacaine was administered with *1 ml* normal saline in Group R and *0.5 µg/kg* (BW) dexmedetomidine, diluted with normal saline to *1 ml*, in Group RD. Drugs were administered under the direct ultrasound guidance. Similarly, contralateral block was also performed.

Intra-operative Data Collection

Intra-operatively, MAP and HR were recorded at *5*, *10*, and *15 min*, after TAP block, and then every *15 min*, till the end of the surgery (up to *120 min*). Intravenous fluids (RL/RS) were administered by replenishing maintenance, deficit, and replacement requirements. The patients were observed for intra-operative complications such as hypotension, bradycardia, nausea, and vomiting. Hypotension (defined as fall in MAP below *65 mm Hg*) was treated with IV fluids and if required, then with *6 mg* of injection, mephentermine IV. Bradycardia (defined as HR < *50 beats per min*) was treated with IV injection, atropine *0.6 mg*. Nausea and vomiting was treated with injection, ondansetron with *0.1 mg/kg* IV. All physiological variables and drugs used were recorded in a data collection chart. After standardized extubation and awakening at completion of surgery, patients were shifted to Post-anesthesia Care Unit (PACU).

Post-operative Management and Data Collection

Patients were observed in recovery room for hemodynamic stability and side effects and were monitored for additional medications. After normalization of vital parameters, the patients were shifted to the ward and were monitored for *3h* by Anesthesiology team members and thereafter, by the on-duty nursing staffs for *24h*, following end of the surgery. Both were blinded to group allocation of the patients.

In the recovery room and ward, the following parameters such as visual analog scale, time of first rescue analgesia, total opioid (Tramadol) requirement, degree of sedation by Modified Wilson's Sedation Scale, occurrence of side-effects and hemodynamic parameters were recorded.

1. *Visual Analog Scale* (*VAS*): VAS score was observed at *1*, *3*, *6*, *12*, *18* and *24h* post-operatively (0: No pain, 1–2: Least pain, 3–4: Mild pain, 5–6: Moderate pain, 7–8: Severe pain, 9–10: Excruciating pain as shown in Fig. 1.

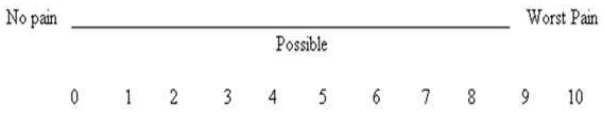

Fig. 1: Visual Analog Scale

2. Time *of First Rescue Analgesia*: Rescue analgesia was provided by injecting Tramadol *2 mg/kg* (BW). This indicated the duration of analgesia from the time of administration of TAP block to VAS score > 4 or on patients requested for analgesia.
3. *Total Opioid* (*Tramadol*) *Requirement*: It is the total amount of supplemental Tramadol, calculated for *24h*, starting from the administration of TAP block.
4. *Degree of Sedation*: Degree of sedation was assessed by Modified Wilson's Sedation Scale (ranging from 1–4) at *1*, *3*, *6*, *12*, *18* and *24h* (1 = oriented, 2 = drowsy but easily roused, 3 = arousable only to mild physical stimulation, 4 = unarousable to mild physical stimulation).
5. *Hemodynamic Parameters*: HR and MAP were recorded at *1*, *3*, *6*, *12*, and *18h*, post-operatively (*i.e.*, after skin closure).
6. *Occurrence of Side-effects*: Nausea, vomiting, drowsiness, bradycardia, or hypotension, were recorded and treated accordingly.

Statistical Analysis

Statistical analysis was done by using Pearson's Chi-square test for independence of attributes for categorical variables which were presented as number of patients and percentage of patients and compared across the two groups. Continuous variables were presented as mean (standard deviation) and compared across the two groups using unpaired *t* - test, if the data followed normal distribution, and Mann—Whitney *U* test, if the data did not follow normal distribution. An alpha level of 5% was taken *i.e.*, if any *p* - value was less than 0.05, it was considered statistically significant. Statistical analysis was performed with the SPSS 20 statistical package.

Results

A total of 60 number of patients were enrolled in the study and randomly divided into two groups of 30 patients each, depending on the drugs used. All enrolled patients completed the study, as specified in Table 1.

Table 1: Specification of groups

Groups	Drugs Received	Number of Patients
Group R	*15 ml* of 0.2% Ropivacaine with *1 ml* with normal saline. (Total volume *16 ml*)	30
Group RD	*15 ml* of 0.2% Ropivacaine with *0.5 mcg/kg* of Dexmedetomidine diluted to *1 ml* with normal saline. (Total volume *16 ml*)	30

We observed that majority of the subjects in Group RD were within the age of "41–50", followed by "21–30", whereas in Group R, most of the subjects were of the age group "31–40", followed by "41–50". Average height and weight of the subjects in the Group RD sample was *159.03* (*cm*) and *63.8* (*kg*), respectively, whereas in Group R, it was *158.37* (*cm*) and *63.07* (*kg*), respectively. The MAP as well as mean HR, at baseline, was not significantly different between the groups ($p = 0.4407$, $p = 0.7612$, respectively). ASA status of subjects in both groups were equally distributed ($p = 0.2949$). The duration of surgery was also similar in both the groups. Majority of the subjects underwent myomectomy surgery followed by salpingo-opherectomy surgery. All these parameters are summarized in Table 2.

Table 2: Summary of statistics of various factors

Factor	Sub-category	Group	
		Group RD *n* (%)	Group R
Age group (*years*)	21–30	8 (26.67%)	2 (6.67%)
	31–40	6 (20%)	12 (40%)
	41–50	10 (33.33%)	9 (30%)
	51–60	6 (20%)	5 (16.67%)
	61–70	0	1 (3.33%)
	71–80	0	1 (3.33%)
Age (*years*)		38.73 ± 11.74	42.87 ± 12.15
Weight (*kg*)		63.8 ± 9.14	63.07 ± 10.19
Height (*cm*)		159.03 ± 7.09	158.37 ± 6.99
B MP		93.8 ± 11.59	96.27 ± 12.98
B Pulse		80.03 ± 9.36	80.8 ± 10.07
ASA	Grade I	20 (66.67%)	15 (50%)
	Grade II	10 (33.33%)	15 (50%)
Duration of surgery (*hours*)		2.10 ± 0.66	2.07 ± 0.69
Type of surgery	myomectomy	8 (26.67%)	7 (23.33%)
	tah with bso	6 (20%)	6 (20%)
	exp laprortomy for ectopic	6 (20%)	5 (16.67%)
	ovarian mass laprotomy	4 (13.33%)	5 (16.67%)
	B/lsalpingoopherectomy	6 (20%)	7 (23.33%)

Abbreviation: B MP: Baseline mean atrial pressure; B Pulse: Baseline Pulse rate; ASA: American Society of Anesthesiologists

Table 3: Mean time (*in hours*) for 1st rescue analgesia

	Group			
	Group RD	Group R		
	Mean ± SD	Mean ± SD	*p* - Value	Significance
Time to 1st rescue analgesia post-operatively (in hrs)	17.63 ± 8.76	12.6 ± 6.61	0.018	Significant

The study showed that the duration of time to first-rescue analgesic was much longer and significant (p = 0.018) in Group RD than in Group R (Table 3).

The study also assessed the comparison of the total amount of opioid requirement, *i.e.*, tramadol (*mg/kg* BW) in first *24h*, post-operation, between both the groups which was statistically significant (p = 0.011). *i.e.*, there was more opioid requirement in Group R than in Group RD (Table 3).

VAS score was significantly lower (p < 0.05) in Group RD as compared to Group R at all the time intervals during the post-operative period at fixed time intervals (*i.e.*, *1*, *3*, *6*, *12*, *18* and *24h*), after skin closure (Table 4).

There was a difference observed in terms of mean sedation scores of the groups at fixed time intervals. About 15 patients in Group RD had Modified Wilsons score of 2, *i.e.*, they were sedated but arousable, whereas in Group R, all the patients had Modified Wilsons score of 1, *i.e.*, they were oriented, without sedation, during first hour of post-operation (p < 0.05). All patients in both the groups were in conscious state without giving any sedation at *3*, *6*, *12*, *18* and *24h*, post-operatively (Table 5).

When the comparison was done for mean HR and MAP during intra-operative condition at fixed time intervals, it was concluded that there were no significant differences found between the groups (Fig. 2). Similar results were also foundin post-operative condition as well for both the mean heart rate as well as MAP (Fig. 3).

When the occurrence of hypotension and bradycardia were monitored and compared, it was found that none of the patients, in either groups, were reported with these conditions.

Table 4: Total opiod requirement in first *24 hours* post-operatively (*in milligrams*)

	Group			
	Group RD	**Group R**		
	Mean ± SD	**Mean ± SD**	***p* - value**	**Significance**
Total Opioid requirement (Tramadol in mg)	86.67 ± 81.93	143.33 ± 81.72	0.011	Significant

Table 5: Post-operative mean VAS scores at fixed time intervals

Post-operative VAS score at different intervals	**Group**			
	Group RD	**Group R**		
	Mean ± SD	**Mean ± SD**	***p* - value**	**Significance**
VAS at *1 hour*	0.03 ± 0.18	0.33 ± 0.48	0.003	Significant
VAS at *3 hour*	0.57 ± 0.68	1.2 ± 0.66	0.001	Significant
VAS at *6 hour*	1.67 ± 1.58	2.6 ± 1.25	0.012	Significant
VAS at *12 hour*	3.17 ± 0.46	4.23 ± 0.43	< 0.001	Significant
VAS at *18 hour*	4.27 ± 0.45	3.5 ± 1.38	0.030	Significant
VAS at *24 hour*	3.33 ± 1.15	4.3 ± 0.79	< 0.001	Significant

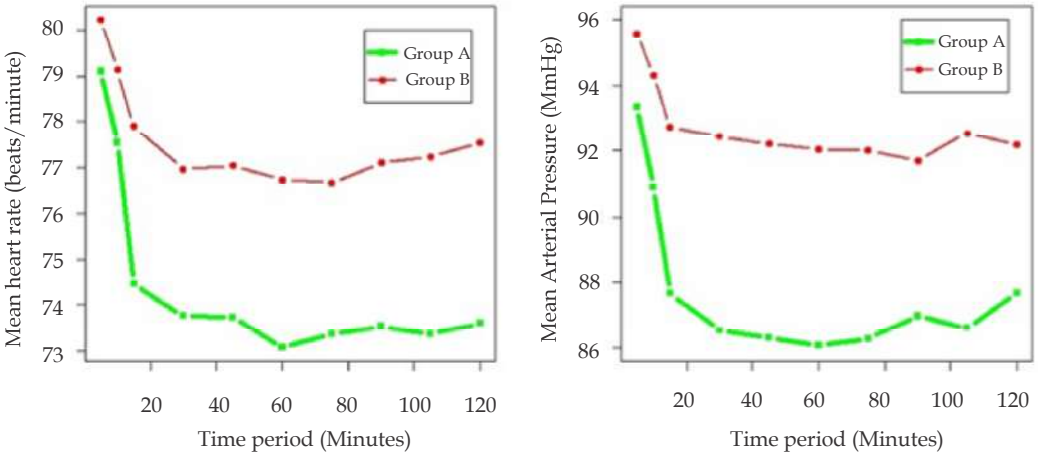

Fig. 2: Intra-operative mean HR and mean MAP between 2 Groups

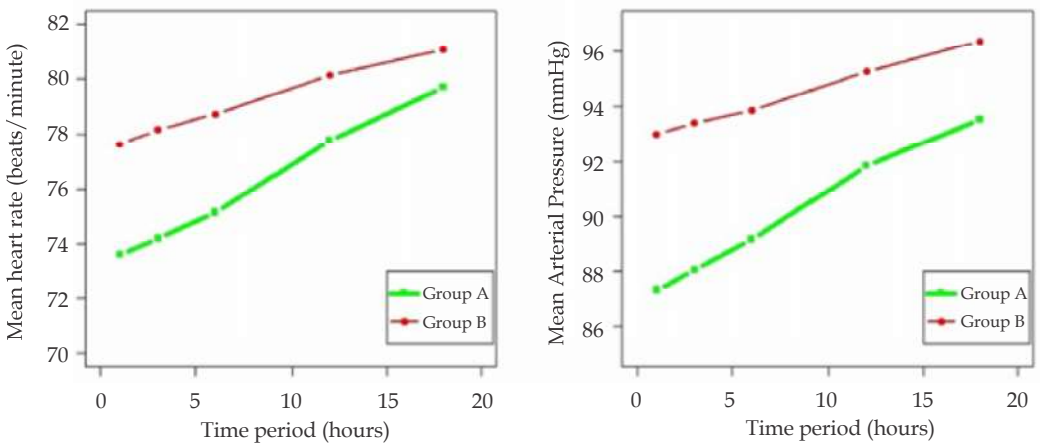

Fig. 3: Comparison of post-operative mean heart rate and mean MAP

Discussion

The present study was a prospective, double blinded, randomized, comparative study which aimed to assess the efficacy of dexmedetomidine with ropivacaine and ropivacaine alone, by using the USG TAP block technique.

In the present study, we compared 0.2% ropivacaine and 0.2% ropivacaine with dexmedetomidine in TAP block, in terms of prolongation of duration of post-operative analgesia. We observed that the duration of post-operative analgesia (*in hours*) was more prolonged in Group RD in comparison to the Group Rand the difference was statistically significant (17.63 ± 8.76 *vs* 12.6 ± 6.61) which was comparable to a study conducted by Ramesh Kumar *et al*. (2017).[10] They observed that, in Group RD, the duration of analgesia was *482 ± 52.94 min* and for Group R, it was *352 ± 22.88 min*. Thus, the mean duration of analgesia was significantly increased ($p < 0.001$) in the Group RD.

Bala Bhaskar *et al*., (2016)[11] stated that addition of adjuvants like dexmedetomidine with local anesthetics have been associated with prolongation of the duration of the TAP block and this study support our findings as well.

In our study, opioid (tramadol *2 mg/kg*) was used as a rescue analgesic. We calculated the total opioid requirement in first *24h*, post-operatively. The total opioid requirement in was much lesser in Group RD (86.67 ± 81.93) than in Group R (143.33 ± 81.72). This difference in total opioid requirement in first *24h* was statistically significant when compared between the groups and was also supported by Kumar *et al*., (2017)[12] who also used tramadol, *2 mg/kg* intravenous as rescue analgesic in patients who had VAS score > 4 post-operatively. They reported that lesser total dose of opioid in first *24h* was seen in the Group RD which received Dexmedetomidine as an analgesic adjuvant as compared to Group R ($p < 0.001$). Our findings were also supported by the findings of Rai *et al*., (2016)[13] who observed that the total dose of tramadol used was less among patients in Group RD when compared to Group R (*98 ± 34.9 mg vs 71 ± 24.9 mg*, $p < 0.001$), during the first *24 h* of post-operative condition.

In our study, VAS scores were recorded in post-operative period at fixed time intervals of *1*, *3*, *6*, *12*, *18*, and *24h*. VAS scores were observed to be lower in Group RD as compared to Group R, at intervals. The differences in between the VAS score of the groups were found to be statistically significant at all the respective time intervals ($p < 0.05$).

The mean VAS score was < *1 during 1st* and *3rd hour* in Group RD. Whereas in Group R, mean VAS score was < 1 only during *1st hour*. In RD Group, the VAS score was appeared to be > 4 first time during *18th hour* and in R Group, it appeared during *12th hour* itself following which rescue analgesia was given. The 1st rescue analgesia post-operatively was given at a mean duration of *17.6h* in Group RD and at *12.6h* in Group R.

Our findings were in concordance with Mishra *et al*., (2017)[14] who found that pain scores in Group RD were significantly lower than pain scores in Group R at 1 ($p = 0.014$), 3 ($p = 0.027$), 12 ($p = 0.011$) and *18h* ($p = 0.041$). The pain scores in Group RD were higher than Group R, at *6h* as well, but the difference was not statistically significant ($p = 0.203$). Rai *et al*., (2016)[13] found that the mean VAS score was significantly less at post-operative time intervals of *1*, *4*, and *6h* in Group RD when

compared with the Group R ($p < 0.05$). Thus, we can infer that dexmedetomidine significantly lowered post-operative VAS scores as proved in studies by Mishra *et al*.,[14] and Rai *et al*., which was similar to findings in our study.

The degree of sedation was assessed at *1*, *3*, *6*, *12*, *18*, and *24h*. It was observed that none of the patients had sedation score of more than 1 in Group R at all the time intervals and Group RD, similar to a study conducted by Waleed *et al*., (2014) who also observed that the incidence of sedation was statistically significant only for the first post-operative hour in patients who received dexmedetomidine ($p < 0.005$).[15] In our study, in the post-operative period, the groups were compared based on the changes in HR and MAP, at fixed time intervals. The differences were statistically significant in median HR for at least a pair of time periods. In a study, conducted by Madhuri *et al*., (2017) HR and blood pressure were monitored at *0*, *2*, *4*, 6, *12*, *24*, *36*, and *48h*.[16] They found that statistically significant difference was noted between groups in terms of HR and blood pressure up to *6h*, with no statistically significant difference noted afters *6h*. Hence, in our study, we found significant difference in HR or MAP between the groups at time interval from *5 min* and *10 mins* (p Adj < 0.05), in both groups.

The distribution of ASA status of patients in both the groups was comparable and difference was not statistically significant. Hence, influence of ASA status, if any, was also similar in both groups. The mean duration of surgery and distribution of patients according to surgery were almost similar in both groups without any statistical significance. Therefore, the influence of these parameters on this study was also same in the groups.

In our study, we have found that the two groups were comparable in HR and MAP intra-operatively and post-operatively at fixed time intervals and there was no difference observed. Similarly, Kumar *et al*., (2017)[12] reported in their study that there is no statistically significant difference in HR, after giving TAP block, between the Group R and RD Group which received Ropivacaine and Dexmedetomidine. In concordance to our study, it was also reported that the results between the groups were not statistically significant, in MAP, at all time intervals.

In our study, peri-operative as well as post-operative hypotension or bradycardia was not observed in any patient. These findings were in accordance to the findings noted by Kumar *et al*., (2017)[17] where none of patients reported any significant hypotension or bradycardia. Thus, we can infer from the above studies that dexmedetomidine leads to some degree of sedation when added as an adjuvant in nerve blocks and this is in concordance with our study, (Table 6 and 7).

Table 6: Distribution of subjects by Hypertension and Bradycardia

	Status	Group RD	Group R	*p* - value
Hypotension	Absent	30 (100%)	30 (100%)	–
Bradycardia	Absent	30 (100%)	30 (100%)	–

Limitations of the study

We had limited access with respective to eligible subjects; A larger sample size would help us in giving more detailed information about the efficacy. The effectiveness of TAP block could not be accurately assessed as it was performed following the induction of general anesthesia, but placement of the needle with USG and skill of the operator was taken into consideration. Secondly, the plasma concentration was not measured of dexmedetomidine, so, determination of its action related to systemic absorption or pure local effect couldn't be found out.

Table 7: Mean Sedation Scores of the groups at Fixed Time Intervals

Post operative modified Wilsons Sedation Score at Various Intervals		Group		Total	p - value	Significance
		Group RD	Group R			
Sedation score at *1 hour*	1	15 (50%)	30 (100%)	45 (75%)	< 0.001	Significant
	2	15 (50%)	0 (0%)	15 (25%)		
Sedation score at *3 hour*	1	30 (100%)	30 (100%)	60 (100%)	NA	NA
Sedation Score at *6 hour*	1	30 (100%)	30 (100%)	60 (100%)	NA	NA
Sedation Score at *12 hour*	1	30 (100%)	30 (100%)	60 (100%)	NA	NA
Sedation Score at *18 hour*	1	130 (100%)	30 (100%)	60 (100%)	NA	NA
Sedation Score at *24 hour*	1	30 (100%)	30 (100%)	60 (100%)	NA	NA

Conclusion

We can conclude that the TAP block technique with dexmedetomidine and ropivacaine increases the duration of time to first rescue analgesia, reduces total opioid requirement, VAS scores in the post-operative period with no side-effects when compared to 0.2% ropivacaine-mediated TAP block technique.

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Comparision of Bupivacaine and Bupivacaine with Dexamethasone Combination in Brachial plexus Block by Supraclavicular Approach

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Abstract

Introduction: As an alternative to general anesthesia, for upper limb surgeries, brachial plexus block is a popular approach. This type of block avoids the untoward effects of general anesthesia including upper airway instrumentation and thus prevents the consequences as shown by the available literatures. *Aim:* To compare 0.5% bupivacaine with normal saline and 0.5% bupivacaine with Dexamethasone (8 *mg*) in brachial plexus block by supraclavicular approach. *Materials and Methods:* This study was a single blinded, randomized study which was taken up among 70 patients aged between 18 to 65 *years* of ASA I and II posted for upper limbs. They were randomly divided into two equal groups where first group received 28 *ml* of Bupivacaine + 2 *ml* NS and second group received 28 *ml* of Bupivacaine + 2 *ml* Dexamethasone (8 *mg*) by supra clavicular approach. *Results:* Between the mean ages of two groups, there was no statistically significant difference. In Bupivacaine group, the mean time for onset of sensory block was 17.4 (± 3.5) *min* and in Bupivacaine dexamethasone group was 11.8 (± 2.7) *min* ($p < 0.05$). The mean time for onset of motor block in Bupivacaine group was 8.5 (± 4.4) *min* and in Bupivacaine dexamethasone group was 6.4 (± 1.8) *min* ($p < 0.05$). Both the differences were statistically significant ($p < 0.05$). The mean duration of sensory block in Bupivacaine group was 2.03 (± 1.4) *hours* and in Bupivacaine dexamethasone group was 5.85 (± 0.84) *hours* ($p < 0.05$). The mean duration of motor block in Bupivacaine group was 2.48 (± 0.59) *hours* and in Bupivacaine dexamethasone group was 6.97 (± 0.47) *hours* ($p < 0.05$). In Bupivacaine dexamethasone group patients required only 1 rescue analgesic dose. Rescue analgesic requirement in Bupivacaine group was higher ($p < 0.05$). No significant difference in hemodynamic variables i.e., pulse rate, systolic BP, diastolic BP and O_2 saturation. *Conclusion:* In brachial plexus block, addition of dexamethasone to bupivacaine produced faster and longer duration of block and less number of rescue analgesics in post-op 24 *hours*.

Keywords: Bupivacaine; Dexamethasone ; Brachial plexus Block.

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Introduction

A popular approach for upper limb surgeries is brachial plexus block as an alternative to general anesthesia. To achieve ideal operating conditions by producing muscular relaxation, maintaining stable intra-operative hemodynamic condition and sympathetic block which reduces post-operative pain, vasospasm and edema, this type of anesthesia is helpful.[1] The untoward effects of general anesthesia including upper airway instrumentation is avoided by this type of block and thus prevents

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the consequences. It is effective in terms of cost and performance, margin of safety, along with good post-operative analgesia. Consistent and easiest method for anesthesia and post-operative pain management is supraclavicular block.[2] Bupivacaine is the local anesthetic used most frequently as it has a duration of action which is longer varying from *3* to *8 hours*. Delayed onset, patchy or incomplete analgesia are the limiting factors. Many drugs like Neostigmine, Opioids, Hyaluronidase, Midazolam, Clonidine, Dexamethasone etc., have been added to local anesthetics to improve the quality and duration of action and post-operative analgesia and to minimize these drawbacks.[3] The steroids have shown to decrease the inflammation and also have shown analgesic effects. Reduction of inflammation by inhibition of Phospholipase A^2 is caused after administration of steroids and also blocks the transmission in nociceptive C–fibers to reduce the pain. Membrane injury and edema by generating inflammatory mediators was induced by phospholipase A^2. For liberation of arachidonic acid leading to the production of prostaglandins and leukotrienes, phospholipase A^2 enzyme is used. Small neurons are sensitized by these enzymes and they enhance pain generation by abnormal conduction and intraneural edema. Dexamethasone is a very potent and selective glucocorticoid. It is used as anti-inflammatory and immunosuppressant. Potency of dexamethasone is about *40 times* that of Hydrocortisone. For treatment of many inflammatory and autoimmune conditions, clinical uses of dexamethasone was used but to treat patients suffering from neuropathic pain, Complex Regional Pain Syndromes (CRPS), glucocorticoid are also used. So, steroids have anti-inflammatory as well as analgesic effects.[4] Hence, this study was taken up to assess the efficacy of Dexamethasone as an analgesic especially for upper limb surgeries.

Materials and Methods

This study was a single blinded study which was taken up among 70 patients aged between *20* and *68 years* undergoing upper limb surgeries in Mamata General and Super Specialty Hospital, Khammam, during *October 2013* to *September 2015*. Ethical clearance was obtained by Institutional Ethical review committee. An informed, written consent was obtained from all the patients.

Inclusion Criteria was that all patients with ASA class I and II, aged between *20* and *68 years* posted for upper limb surgeries.

Exclusion Criteria was known case of hypersensitive reaction to local anesthetic, with abnormal BT, CT or on anticoagulation therapy, severe anemia, hypovolemia, shock, septicemia and h/o seizures, for supraclavicular block, local infection at the site of proposed puncture.

Routine blood and urine investigations done along with Chest *X*-ray, ECG, HIV, HBsAg screening. Written informed consent was obtained. Intravenous access with a *20 gauge* IV cannula on the contralateral upper limb under aseptic techniques. Study consisted of control group (Group I) received *28 ml*, bupivacaine 0.5% + *2 ml* NS. Study group (Group II) received *28 ml* bupivacaine 0.5% + *2 ml* Dexamethasone (*8 mg*). Pre-anesthetic checkup would be done and all the patients were informed about the procedure. IV line was secured and patients would be connected to monitors to record pulse, O_2 saturation, NIBP and ECG. Before the procedure, pre-medication with inj Midazolam *0.05 mg/kg* body weight was administered. Patient lies supine, arms by the side and head turned to other side. At a point *1.5* to *2.0 cm* posterior, after aseptic preparation of the area, and cephalad to midpoint of clavicle, pulsations of subclavian artery is felt. Cephalo-posterior to the pulsations, a skin wheel is raised with local anesthetic. Until either paresthesia is elicited or first rib is encountered, introduction of a *22 guage*, 1.5 inches short beveled needle was done through the same point, parallel to head and neck, in a caudal, slightly medial and posterior direction. The needle would be moved over the first rib until paresthesia is elicited in the arm or hand, if the rib is encountered. The study medication would be injected slowly ruling out intravascular injection intermittently, after eliciting paresthesia and negative aspiration of blood, keeping the needle in the same position. By pin prick method with a *23-gauge* needle, sensory block is evaluated. The time between injection and complete loss of pin prick sensation in C_2 and T_2 dermatome and temperature testing using spirit soaked cotton on skin dermatomes C_2 to T_2 is called as onset time. The time when complete sensory blockade achieved would be noted. The motor block was assessed by using bromage three point score which is 0 = normal motor function with full flexion and extension of elbow, wrist and fingers, 1 = decreased motor strength with ability to move fingers and/or wrist only, 2 = complete motor blockade with inability to move fingers. The time of motor blockade was noted. The time elapsed between the injection of drug and complete loss of cold perception of the hand, while onset of the motor blockade was defined as the time elapsed from injection of drug to complete motor

block is called the time of onset of sensory block. During the surgery, heart rate, non-invasive blood pressure and oxygen saturation were monitored. The time elapsed between the injection of drug and appearance of pain requiring analgesia is called duration of sensory block and duration of motor block was also recorded.

The data thus obtained was compiled and analyzed using Statistical Package for Social services. (SPSS *vs* 18). Quantitative data was analyzed by using student '*t*' test. Qualitative data was analyzed using Chi–square test. A *p* - value of less than 0.01 was considered as statistically significant.

Results

About 70 patients of ASA I and II who had upper limb surgeries were considered in this study as study subjects. They were randomly divided into two equal groups where first group received *28 ml* of Bupivacaine + *2 ml* NS and second group received *28 ml* of Bupivacaine + *2 ml* Dexamethasone (*8 mg*) by supraclavicular approach, shows in Table 1.

Table 1: Age distribution of the study group

Age groups	Bupivacaine group n (%)	Bupivacaine Dexamethasone group n (%)	Total n (%)
Less than 30 years	10 (28.6)	9 (25.7)	19 (27.1)
31–40 years	13 (37.1)	21 (60.0)	34 (48.6)
41–50 years	8 (22.9)	0	8 (11.4)
51 years and above	4 (11.4)	5 (14.3)	9 (12.9)
Total	35 (100)	35 (100)	70 (100)
Mean ± SD	37.7 ± 12.8	35.6 ± 8.8	37.8 ± 9.7

T value = 0.988 *p* = 0.419 students unpaired *t* test NS-not significant

Age groups were similar the groups were comparable in age.

The mean time of onset of sensory block in Bupivacaine group was *17.4 minutes* and *11.8 minutes* in Bupivacaine – Dexamethasone group. This difference in onset of sensory block was statistically significant between the two groups. The mean time of onset of motor block in this study in Bupivacaine group was *8.5* (± *4.4*) *minutes* and the mean time of onset of motor block in Bupivacaine – Dexamethasone group was *6.4* (± *1.8*) *minutes*. This difference in onset of motor block was statistically significant between the two groups, shown in Table 2.

The mean duration of sensory block in Bupivacaine group was *2.03* (± *1.4*) *hours* and in Bupivacaine – Dexamethasone group was *5.85* (± *0.84*) *hours*. There was statistically significant difference in duration of sensory block between Bupivacaine and Bupivacaine – Dexamethasone groups. The mean duration of motor block in Bupivacaine group was *2.48* (± *0.59*) *hours* and the mean duration of motor block in Bupivacaine – Dexamethasone group was *6.97* (± *0.47*) *hours*. There was statistically significant difference in duration of motor block between Bupivacaine and Bupivacaine – Dexamethasone groups. The patients of Bupivacaine group had received *2.5* (± *0.5*) *doses* and the patients of Bupivacaine – Dexamethasone group received *1.4 mean doses* of rescue analgesic. The difference in receiving the mean doses of rescue analgesic was statistically significant between the Bupivacaine and Bupivacaine – Dexamethasone groups. The mean heart rate in Bupivacaine group was around 77 to 79 beats per minute. The mean heart rate in Bupivacaine – Dexamethasone group was around *79* to *80 beats per minute*. There was no statistically significant difference between Bupivacaine and Bupivacaine – Dexamethasone groups in Heart rate at different time intervals. The mean systolic blood pressure in Bupivacaine

Table 2: Onset of sensory and motor block between the study groups

Groups	Bupivacaine group	Bupivacaine – Dexamethasone group	t value*	*p* - value, Sig
Onset of sensory block in min Mean ± SD	17.4 (± 3.5)	11.8 (± 2.7)	14.897	0.001, Sig
Onset of motor block in min Mean ± SD	8.5 (± 4.4)	6.4 (± 1.8)	12.669	0.001, Sig

Table 3: Mean time of onset of sensory and motor block in the study groups

Groups	Bupivacaine group	Bupivacaine – Dexamethasone group	t value*	*p* - value, Sig
Duration of sensory block in hrs Mean ± SD	2.03 (± 1.4)	5.85 (± 0.84)	13.26	0.001
Duration of motor block in hrs Mean ± SD	2.48 (± 0.59)	6.97 (± 0.47)	28.9	0.0001

group ranged from *115.4 ± 6.4 mm of Hg* to *115.6 ± 7.1 mm* of *Hg*. The mean systolic blood pressure in Bupivacaine – Dexamethasone group was ranging from *119.8 ± 10.7 mm of Hg* to *120.3 ± 12.1 mm of Hg* at different time intervals. There was no statistically significant difference in systolic blood pressure between Bupivacaine and Bupivacaine – Dexamethasone groups at different time intervals. The mean diastolic pressure in Bupivacaine group was ranging from *74.2 ± 5.8 mm of Hg* to *76.6 ± 7.7 mm of Hg*. It was ranging from *77.0 ± 6.9 mm of Hg* to *79.2 ± 7.7* in Bupivacaine – Dexamethasone group at different time intervals. There was no statistically significant difference in diastolic blood pressure between Bupivacaine and Biscayne – Dexamethasone groups at different time intervals.

The oxygen saturation was ranging from *98.7 ± 0.8 percent* to *99.9 Percent* in Bupivacaine group and it was ranging from *98.6 ± 0.7 percent* to *98.9 ± 0.6 percent* in Bupivacaine – Dexamethasone groups. The difference between the oxygen saturation was not statistically significant between Bupivacaine and Bupivacaine – Dexamethasone groups, shown in Table 3.

Discussion

For prolongation of analgesic effects, dexamethasone has emerged as a potent corticosteroid when used along with Bupivacaine. However, the studies are scanty to evaluate the efficacy of Bupivacaine alone and when used in combination with corticosteroids like Dexamethasone.[4] Hence, this study was undertaken to evaluate the efficacy of Bupivacaine with Dexamethasone.

About 37.1% of the patients in Group I and 60.0% of the patients in Group II belonged to *31–40 years* age group. The mean age of patients posted was *37.7 ± 12.8 years* in Bupivacaine and *35.6 ± 8.8 years* in Bupivacaine – Dexamethasone groups. There was no statistically significant difference in age between the two groups. Majority of the patients in this study belonged to *31–40 years* in both the groups. In a study by Sheshtha *et al*. in Nepal in 2003, the mean age was *25.5 ± 12.02 years* in local anesthetic group and *28.05 ± 16.1* in Dexamethasone groups.[5] In a similar study, the mean age in local anesthetic group was *33.8 years* and in Dexamethasone group was *30.3 years*.[6] In our study, the mean time of onset of sensory block in Bupivacaine group was *17.4 minutes* where as it was *11.8 minutes* in Bupivacaine – Dexamethasone (study) group. The mean time of onset of sensory block was late in Bupivacaine group compared to Bupivacaine – Dexamethasone group. Our study is comparable to the study done by Shreshtha *et al*., in which the mean onset of action was *18.15 ± 4.25 minutes* in group which received local anesthetic with adrenaline while it was *14.5 ± 2.1 minutes* in the group which received local anesthetic with dexamethasone.[5] However, the mean onset of sensory anesthesia was slightly lesser in this study in contrary to findings of Shrestha *et al*.[5] In another study, Yadav *et al*. compared the effect of adrenaline, neostigmine and dexamethasone (three different drugs) by supraclavicular brachial plexus block.[3] However, the onset of anesthesia in Dexamethasone group was faster than other two groups of drugs which is comparable to our study. In a study by Islam *et al*., the onset of sensory block was also lesser in Dexamethasone group than the plain local anesthetic group.[7] Thus, the observation of our study shows that addition of dexamethasone to bupivacaine decreases the onset time of analgesia. In our study, the mean duration of sensory block in Bupivacaine group was *2.03* (± *1.4*) *hours* and *5.85* (± *0.84*) *hours* in Bupivacaine–Dexamethasone group. A similar study in Nepal found that the duration of action of the local anesthetic as *3.16 hours* in local anesthetic group and *12.75 hours* in steroid group.[8] In a study by Shreshtha *et al*., the mean duration of post-operative analgesia was around *16 hours* in a group who received Bupivacaine with Dexamethasone and its was around *8 hours* in Bupivacaine–Tramadol group.[5] This shows that the addition of steroid to certainly prolongs the duration of anesthesia and also produces earlier onset of action. This might be due anti-inflammatory effect of Dexamethasone. It has also been proved in many studies that the addition of Dexamethasone to local anesthetic prolongs the duration of action. our study shows similar results when compared with other studies done previously which again proves that dexamethasone prolongs the duration of analgesia. In our study, the mean time of onset of motor block was lesser in Group II *i.e*., Bupivacaine – Dexamethasone group (*6.4 mins*) than in Group I *i.e*., bupivacaine group (*8.5 mins*). This difference was statistically significant between the two groups. Yadav RK *et al*. reported a little early onset of motor blockade with dexamethasone. Pathak RG *et al*. did not find significant reduction of motor blockade time.[3] This might be due to usage of adrenalized xylocaine along with bupivacaine and dexamethasone. But they found a significant prolongation of motor blockade with dexamethasone. Shrestha BR *et al*. (2007) in their study found a significant early onset in motor blockade when dexamethasone was added to a

mixture of 2% lignocaine and 0.5% bupivacaine.[5] Our study correlates with the study done by Yadav RK and Shrestha BR.[3,5] Birdar PA *et al*. (2013) studied the effect of admixture of lidocaine 2% and dexamethasone on onset and duration of sensory and motor blockade.[9] They concluded that onset of sensory and motor blockade was more rapid in dexamethasone group. It correlates our study but in which bupivacaine was used instead of lidocaine with dexamethasone. Estebe JP, Le Corre *et al*. in 2003 stated in their study that dexamethasone alone did not produce any motor block.[10] When added to plain bupivacaine without pH correction, complete motor block could not be obtained. With corrected pH, addition of dexamethasone to plain bupivacaine seemed to delay the onset of motor block and did not prolong its duration. In our study correction of pH was not done in both the groups. But the results were encouraging with addition of *8 mg* dexamethasone to *28 ml* of 0.5% bupivacaine. The mean duration of motor block in Bupivacaine group was *2.48* (± *0.59*) *hours* and in Bupivacaine – Dexamethasone group was *6.97* (± *0.47*) *hours*. There was statistically significant difference in duration of action between Bupivacaine and Bupivacaine – Dexamethasone groups. Tandoc MN *et al*. did a study in 2011 at University of Buffalo.[11] They compared 0.5% bupivacaine with dexamethasone *4 mg* and *8 mg* as an additive to bupivacaine. Their results showed that duration of motor blockade was significantly prolonged in patients receiving dexamethasone. Pathak RG *et al*. in 2012 conducted a study with the aim to compare effect of addition of dexamethasone to local anesthetic in brachial plexus block.[12] They concluded addition of dexamethasone significantly prolongs the duration of analgesia and motor block. This observation is comparable to our study. Vieira PA *et al*. (2010) also concluded that addition of dexamethasone prolonged both sensory and motor blockade in interscalene block with bupivacaine.[13] In our study, the mean numbers of rescue analgesic doses were lesser in Dexamethasone group than Bupivacaine alone group significantly. Our study correlates the study done by Yadav *et al*. 3 where the mean number of rescue analgesic doses was also lesser in Dexamethasone group than other two groups. Tandoc MN *et al*. also reported that post-operative analgesic consumption was significantly low in patients who received dexamethasone along with bupivacaine.[11] Vieira PA *et al*. concludes in their study that addition of dexamethasone to bupivacaine-epinephrine-clonidine combination in interscalene block significantly reduces the use of opioids post-operatively.[13] In our study, the mean heart rate in Bupivacaine group was around slightly higher in Dexamethasone group than the local anesthetic group. There was no statistically significant difference between the pulse rates of the Dexamethasone group than local anesthetic group. The mean systolic and diastolic pressure was also almost similar in both the groups within normal limits. The mean oxygen saturation also not varied much in both the groups. In summary, the hemodynamic responses are crucial in maintenance of patient during anesthesia. However, the Bupivacaine has already proved its safety especially when used as local anesthetic in supraclavicular block. Since, the hemodynamic responses were similar, the study concludes that the Bupivacaine – Dexamethasone combination is also safer to use in supraclavicular block. The adverse effects were not reported in both the groups in this study.

Conclusion

In brachial plexus block, addition of dexamethasone to bupivacaine produced faster onset of sensory block and motorblock, longer duration of sensory block and motor block. Dexamethasone to bupivacaine has less number of rescue analgesics in post-op *24 hours*. No significant difference in hemodynamic variables *i.e*., pulse rate, systolic BP, diastolic BP and O_2 saturation.

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Original Research Article

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A Comparative Study of Levobupivacaine and Levobupivacaine with Dexmeditomidine in USG Guided Axillary Block for Elbow, Forearm and Hand Surgeries

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Abstract

Background and Aims: The present clinical study was conducted to evaluate the onset of analgesia, degree of sensory and motor blockades, duration of analgesia and complications between Levobupivacaine and Levobupivacaine with Dexmeditomidine in USG guided axillary brachial plexus block. *Methods:* The study was conducted on 60 ASA 1 and 11 patients of either sex posted for various elective or emergency surgeries of the upper limb involving elbow, forearm and hand surgeries. The subjects were divided into two groups, Group A receiving axillary brachial plexus block with 0.5% Levobupivacaine alone and Group B receiving Levobupivacaine with Dexmeditomidine 1 *µg/kg. Results:* The onset of sensory and motor blockades were quicker in Group B compared to Group A. Both these findings were statistically significant. Both the duration of sensory and motor blockades were longer in Group B compared to Group A which were statistically significant. Time taken for starting of regression was more in Group B compared to Group A but this finding was not statistically different. All other parameters related to duration of anesthesia including time taken for full motor and sensory recovery were longer in Group B compared to Group A. There were statistically significant differences in the duration of complete analgesia, duration of effective analgesia and time of first pain medication were longer in Group B compared to Group A. *Conclusion:* The onset, quality, intensity of sensory and motor blockades and the duration of analgesia is both clinically and statistically significantly prolonged in Levobupivacaine with Dexmeditomidine group.

Keywords: Levobupivacaine; Dexmeditomidine; USG; Axillary brachial plexus block.

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Introduction

The techniques of peripheral nerve blockade were developed early in the history of anesthesia. The US surgeons Halsted and Hall described the injection of cocaine in to peripheral sites which include the ulnar, musculo cutaneous, supra trochlear and infra orbital nerves for minor surgical procedures in the 1880s.[1] James Leonard Corning recommended the use of an esmarch bandage in 1885 to arrest the local circulation; prolong the cocaine induced block, decrease uptake of that local anesthetic

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from tissues. This concept was further developed by FW Braun who substituted epinephrine, a chemical tourniquet in 1903. He also introduced the term conduction anesthesia in his textbook on Techniques of local anesthesia.

Peripheral nerve blockade remains a well-accepted component of comprehensive anesthetic care. Its role has expanded from the operating site into the arena of post-operative and chronic pain management. Skillful application of peripheral neural blockade broadens the anesthesiologists' range of options in providing optimal anesthetic care. The axillary approach to the brachial plexus is the most popular because of its ease, reliability and safety. Blockade occurs at the level of the terminal nerves and blockade of musculocutaneous nerve is always ensured with the use of ultrasound.

Materials and Methods

This was a randomized prospective double blinded control study conducted in a tertiary care teaching hospital. Following institutional ethical committee approval, sixty patients of the age group *18* to *60 years* of both sexes with ASA Grade I and Grade II requiring both elective and emergency surgery of the elbow, forearm & hand between *January 2014* and *February 2015* were selected and divided into two groups of 30 patients each. Patients with history of bleeding disorders, local infection at the site of block, documented neuromuscular disorders, respiratory compromise, known allergy to local anesthetic drugs and ASA Grade III and IV were excluded from the study. Allocation to different regimens are:

Group A: Patients receiving 0.5% Levobupivacaine (*20 ml = 100 mg*) + normal saline.

Group B: Patients receiving 0.5% Levobupivacaine (*20 ml = 100 mg*) + Dexmeditomidine.

The same volume of saline (placebo) corresponding to that of Dexmeditomedine was added to Levobupivacaine for the Levobupivacaine + placebo group (Group A). The drugs used were Levobupivacaine hydrochloride at a dose of *2 mg/kg* in a concentration of 0.5% and Dexmeditomidine at a dose of *1 µg/kg*. The concentration was fixed and dose and volume varied according to the body weight of the patient. The sample size was calculated by taking 30 patients as study and 30 patients were taken as control (total 60 patients).

The procedure was explained to the patient and informed consent was obtained. The patients were brought to the operation theatre and advised to lie in supine position with due comfort on the operating table. Preop heart rates (HR), Non Invasive Blood Pressure (NIBP), Saturation Pressure of Oxygen (S_pO_2) were recorded. Intravenous access was secured in the nonoperative limb and a crystalloid was started. All the blocks in both the groups were administered by different anesthesiologists who were blinded from the drug composition of the local anesthetic mixture used for the axillary block. 60 patients were randomly allotted into 2 groups, Group A and Group B. All the patients received injection Midazolam 0.05 mg/kg and injection Fentanyl *0.5 µg/kg* intravenously *15 minutes* before the procedure. Axillary brachial plexus block was given with the patient lying supine with the arm abducted from the body at 90° and flexed in the elbow joint at 90°[2]

The axillary sheath was identified and approached under Sonosite M-Turbo high frequency linear probe and using a 50 mm insulated needle with an extension catheter for injecting the LA solution.[3] After repeated negative aspirations, *5 ml* of local anesthetic solution which contains either Levobupivacaine alone or Levobupivacaine with Dexmeditomedine was injected at each nerve like radial, ulnar, median and musculo cutaneous.[4] Totally *20 ml* given with either *0.5 ml* normal saline or *0.5 ml* of dexmeditomedine which is *50 µg*. The intra and postoperative assessment was done by an anesthesiologist who had no idea of the drug given. The onset of analgesia was recorded as the interval between the time of injection and the development of loss of sensation to pin prick. The dermatome areas corresponding to the median nerve, radial nerve, ulnar nerve and musculo cutaneous nerves were checked at every minute till there was complete loss of sensation. The onset and completion of analgesia was tested by loss of sensation to pin prick. The effect of analgesia after injection was graded as Grade 1 (good), Grade 2 (inadequate) and Grade 3 (very poor). The conclusion of Grade 2 was arrived when any one of the segments supplied by four major nerves (radial, ulnar, median and musculo cutaneous nerves) did not have loss of sensation even after *30 minutes* of the block. They were supplemented with mask ventilation with nitrous oxide, IV ketamine *0.5 mg/kg*/fentanyl (*1 µg/kg*) and midazolam (*0.02 mg/kg*). When there was no loss of sensation in more than one nerve segment then it was considered a failed block. In such case, general anesthesia was provided. Sedation component was recorded by the Ramsay Sedation Score. The duration of sensory block was called as the time interval between the end of drug injection

and the complete resolution of pin prick sensation on all nerve segments. All patients were monitored for complications (if any) during the intraoperative period and up to forty eight hours post-operatively.

The degree of motor blockade was assessed by modified Bromage scale for upper extremities (3-point scale) as Grade 1 (complete block) Grade 2 (near complete) and Grade 3 (no block). Duration of analgesia was recorded with the help of Visual Analog Scale (VAS) which ranges from 0 to 10. This scale was noted per every *60 minutes* post-operatively till it comes to 5.

Detailed descriptive analysis of socio demographic and clinical parameters was done in the first step. The quantitative variables were presented as mean ± standard deviation and the categorical variables were presented as frequency and percentage. All the basic parameters were compared between the two treatment groups. The time taken for onset of anesthesia, duration of anesthesia, analgesic requirement etc. was considered as primary outcome parameters. The hemodynamic and respiratory parameters of the patients during and after anesthesia were considered as secondary outcome variables. Both the outcomes were compared between the two treatment groups by calculating mean differences. The statistical significance and 95% CI of these differences was assessed by unpaired *t*-test. Microsoft excel and IBM SPSS (Statistical Package for Social Sciences) version 21 were used for statistical analysis Unpaired *t*-test was applied for demographic data, hemodynamic parameters, onset and duration of sensory and motor blockade and duration of analgesia. For assessing the quality Fisher exact test was applied. *p* - value was considered significant if < 0.05 and highly significant if < 0.001.

Results

A comparative study of Levobupivacaine alone and Levobupivacaine with Dexmeditomidine in axillary brachial plexus block was carried out on sixty patients divided into two groups of thirty patients each in the age group of 18 to 60 years. The following observations were made. A total of sixty participants were included in the final analysis. Out of the 60, 34 (56.7%) were randomized to intervention Group A, to receive 0.5% Levobupivacaine + Normal saline (0.5 *ml*)). The remaining 26 (43.3%) received intervention Group B i.e. 0.5% Levobupivacaine + Dexmeditomedine (0.5 *ml* = 50 *μg*) (Table 1).

Table 1: Descriptive analysis intervention groups (n = 60)

Treatment group	Frequency	Percent
Group A (0.25% Levobupivacaine + Normal saline (0.5 *ml*))	34	56.7
Group B (0.25% Levobupivacaine + Dexmedetomidine (0.5 *m1*)	26	43.3
Total	60	100

The socio demographic and anthropometric parameters were comparable between two groups. Only minor differences existed in the mean values of age and proportion of females (Table 2).

Table 2: Descriptive analysis of socio demographic parameters in study groups (n = 60)

Parameter	Group A	Group B
Age [mean (SD)]	37.47 (SD)	34.19 (SD)
Sex		
Male [Frequency (%)]	26 (%)	18 (%)
Female [Frequency (%)]	8 (%)	8 (%)
Anthropometry		
Weight [mean (SD)	67.59 (SD)	1.67 (SD)
Height [mean (SD)	67.85 (SD)	1.68 (SD)

Table 3: Comparison of onset and duration of anesthesia in both study groups (n = 60)

Parameter	Group	Mean	Mean difference	*p* value	95% CI	
					Lower	Upper
Onset of Sensory Blockade (minutes)	Group A	0.07	0.04	<0.001	0.032	0.048
	Group B	0.03				
Onset of Motor Blockade	Group A	0.10	0.03	<0.001	0.023	0.037
	Group B	0.07				
Duration of Sensory Block	Group A	8.91	-4.70	<0.001	-5.31	-4.09
	Group B	13.61				
Duration of Motor Block	Group A	5.82	-1.82	<0.001	-2.37	-1.28
	Group B	7.65				

The onset of sensory blockade (mean difference *0.04 minutes*, *p* - value < 0.001) and motor blockade (mean difference *0.03 minutes*, *p* - value < 0.001) were quicker in Group B compared to Group A. Both these findings were statistically significant. Both the duration of sensory blockade (mean difference *282 minutes*, *p* - value < 0.001), and motor blockade (mean difference *108 minutes*, *p* - value < 0.001) were longer in Group B compared to Group A and both these findings were statistically significant (Table 3).

Time taken for starting of regression (mean difference *-1.37 minutes*, *p* - value < 0.108) was more in Group B compared to Group A, but this finding was not statistically different. All other parameters related to duration of anesthesia including time

Table 4: Comparison of other anesthesia related parameters in both study groups = 60

Parameter	Group	Mean	Mean difference	p value	95% CI	
					Lower	Upper
Time Taken forstarting of Regression	Group A	0.53	-1.37	.108	-3.37	0.22
	Group B	2.31				
Time of fullsensory recovery (mnts)	Group A	10.01	-4.78391	<0.001	-5.42451	-4.14322
	Group B	14.79				
Time of full motor recovery (mnts)	Group A	6.85	-1.946	<0.001	-2.574	-1.318
	Croup B	9.70				

taken for full motor and sensory recovery were longer in Group B compared to Group A. These differences were statistically significant. There were statistically significant differences in the duration of complete analgesia, duration of effective analgesia and time of first pain medication between the study groups. All these parameters were longer in Group B compared to Group A (Table 4).

Onset of analgesia was immediate with Dexmeditomidine with Levobupivacaine (*3–5 minutes*) whereas the onset of analgesia took *8–10 minutes* in patients with Levobupivacaine alone. The quality of analgesia was Grade I in 76.6% patients with Levobupivacaine with Dexmeditomidine whereas it was Grade I in 50% patient's receiving Levobupivacaine alone.[5] Degree of motor block was Grade I in 56.6% patients with Levobupivacaine with Dexmeditomidine as compared to only 26.6% patients with Levobupivacaine alone. Duration of analgesia was found to be in the range *of 8–10 hours* with Levobupivacaine alone, whereas duration with *14–16 hours* was found with Levobupivacaine with Dexmeditomidine.[6,7] Complications with both the drugs were found to be mild.

Discussion

Regional Anesthesia is becoming more popular especially with the advent of safer drugs and techniques. Ultrasound has become more useful in the last few decades. Since, both the drugs namely, levobupivacaine and dexmeditomidine are relatively newer in peripheral nerve block procedures, an attempt has been made to compare the two. Until now, the common adjuvant used with local anesthetics was the opioids.[8] More recently, α2 agonists have been used with good success. They improve the quality and duration of block in peripheral nerve blocks. The α2 agonists act through vasoconstriction, centrally acting pain relief, anti-inflammatory effects, hyperpolarization and decrease in compound action potential (CAP) and inhibition of voltage gate of sodium pump.[9]

Axillary block was conducted by Edson D Carel in 1971 in pediatric age group by B. Fitz Gerald in 1976, by RK Mehta *et al*., in 1979, Blasier and White in 1996 and Colizza and Said in 1993, and supraclavicular brachial block in combination with general anesthesia was used for micro vascular surgery in children by Inberg P *et al*., 1995. In our study only adult patients were selected because of good patient cooperation with regard to the procedure.

All the patients have received injection Midazolam *0.05 mg/kg* and injection Fentanyl *0.5 µg/kg* intravenously *15 minutes* before the procedure. This premedication was comparable with Sarita *et al*. where there was no premedication whereas Amany *et al*. have used midazolam of *1–2 mg* and fentanyl *50–100 µg* (not based on *per kg dose*) in all of their patients undergoing single shot infraclavicular block using bupivacaine with dexmeditomidine (2012).

Andrea *et al*. compared the use of ultrasound and nerve stimulator for axillary block. They found that ultrasound has supremacy in 98.5% of successful blocks. The findings of Vincent *et al*. and Christophe *at al*. also highlighted the role of ultrasound in the success of axillary block. In our study, we observed that almost all the 60 patients had Grade 1 block (Good analgesia, sedatives were given only to relieve apprehension). This was made possible by the accuracy of the ultrasound in permitting direct visualization of the nerves.

The recommended maximum dose for Levobupivacaine is *5 mg/kg* body weight in peripheral nerve blocks. This dose recommendation serves only as a base upon which a person using the drug in the technique should apply a sensible judgment and make appropriate adjustment. Kenan Kaygusuz et al. (2012**)** and many others used 0.5% Levobupivacaine for axillary block (Paresthesia technique) with a dose of *200 mg* (*4 mg/kg*) without any toxic symptoms. In our study, Levobupivacaine was used as an anesthetic agent for all the cases in a concentration of 0.5%. We used Levobupivacaine in a dose of *2 mg/kg* body weight, with a total dose of

only *100 mg* and *1 µg/kg* of Dexmeditomidine with a maximum of *50 µg* because of precise location of nerves made possible by ultrasound.

In a study of Sarita *et al*. (2012) where clonidine and Dexmeditomidine were compared in supraclavicular block, mean onset time of motor block in clonidine was *4.65 minutes* whereas in Dexmeditomidine group was *3.87 minutes*. The mean onset time of sensory block in clonidine group was *2.3 minutes* whereas in Dexmeditomidine group was *1.7 minutes*. In a study by Kenan *et al*., when Dexmeditomedine was added with Levobupivacaine in axillary block, there was no shortening of onset of motor block whereas the onset of sensory block was shortened. Keshav Govind Rao *et al*. (2014) and Rachana Gandhi *et al*. studied the effects of Dexmeditomidine with bupivacaine in supraclavicular block. They found that there was significant reduction of onset in the duration of motor and sensory blockade.

In our study, the onset of sensory blockade (mean difference *0.04 minutes*, *p* - value < 0.001) and motor blockade (mean difference *0.03 minutes*, *p* – value < 0.001) were quicker in Levobupivacaine with Dexmeditomidine group compared to plain Levobupivacaine group. Both these findings were statistically significant. The mean onset time of sensory block in plain Levobupivacaine was *7 minutes* whereas in Levobupivacaine with Dexmeditomidine was *3 minutes*. The mean onset time of motor block with plain Levobupivacaine was *10 minutes* whereas in Levobupivacaine with Dexmeditomidine group was *7 minutes*. Thus, the durations of onset of sensory and motor block observed in our study are comparable with the above mentioned studies done earlier.

Amany S *et al*. compared bupivacaine alone and bupivacaine with Dexmeditomedine in ultrasound-guided single injection infraclavicular brachial plexus block. They reported that Dexmeditomidine group showed a statistically important reduced time of onset of sensory block (13.2 *vs*. 19.4 *min*, *p* = 0.003), increased duration of the sensory block (179.4 *vs* 122.7 *min*, *p* = 0.002), reduced time of onset of motor block (15.3 *vs* 22.2 *min*, *p* = 0.003), prolonged duration of motor block (155.5 *vs* 105.7 *min*, *p* = 0.002), prolonged duration of post-operative analgesia (403 *vs* 233 *min*, *p* = 0.002) and reduced opioid requirements *48 hours* after surgery.[10,11] Sarita *et al*., Kenan *et al*. and Aliye Esmaoglu *et al*. also reported similar effects in terms of prolongation of the duration of sensory and motor blocks. In our study time taken for starting of regression (mean difference *-1.37 minutes*, *p* - value < 0.108) was more in Levobupivacaine with Dexmeditomedine compared to group levobupivacaine alone and this finding was statistically significant. There were statistically significant differences in the duration of complete analgesia, duration of effective analgesia and time of first pain medication between the study groups. All these three parameters were significantly prolonged in the group Levobupivacaine with Dexmeditomidine.

Memis *et al*. in their study have showed that when Dexmeditomedine was added with lignocaine for Biers block, it enhances the quality of analgesia. In the study of Sarita *et al*., the quality of analgesia was 80% in patients with Dexmeditomedine whereas it was only 40% in patients with clonidine in supraclavicular block. In our study, we graded the quality of analgesia into three grades and recorded the observations. Grade I analgesia was observed in 84.4% of patients in the levobupivacaine group whereas in the Levobupivacaine with Dexmeditomedine group, 93.6% of the patients were found to achieve Grade I analgesia.[12] The remaining patients in both the groups achieved Grade II analgesia. Kenan *et al*. observed that in both the groups with and without added Dexmeditomedine, 78% of patients achieved, Grade I degree of motor block.

In the present study, the degree of motor blockade observed in plain Levobupivacaine was found to be Grade I (Complete block, no active movements of entire elbow, forearm and hand) in 74.6% of patients and 86.6% in levobupivacaine with Dexmeditomidine patients. Grade II motor blockade was found to be 25.4% and 13.4% in Levobupivacaine group and Levobupivacaine with Dexmeditomedine group respectively.[13,14] These findings are comparable to the findings of the above mentioned study.

Esmaoglu *et al*. observed bradycardia in their patient group in which *100 µg* of Dexmeditomedine was used with Levobupivacaine. In our study, our observations show that the hemodynamic parameters like heart rate and blood pressure were more in the optimal range in Levobupivacaine with Dexmeditomidine group than plain Levobupivacaine group. The respiratory parameters were almost similar in both the study groups. Bradycardia and hypotension (transient) were observed in 3 patients in the Levobupivacaine with Dexmeditomidine group. The incidence of bradycardia was lesser in our study (only 3 cases) probably because of the lower dose of Dexmeditomidine we used. In our study, we used *1 µg/kg* of Dexmeditomidine with a maximum of *50 µg*.

Vikram Uday Lahori and Anjana Raina *et al*. (2011) have reported complications like accidental vascular puncture[15] in two patients of axillary block group. In our study axillary pain or discomfort was the only complication in both the groups. No other complications or significant adverse effects were observed in both the study groups, shown as (Table 5 and Fig. 1).

Table 5: Showing complication

Complications	Group A	Group B
Axillary pain or discomfort	2	–
Bradycardia and hypotension	–	3

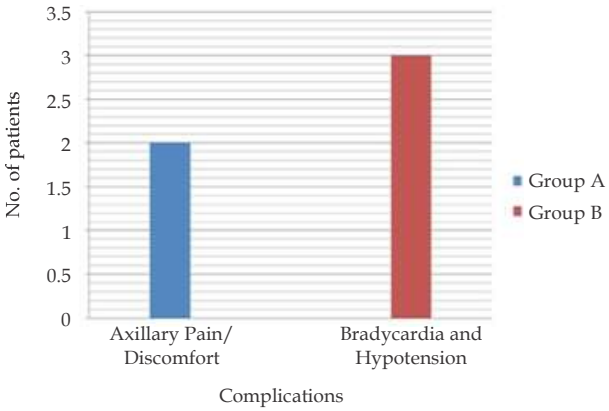

Fig. 1: Showing complication

Conclusion

Based on our observations, we conclude that in ultrasound guided axillary block for elbow, forearm and hand surgeries, when compared to plain Levobupivacaine, the mixture of levobupivacaine with Dexmeditomidine produces statistically significant faster onset of sensory and motor blockade, statistically significant increase in duration of sensory and motor block, better grade of sensory and motor block, though this is not statistically significant and without much increase in the incidence of complications.

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Comparison of Face Mask Ventilation before and after the Administration of Neuromuscular Blocking Drugs: A Prospective Study

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Abstract

Background: Anesthesiologist often check for the ability to ventilate the patient before administering neuromuscular blocking drugs to avoid cannot intubate-cannot ventilate scenario. *Aim:* To compare the ease of ventilation before and after administration of Neuromuscular Blocking Drugs (NMBD) in terms of expired tidal volume as the primary aim. *Materials and Methods:* One hundred adult (> 18 years of age) patients of both sexes, undergoing elective surgery under general anesthesia were selected. Different predictors for difficult mask ventilation were assessed preoperatively. Peak Inspiratory Pressure (PIP) in cm H_2O, expired tidal volume (TV) in *ml*, minute ventilation (MV) in litres and ease of ventilation of the patient were noted one minute after induction with propofol and again one minute after giving NMBD. *Results:* It was seen that facemask ventilation was better after administration of NMBD. The mean (SD) expired tidal volume in ml increased from 414 (110) to 442 (115) and the peak inspiratory pressure decreased from 18 (5.4) to 14 (3.5) ($p < 0.001$). No patient who was difficult to ventilate after induction became impossible after NMBD. *Conclusion:* We concluded that facemask ventilation improves after NMBD.

Keywords: Facemask ventilation; NMBD; Airway.

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Introduction

Face mask ventilation is the most basic and essential skill in airway management. It is considered as the first line technique for maintaining patency of airway in unconscious and apneic patients.[1]It is rescue method for ventilation and oxygenation if tracheal intubation is difficult.[2]

In our routine anesthesia practice for administration of general anesthesia we administer neuromuscular blocking drugs for tracheal intubation. There is a dictum for testing the ability to ventilate the patient before giving NMBD.

During induction of anesthesia whether to administer neuromuscular blocking drugs before confirmation of ventilation is still a debatable question.

In the awake state, the upper airway is maintained by physiologic reflexes and neural activity of the upper airway muscles.[3] In the unconscious state, neuromuscular control of the upper airway muscles is reduced or abolished contributing to upper airway narrowing and collapse.[4–6]

Those who opt for testing the ability to ventilate fear that the use of NMBDs causes airway collapse which leads to severe hypoxia if the trachea cannot

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be intubated and the patient's lungs cannot be ventilated; resulting in a "cannot intubate–cannot ventilate" situation.[1,7] Thus, if facemask ventilation is ineffective, non paralyzed patients can be awaken and spontaneous respiration can be achieved early.

However, some argue that withholding an NMBD in cases where it is clearly indicated, such as laryngospasm or opioid-induced muscle rigidity increases the resistance to mask ventilation. With early administration of NMBD there is improvement in mask ventilation, moreover, optimal intubation conditions can be obtained and patients with difficult mask ventilation can be identified and earlier intervention for alternative airway management can be done.

It is said that "If difficulty in mask ventilation is observed before paralysis, a short-acting neuromuscular blocking drug should always be preferred over a long-acting one to maximise the chance of return of spontaneous ventilation".[8] This recommendation is obviously based on the still frequently held view that the administration of suxamethonium preserves the option of restoring adequate spontaneous respiration before severe hypoxemia develops.[9-11]

Furthermore, muscle relaxation will facilitate placement of a supraglottic airway device and endotracheal intubation, interventions which may become essential should the patient become hypoxemic during failed FMV. Insertion of these devices may be difficult without muscle relaxation.

Now-a-days videolaryngoscopes, fiberoptic bronchoscope and suproglottic airway devices are readily available. The use of these devices becomes easy in fully relaxed patients and it is not equally effective in non-paralyzed patients.[12]

Administration of a NMBD has been compared with 'crossing the Rubicon'.[13] The Rubicon is the administration of a hypnotic at a dose that abolishes spontaneous respiration.[14] Thus, once we have crossed that Rubicon (i.e., have abolished spontaneous respiration), our goal must not be to 'consider preserving a way back over the bridge' (i.e., wake up the patient),[13] but to concentrate all our efforts on putting up camp quickly and safely on the other side of the river (i.e., provide effective ventilation).

Various studies done previously have demonstrated improvement in ventilation or no effect after administration of NMBD. However, none of the studies showed worsening of facemask ventilation. Based on these studies our aim was to compare the ventilation in terms of exhaled tidal volume before and after administration of NMBD.

Materials and Methods

The trial was conducted at a tertiary care government hospital. One hundred adult (> 18 *years of age*) patients of both sexes, undergoing elective surgery under general anesthesia where placement of tracheal tube was considered were selected. Written informed consent and institutional review committee approval was obtained. Patients with known allergy or contra-indication to muscle relaxants, congenital heart disease, hiatus hernia, pregnant and full stomach patients were excluded from the study.

Patients enrolled for the study underwent thorough preoperative assessment including detailed case history, clinical examination and all necessary investigations. Baseline patient characteristics, including age, sex, height, weight, and ASA physical status were recorded. Each participant underwent an independent airway exam by the study coordinator in addition to that of the primary anesthesia team prior to induction. Risk factors for DMV, including Mallampati grade, BMI>30, presence of beard, the ability to and extent of mandibular protrusion, lack of dentition, limited cervical spine motion, or a history of obstructive sleep apnea were noted.

Written informed consent was taken from all patients. Once patient was taken inside the operation theatre an intravenous canula was secured and monitors were attached. Monitoring included heart rate (HR), electrocardiogram (ECG), Non-invasive Blood Pressure (NIBP), pulse oxymetry (SpO_2), end tidal CO_2 ($ETCO_2$). Patients were placed supine, with their head in a sniffing position using standard pillows. Patients with a body mass index > *30 kg/m*$^{-2}$ were given ramp position.

All the patients were given premedication Inj Glycopyrollate (*0.05 mg/kg*) and Inj Ondansetron (*0.08 mg/kg*). Inj Midazolam (*0.03 mg/Kg*) and Inj Fentanyl (*1 ug/kg*) was given as sedation and analgesic before induction.

Preoxygenation was done with 100% O_2 by tidal breathing *8–10 litres* for *3 min*. General anesthesia was induced with Inj propofol *2 mg/kg* IV slowly. Dragger Primus anesthesia work station was used for recording and anesthesia delivery purpose in all 100 cases. The ventilator was set to deliver volume controlled ventilation with tidal volume of *6 ml/kg*, respiratory rate *12 per minute*, inspiratory-expiratory ratio of 1:1, Positive End-expiratory Pressure (PEEP) of 3 *cm* H_2O and a fresh gas flow of *6 L/min*. Once we achieved loss of eyelash reflex,

Peak Inspiratory Pressure (PIP) in cm H_2O, expired tidal volume (TV) in *ml*, minute ventilation (MV) in litres and ease of ventilation of the patient were noted. Ease of ventilation was described as easy, moderate or difficult for the anesthesiologist.

After *one minute* Inj Succinyl-choline (*2 mg/kg*) IV was given as skeletal muscle relaxant. Face-mask ventilation was continued with 100% oxygen on ventilator. PIP, expired TV, MV and ease of ventilation were noted on anesthesia ventilator again after *1 minute* of administration of succinyl-choline.

Patient was intubated with appropriate size endotracheal tube. General anesthesia was maintained with mixture of oxygen (50%), nitrous oxide (50%), isoflurane as an inhalation anesthetic agent and long acting neuromuscular blocker vecuronium (0.08 mg/kg) as a part of standard anesthetic protocol. At the end of the procedure patients were extubated, after adequate reversal of neuromuscular blockade and recovery of tone, power and reflexes.

Facemask ventilation was defined as impossible mask ventilation if during ventilation delivered tidal volume was <*2 ml/kg*, no adequate chest rise was observed, no end-tidal CO_2 was observed or oxygen saturation measured by pulse oximetry decreased <90%. In such situation, patient was excluded from the study and rescue plan was followed which included securing an airway.

Statistical Anaylysis

Preliminary sample size estimation using previous studies showed that approximately 50 patients should be included in each group, assuming alpha error of 0.05 (95% confidence interval) in order to obtain power of study > 80%.

Comparison of expired TV, MV and PIP was done using paired *t* - test. Comparison of ease of ventilation was done using Wilcoxon sign rank test. $p < 0.05$ was considered significant, $p > 0.05$ not significant and $p < 0.001$ highly significant. Data analysis was done using SPSS (Statistical Package for Social Science) version 17.0 (SPSS inc., Chicago II, USA).

Results

We studied 100 patients. The baseline characteristic of patients is shown in Tables 1 and 2.

In our study we included different risk factors for difficult mask ventilation. Distribution of patients according to number of risk factors for difficult mask ventilation is shown in table 3. They were grouped as patients with no risk factor, with one risk factor, with two risk factors and with three or more risk factors for difficult mask ventilation.

Table 1: Distribution of patients according to age

Age group	Number of patients	Percentage (%)
≤ 20	2	2.0
21–30	13	13.0
31–40	25	25.0
41–50	23	23.0
51–60	24	24.0
> 60	13	13.0
Total	100	100.0

Table 2: Distribution of patients according to sex

Gender	Number of patients	Percentage (%)
Male	55	55.0
Female	45	45.0
Total	100	100.0

Table 3: Distribution of patients according to number of risk factors for difficult mask ventilation.

Number of risk factors	Number of patients	Percentage (%)
0	21	21.0
1	25	25.0
2	26	26.0
≥ 3	28	28.0
Total	100	100.0

Prevalence of risk factors for difficult mask ventilation in study population is shown in Table 4.

Table 4: Prevalence of risk factors

Risk Factors	Number of patients	Percentage (%)
BMI > 30.0	29	29.0
BEARD	25	25.0
Edentulous	9	9.0
MPC grade > 3	23	23.0
History of OSA	18	18.0
Limited mandibular protrusion	16	16.0
Gender Male	55	55.0

From table 5 it can be seen that there is significant increase in tidal volume after administration of succinylcholine ($p < 0.001$). Peak inspiratory pressure shows a significant decrease after succinylcholine < 0.001). Figure 1 shows that expired tidal volume has improved after administration of succinylcholine irrespective of the number of risk factors for difficult mask ventilation. There is no worsening in facemask ventilation in any case.

Table 5: Comparison of expired TV, MV and PIP before and after administration of succinylcholine.

	Before succinylcholine (n = 21)		After succinylcholine (n = 21)		p-value
	Mean	SD	Mean	SD	
PIP	18.31	5.43	14.97	3.59	< 0.001
MV	4.78	1.41	5.01	1.48	0.025
Expired TV	414.60	110.79	442.88	115.23	< 0.001

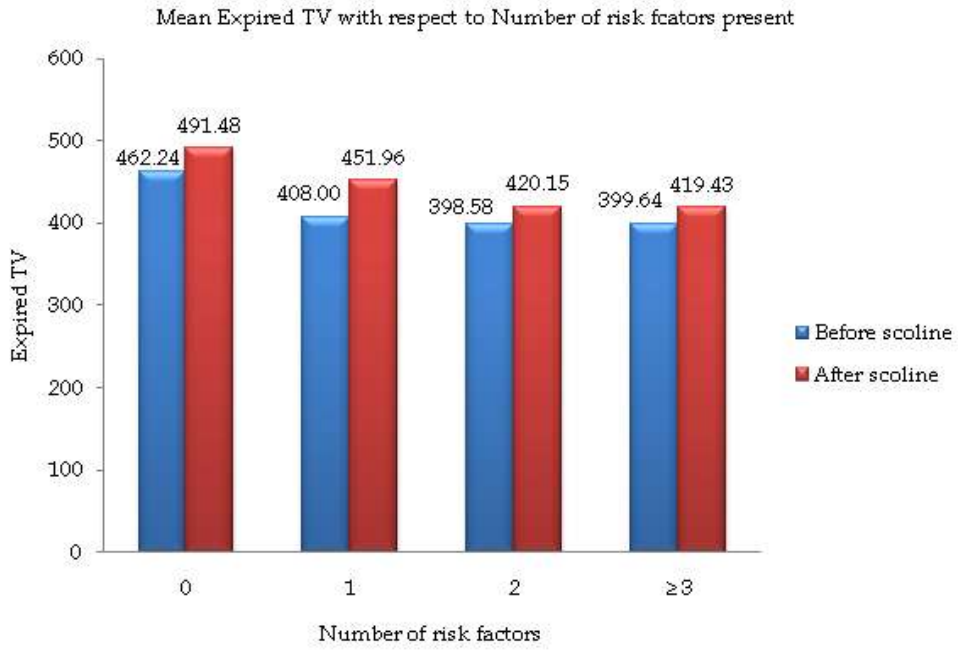

Fig. 1: Comparison of expired TV before and after administration of succinylcholine according to number of risk factors.

It can be seen from table 6 that ease of ventilation improves significantly after giving succinylcholine (p < 0.001).

Table 6: Comparison of ease of ventilation before and after administration of succinylcholine.

Ease of ventilation	Number of patients		p-value
	Before succinylcholine	After succinylcholine	
Easy	39	70	< 0.001
Moderate	28	22	
Difficult	33	8	

Discussion

Ventilation by mask is of utmost important for emergency airway management. It is important to predict which patients may be difficult to ventilate.

Difficult mask ventilation is defined as 'the inability of an unassisted anesthesiologist to maintain the measured oxygen saturation as measured by pulse oximetry > 92% or to prevent or reverse signs of inadequate ventilation during positive pressure mask ventilation under general anesthesia.

There are certain predictors or factors which can make mask ventilation difficult.[15] Thus, whether to administer NMBD before testing facemask ventilation remains a controversy. Our primary outcome was that FMV after administration of NMBD is superior as compared to FMV after induction.

Baseline demographic characteristics and prevalence of predictors of DMV are shown in Tables 1, 2 and 3.

In our study it can be seen that expired tidal volume improved significantly after the administration of NMBD, $p < 0.001$ (Table 5). It was seen that expired tidal volume increased from 414.6 ml (110) before administration of succinylcholine to 442.8 *ml* (115.23) after administration of succinylcholine.

In a study conducted by Ikeda *et al*. in 2012, tidal volume increased significantly from 4.2 to 5.4 *ml/kg* (p = 0.020) after 60 seconds of administration of scoline in 17 patients; however there was no

significant change in tidal volume with rocuronium in 14 patients[16]. We used succinylcholine in all 100 patients.

Similarly in a study by R. Sachdeva, T. R. Kannan *et al.* the tidal volume increased significantly from 525 to 586 *ml* ($p < 0.001$) after administration of rocuronium.[17] Aaron M Joffe, Ramesh Ramaiah *et al*. in 2015 demonstrated an increase in mean tidal volume from 399 *ml* (169) to 428 (166) $p < 0.001$[1]. The results of all these studies were similar to our study.

In our study we included patients with normal as well as difficult airway. We had 28% patients with 3 or more risk factors for difficult mask ventilation and 26% patients with 2 risk factors. So almost half of patients were with difficult airway. Soltezs S *et al*. assessed the effect of neuromuscular blockade on expiratory tidal volume in patients with difficult mask ventilation in all 113 patients.[8] They concluded that the administration of rocuronium improves facemask ventilation in all cases with a potentially difficult mask ventilation and causes clinically relevant increase in tidal volume. These results were similar to our study.

Also there was a significant decrease in peak inspiratory pressure (PIP) after administration of NMBD, $p < 0.001$ (Table 5). None of the patient had deterioration in ventilation or became impossible to ventilate after giving succinylcholine. Ease of ventilation improved significantly after administration of NMBD (Table 6). Our findings are consistent with previous studies.

Warters R. D, Szabo T. A, *et al.* conducted a study in 2011 to prove neuromuscular blockade facilitates mask ventilation and developed a grading scale (Warters scale), based on attempts to generate a standardised tidal volume.[18] They observed that patients with a baseline Warters scale value of > 3 (i.e. difficult to mask ventilate; $n = 14$), the ventilation scores also showed significant improvement (4.2 (1.2) vs 1.9 (1.0), $p = 0.0002$).

In our study, ease of ventilation improved significantly after administration of NMBD. 33 patients were difficult to ventilate before giving succinylcholine which reduced to 8 after administration of succinylcholine. Furthermore 70 out of 100 patients were easy to ventilate after giving NMBD. However no specific grading scale was used in our study.

Amathieu *et al*.[19] assessed 12221 patients for difficult airway management in a two-year prospective study and in 56 of the 90 patients (62 %) with FMV difficulty grade III, the quality of FMV improved by one grade following administration of suxamethonium. Equally important, in none of the 12,003 patients did the quality of FMV worsen following administration of the NMBD. The results of this study were similar to our study. We compared the patients with respect to number of predictors present: with no predictor, with one predictor, with 2 predictors and >3 predictors.

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In 2008, Calder and Yentis questioned the validity, safety and rationale of the practice of demonstrating wheather facemask ventilation is possible before giving a neuromuscular blocking drug (NBD)[20]. Calder and Yentis argued that insistence on checking facemask ventilation, and the subsequent fear of not being able to restore spontaneous respiration should it be difficult, increased the likelihood of 'light anesthesia', which itself caused difficulty with facemask ventilation. Neuromuscular blocking drugs appeared to improve facemask ventilation but evidence was lacking.

Mechanism by which neuromuscular blockade improves facemask ventilation and causes decrease in peak inpsiratory pressure is debatable. Ikeda suggested that pharyngeal fasciculations during suxamethonium administration causes airway dilatation.[16] They performed endoscopic evaluation of airway during suxamethonium administration in 6 patients to demonstrate contractions of both pharyngeal dilators and contractors causing re-opening of airways, no such evaluation was done following rocuronium administration. NMBDs may also improve the FMV by improving chest wall compliance.

Ease of ventilation in our study was a subjective measurement of the anesthesiologist, we did not use any scale for the grading of the same. This is a limitation of our study.

Conclusion

Overall we conclude that, facemask ventilation improves after administration of NMBD with

improvement in expired tidal volume and decrease in peak inspiratory pressure. It also increases ease of ventilation. There is no worsening of face mask ventilation after its administration.

Conflict of interest: None.

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Original Research Article

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Comparison of Analgesic Efficacy of Transversus Abdominis Plane Block with Ilioinguinal Iliohypogastric Nerve Block in Lower Abdominal Surgeries under Spinal Anesthesia: A Double Blind Randomized Study

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Abstract

Background: Regional blocks of the anterior abdominal wall have proven to be highly effective in providing excellent postoperative analgesia, decreasing opioid requirements and facilitating early mobilization and discharge after lower abdominal surgeries. In our study, we compared Transversus Abdominis Plane (TAP) block and Ilioinguinal/iliohypogastric block (IL/IH) for postoperative analgesia in lower abdominal surgeries. *Materials and Methods:* After local ethical committee approval and written consent, the double blind prospective randomized study was conducted on 116 patients (Type I error of 0.05 and a power of 0.9, a sample size of 44 patients/group) of ASA Grade I-II undergoing lower abdominal surgeries under spinal anesthesia. Patients were randomly divided into two Groups through computer generated sequence: Group T: Bilateral TAP block and Group I: Bilateral IL/IH block. Patients were assessed postoperatively for tramadol requirement, first analgesic demand, postoperative pain using Verbal Analog Score (VAS), nausea, vomiting and sedation. Statistical analysis was done by SPSS software version 20 (SPSS Inc., Chicago, IL, USA) and Student's *t* - test, Mann-whitney U test and Fisher's exact test applied. (p – value < 0.05 significant). *Results:* Demographic data were comparable. Tramadol requirement (primary outcome) was lesser in Group T as compared to Group I ($p < 0.001$), time for first analgesic dose was greater in Group T. Group T expressed significantly lesser VAS scores at 4, 12, and 24 hours. Postoperative nausea & vomiting was reduced in Group T as compared to Group I but was statistically insignificant. Patient satisfaction was greater in Group T. *Conclusion:* Transversus Abdominis Plane block provided better pain control than ilioinguinal-iliohypogastric block in lower abdominal surgeries.

Keywords: TAP Block; Ilioinguinal-Iliohypogastric block; Bupivacaine; tramadol.

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Introduction

A substantial amount of pain experienced by patients after abdominal surgery is attributed to the anterior abdominal wall incision. The anterior abdominal wall is innervated by nerve afferents coursing through the transversus abdominis neuro-vascular fascial plane.[1] Pain after surgery has both somatic and visceral components and can be effectively relieved with neuraxial or systemic narcotics.[2] Somatic (cutaneous) pain generated from a Pfannensteil incision is

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principally conducted by the iliohypogastric and ilioinguinal nerves supplying afferent coverage to the L1–2 dermatome. Suboptimal analgesia accounts for considerable patient dissatisfaction, prolonged length of stay, and delayed return to normal daily activity.

Opioids given either systematically or as part of regional anesthesia are the most commonly used modality for pain control after lower abdominal surgeries. Though opioids have been seen to provide adequate analgesia they are also responsible for side effects such as nausea, vomiting, pruritis, sedation and respiratory depression.[3,4]

Also, pain relief is provided by infiltration of the incision site with local anesthetic or by providing epidural block where local anesthetic and other additives are injected through an epidural catheter into the epidural space of the lower back numbing the nerves that supply the abdomen.

Regional blocks of the anterior abdominal wall including TAP block and Ilioinguinal block can significantly help with intraoperative and postoperative analgesia. The benefits of adequate postoperative analgesia include a reduction in the postoperative stress response, reduction in postoperative morbidity, and in certain types of surgery, improved surgical outcome. Effective pain control also facilitates rehabilitation and accelerates recovery from surgery. Other benefits of effective regional analgesic techniques include reduced pain intensity, decreased incidence of side-effects of opioid usage and improved patient comfort.

In this study, we explored the utility of regional blocks of the anterior abdominal wall in developing a multimodal approach to postoperative analgesia. In the past few years, there has been increasing research and interest describing how TAP and ilioinguinal blocks are being used for pain relief in both adults and children having abdominal surgical procedures. Several studies have documented that the TAP block provided effective analgesia during the first *24 hours* after surgery in a series of lower abdominal or pelvic surgical procedures. Comparisons of TAP block were performed with a control group receiving systemic analgesia.

Complementary information is still required concerning the TAP block compared with other techniques of regional anesthesia in terms of efficacy and side-effects.[5] Both TAP block and ilioinguinal-iliohypogastric block have proven to provide effective analgesia after lower abdominal surgeries.[6]

Materials and Methods

After the approval of our instituional review board, the double blind randomized study was conducted according to the study protocol submitted to the board. After taking written informed consent, 116 adult patients, of ASA Grade 1 and 2 undergoing lower abdominal surgeries including gynecological surgeries as well as urogenital surgeries, under spinal anesthesia were recruited in this prospective double blind study. Recruited patients were randomnly allocated into two Groups on the basis of computerized randomization technique. The patients received either TAP block or IL/IH block according to group allocation with bupivacaine 0.5% (*2 mg/kg*), *10 ml* each side.

As a part of routine preoperative preparation, standard monitors including pulse oximetry, blood pressure and ECG were applied to all patients. Patients received intravenous metoclopramide (*10 mg*) and ranitidine (*50 mg*) *20–30 minutes* before transfer to the operation theatre. All patients were preloaded with *500 ml* ringer lactate before start of surgery and received spinal anesthesia with *3–3.5 ml* of 0.5% bupivacaine heavy. Intraoperative antiemetics were not used routinely,but if needed, *4 mg* of ondansetrone iv was used. With the onset of satisfactory block, the surgeon proceeded with the surgery and at the end of surgery bilateral transversus abdominis block or bilateral ilioinguinal block was given. Transversus abdominis plane block was performed by using the landmark technique as described by Rafi *et al*.[7] The aim was to place a large volume of local anesthetic in the fascial plane between the internal oblique and transversus abdominis muscles which contains the nerves from T7 to L1. With the patient in the supine position, the iliac crest was palpated from anterior to posterior until latissimus dorsi muscle insertion could be felt. The 'Triangle of Petit' was located (bounded anteriorly by the external oblique, posteriorly by the latissimus dorsi, and inferiorly by the iliac crest). A *22 gauge 5 cm*. long blunt tipped, short-bevelled needle was inserted in the triangle of petit just above the iliac crest at right angle to the coronal plane until resistance was felt. This indicated that the needle tip pierced the external oblique muscle. The needle was advanced in the same direction until a pop sensation was felt. This showed the entry into fascial plane between the external oblique and internal oblique muscles. Further, advancement of the needle resulted in a second 'pop' after passing through the internal oblique fascia into the transversus abdominus plane. At this point, after careful aspiration, *10 ml* of

0.5% bupivacaine was injected. The same procedure was applied on the other side.In the other group patients received Ilioinguinal-iliohypogastric block, which was performed at a location *2 cm* medial and *2 cm* cephalad to the ASIS, using a 2-pop technique. Bupivacaine 0.5% (*10 ml* each side) was injected. The same procedure was repeated on the other side. After completion of the procedure, the patient was shifted to Postanesthesia care unit (PACU). The patients received standard analgesia according to the obstetric department protocol including Inj diclofenac *i.m 12 hrly* and Patient Controlled Analgesia (PCA) pump was also connected to the intravenous line. The patient was instructed to press the demand button whenever the patient felt pain. PCA device was set to deliver a *50 mg* loading dose of tramadol with a bolus dose of *25 mg* and a lock out time of *15 minutes* and *4 hour* limit of *300 mg*.

The assessment of presence and intensity of pain (both on rest and on passive flexion of hip and knee), nausea,vomiting sedation, patient satisfaction score was done immediately after transfer to PACU (0 hrs) and at *6, 12, 24, 48 hrs* after surgery.

Pain using verbal rating scale was assessed on a scale of 0-100 (0-No pain, 100-Severe pain). Nausea and vomiting was assessed on a three point score (0-No nausea/vomiting, 1-Nausea in postoperative period, 2-Vomiting in postoperative period). Sedation was assessed on a 4 point score (0-Awake and restlessness, 1-A quietly awake patient, 2-Asleep but arousable, 3-Deep sleep). Patient was assessed regarding pain, nausea, vomiting and sedation at arrival in the postoperative unit, *6 hrs*, *12 hrs*, *24 hrs* and *48 hrs* after surgery was over.

In PACU, all the observations were made by an independent observer who had no information of group allocation. The primary outcome variable was total dose of tramadol consumed in *48 hours*. The secondary outcomes were VAS score at rest and movement, time for 1st request of analgesia, postoperative nausea vomiting score, sedation score and patient satisfaction score. Electronic memory of PCA device was used to obtain the time of first PCA tramadol and total tramadol consumption.

Primary end point of the study was to evaluate 30% decrease in analgesic consumption between the two groups at estimated time intervals postoperatively. A sample size of at least 48 patients per group was required to detect this difference with a power of 90% at the 5% significance level. All statistical analyses were performed using SPSS software (Statistical Package for Social Sciences) version 20 (SPSS Inc., Chicago, IL, USA) Data are presented as mean and standard deviation. Means were compared by using Student's t or Mann Whitney *U* tests, where appropriate. Chi-square or Fisher's Exact tests were used for categorical comparisons. A *p* - value less than 0.05 was considered statistically significant.

Results

Patient's characteristics were comparable in the two groups. Female patients were predominant in both the groups but the two groups were statistically insignificant with respect to sex distribution of the patients. Tramadol consumption was reduced by 30% in Group T as compared to Group I with a highly significant difference between the two groups. Tramadol consumption was lesser in Group T as compared to Group I during the 1st 24 *hours* and 24–48 *hours*. The difference was highly significant. On movement pain scores were reduced in Group T than Group I at 6 and 12 *hours* but beyond 12 *hours* pain scores were similar in both the groups. Time for first request of analgesia was prolonged in Group T in comparison to Group I. PONV scores were reduced but comparable in both the groups. No significant difference was found between the sedation scores of both the groups.

Table 1: Total analgesic (tramadol) consumption in 48 hours

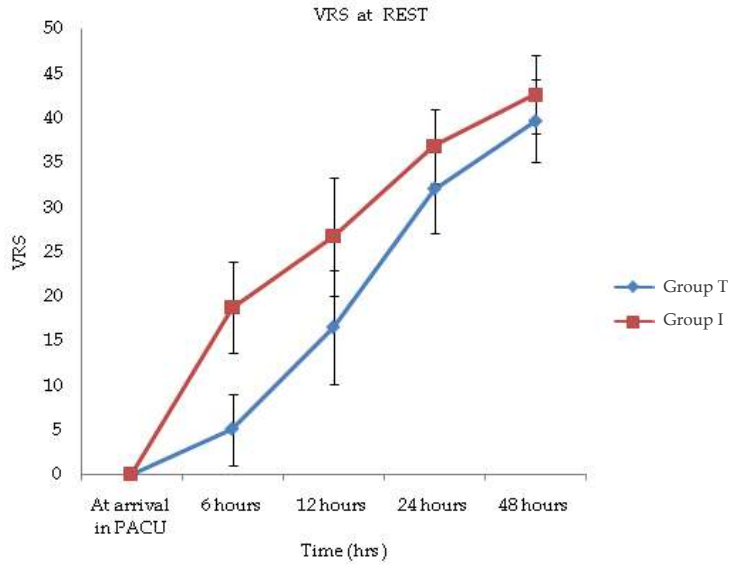
	Group T	Group I	*p* Value
Tramadol Consumption (*mg*) in 48 hours	128.01 ± 16.27	211.63 ± 23.51	<0.0001

Table 2: Stratified analgesic (tramadol) requirement

Tramadol consumption(mg)	Group T	Group I	*p* Value
1st 24 *hours*	52.15 ± 8.48	78.01 ± 12.45	<0.0001
24-48 *hours*	99.13 ± 14.02	114.65 ± 13.27	<0.0001

Table 3: Verbal rating scores (VRS) at rest

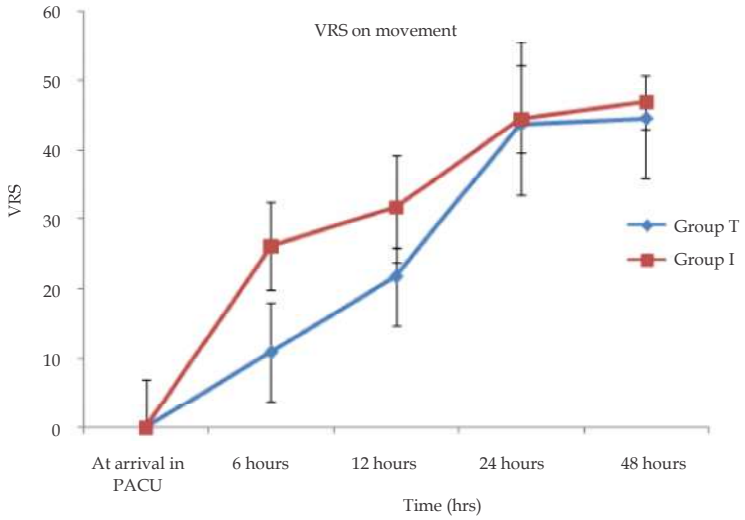
Interval	Group T (Mean ± S.D)	Group I (Mean ± S.D)	*p* Value
VRS at arrival in PACU (0 Hours)	0.17 ± 0.92	0.25 ± 1.45	0.35
VRS (6 hours)	5.07 ± 5.41	18.71 ± 5.15	0.0001
VRS (12 hours)	16.50 ± 6.38	26.72 ± 6.62	0.0001
VRS (24 hours)	32.05 ± 5.01	36.81 ± 4.16	0.0001
VRS (48 hours)	39.66 ± 4.67	42.61 ± 4.41	0.0005



Graph 1: Verbal rating scores (VRS) at rest

Table 4: Verbal rating score on movement (VRSm)

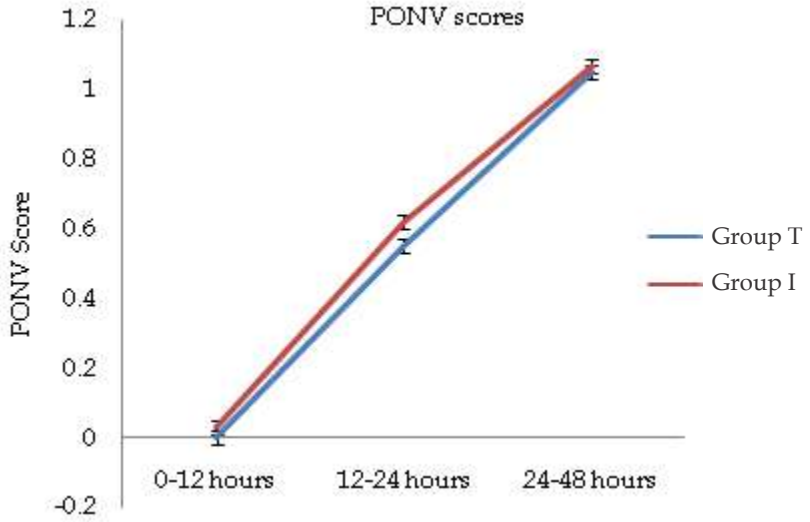
Interval	Group T (Mean ± S.D)	Group I (Mean ± S.D)	*p* Value
VRSm at arrival in PACU (0 Hours)	0.17 ± 0.92	0.34 ± 1.84	0.26
VRSm (6 hours)	10.90 ± 6.23	26.24 ± 6.97	0.0001
VRSm (12 hours)	21.84 ± 7.74	31.69 ± 7.16	0.0001
VRSm (24 hours)	43.72 ± 10.99	44.57 ± 4.0	0.5834
VRSm (48 hours)	44.57 ± 4.0	46.98 ± 8.53	0.0535



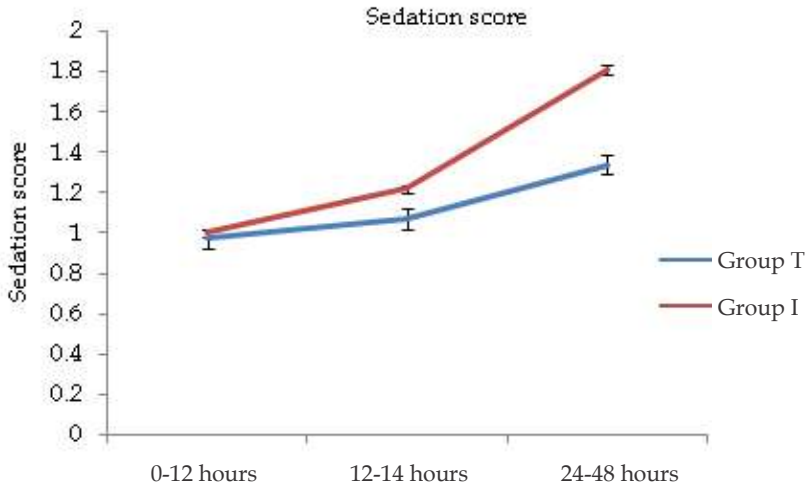
Graph 2: Verbal rating score on movement (VRSm)

Table 5: Time for first request of analgesic(Tramadol through PCA)

	Group T	Group I	*p* V alue
First Request for Tramadol (hours)	16.052 ± 0.78	12.336 ± 1.14	0.0001



Graph 3: Post operative nausea and vomiting scores



Graph 4: Sedation scores

Discussion

The ideal analgesic regime should be safe and effective with minimal side effects. A mutimodal analgesic regime is most likely to achieve these goals. However, optimal components of this regimen continue to evolve. Although single shot neuraxial analgesic technique using long acting opioids or patient controlled epidural opioid administration provide effective analgesia, they are associated with frequent incidence of side effects, particularly nausea, vomiting and pruritis which reduce overall patient satisfaction.

Transversus abdominis plane block is a new regional analgesic technique which targets nerves of anterio-lateral abdominal wall mainly T-10 to L1 or T-9 to T-11. The block has been found to be effective after various abdominal surgeries like abdominal hysterectomy,[8] open prostratectomy,[9], laproscopic cholecystectomy and appendicectomy. Ilioinguinal-iliohypogastric nerve block involves the blocking of ilioinguinal and iliohypogastric nerves (L1-L2) in the plane between the transversus abdominis and internal oblique. It has been found to reduce analgesic requirement after cesarian section and inguinal hernia surgeries.

Several studies have documented that the transversus abdominis plane block provided effective analgesia during the first *24 hrs* after surgery in a series of lower abdominal or pelvic

surgical procedures. But these studies included a limited number of patients for each surgical procedure and comparisons were performed with a control group receiving systemic analgesia. The aim of our study was to compare the analgesic efficacy, patient satisfaction regarding analgesia and side effects of TAP block and ilioinguinal iliohypogastric block in patients undergoing lower abdominal surgeries. We found that the overall tramadol consumption was reduced by 30% in the first *48 hours* postoperative group which received TAP block as compared to the group which received IL/IH block.

Our study demonstrated reduced mean pain scores on rest in Group T at *6 hours* (5.07 ± 0.71 *vs* 18.53, $p < 0.0001$), *12 hours* (16.4 ± 6.39 *vs* 26.64, $p < 0.0001$), *24 hours* (32.05 ± 5.01 *vs* 36.81 ± 4.16, $p < 0.0001$) and *48 hours* (39.66 ± 4.67 *vs* 42.67 ± 4.41, $p < 0.0005$) as compared to Group I.

Pain at knee flexion was significantly reduced in Group T at *6 hours* (10.90 ± 0.82 *vs* 26.33 ± 0.97, $p < 0.0001$) and *12 hours* (21.84 ± 7.74 *vs* 31.69 ± 7.16, $p < 0.0001$) but no difference was found in the pain scores beyond *12 hours* in both the groups. These findings can be explained by the fact that while providing analgesia of the skin and deeper layers of the anterior abdominal wall, regional nerve blockade would not provide analgesia for visceral pain which is diffuse and not associated with peripheral nerve supply.[8] Both the nerve blocks provided a significant duration of analgesia. This is in keeping with the prolonged duration of action of bupivacaine.[9] Along with reduced analgesic consumption we also observed that the group which received TAP block took a longer time to request for the first rescue analgesic dose as compared to the group which received IL/IH block. The mean time for 1st analgesic request analgesic in Group T was 16.052 ± 0.103 hours as compared to *12.336 ± 0.15 hours* in Group I ($p < 0.0001$).

The site of penetration of the two nerves towards the abdominal wall muscles also varies, so that, the more proximal the nerves are blocked, the more effective the block could be. Nerve endings anesthetized by the TAP block originate from T7 to L1 and include the Iliohypogastric nerve which is responsible for better analgesic efficacy of TAP block when compared to IL/IH block. Tramadol demand was decreased in patients who benefited from a TAP block, but the difference in tramadol consumption between the two Groups was not important enough to account for a difference in the incidence of PONV. Sedation scores observed were similar in both the groups. None of the patients were deeply sedated to require intervention in any group.

Very few studies have been done comparing the analgesic efficacy of TAP block and ilioinguinal iliohypogastric nerve block. Most studies have been performed comparing these two abdominal nerve blocks with a placebo group and both TAP block and IL/IH block have proven to be effective in reducing pain scores and decreasing opioid consumption. A meta-analysis done by Wang *et al*. also showed that ultrasound-guided II/IH nerve or TAP block is associated with reduced use of intraoperative additional analgesia, reduced pain in day-stay unit, and reduced use of rescue drug.[6] Our results were consistent with those found by a study done by Aveline *et al*. In 2012 Aveline *et al*. compared ultrasound guided TAP block with ilioinguinal-iliohypogastric block in patients undergoing inguinal hernia repair.[5]. Median VAS pain scores at rest were lower in the ultrasound-guided TAP group at *4h*,*12h* and *24h*. Postoperative morphine requirements were lower during the first *24h* in the TAP block group. Aveline concluded that after open inguinal hernia repair in ambulatory patients, ultrasound-guided TAP block provided better immediate postoperative pain relief and reduced opioid demand, when compared with conventional loss-of-resistance IHN blocks.

In a recent study (2015), Faried AM, Lahloub FMF and Elzehery MM compared ultrasound guided TAP block with ultrasound guided IL/IH block in children undergoing unilateral groin surgery and found that ultrasound guided TAP block provides postoperative pain relief for longer duration as compared to ultrasound guided ilioinguinal/ iliohypogastric nerve blockade.[10]

Our study had certain limitations such as limited assessment of postoperative analgesia time to first *48 hours* after surgery. The severity of pain usually diminishes substantially by this time and pain scores are reduced. We could not use ultrasound guided blocks for our study due to the non availability of ultrasound. Therefore, we could not guarantee the correct placement of local anesthetic into the corresponding planes. The study was not large enough to assess safety of the blocks. There is risk of inadvertent peritoneal puncture with these blocks. Although their incidence is not known, risk of peritoneal puncture is likely to be low. There is also risk of needle puncture of liver in cases where hepatomegaly is seen, though we did not encounter any such cases.

We conclude that both the TAP and IL/IH nerve blocks hold considerable promise as a part of

multimodal analgesic regimen for lower abdominal surgeries but the TAP block was more effective in comparison to IL/IH block, with reduced pain scores and decreased tramadol requirement.

Conclusion

In this randomized, double-blind randomized study, we found that both the transversus abdominis plane block and ilioinguinal-iliohypogastric nerve block were easy to perform and effective in reducing analgesic demand (PCA tramadol) as a part of multimodal analgesia regime but the transversus abdominis plane block was more effective in reducing severity of pain both at rest and on movement, delayed the demand of first postoperative analgesic and reduced the need of PCA tramadol during first *48h* after surgery when compared with ilioinguinal iliohypogastric block.

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Original Research Article

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Impact of Structured Teaching Programme on Peripheral Intravenous Cannulation among Doctors and Paramedical Staff in Medical College

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Abstract

Context Background: A Workshop was conducted on intravenous line insertion among doctors and nursing staff. Theoretical aspect was explained through standees whereas practical aspect was demonstrated through skill mannequin. *Aims:* It was an interventional study conducted for 3 days, where an effect of a training on IV line insertion was evaluated based on pre and post training assessment score. *Settings and Design:* The study population was 582 including medical and n paramedical staff. The training cum workshop was divided in two sections - theoretical part and skill oriented part, theoretical aspect was explained by expert in the field by the PowerPoint presentation then Mannequin training was given. Same training method was used for all the batches. Evaluation of training was done by asking the participants to fill a questionnaire with 10 questions, before and after training session. *Statistical analysis used:* The results were collected and evaluated by applying paired *t* - test and *p* - value obtained SPSS statistical software. *Results:* In pretest out of 582 members, only 16% secured ≥ 70% marks. But in posttest evaluation showed 94% candidates securing ≥ 70%. The difference is said to be statistically significant at 95% confidence interval when *p* - value is < 0.05 (0.0001) Out of 582 responders 148 were doctors 434 were paramedical staff. *Conclusions:* Hence, we concluded that intravenous cannulation workshop is essential to improve knowledge and skill of intravenous line insertion.

Keywords: Intravenous line; Training programme; Doctors; Paramedical staff.

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Introduction

Intravenous (IV) means "within vein". Intravenous therapy (IV) is a therapy that delivers fluids directly into a vein and can be used for injections or infusions due to fastest way to deliver fluids and medication[1] and 100% bioavailability. IV Cannulation skills develops from a combination of theoretical instruction and on the job practice. Educational programs may lead to a substantial decrease in cost, morbidity, and mortality.[2] Then the researcher thought of taking the task of assessing the knowledge of paramedical staff and doctors and educating them. The Guideline for Hand Hygiene in Healthcare Settings provides Healthcare Workers (HCWs) with a review of data regarding handwashing and hand antisepsis in healthcare settings and it provides specific

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recommendations to promote improved hand hygiene practices and reduce transmission of pathogenic microorganisms.[3]

Materials and Methods

It was an interventional study. Medical and paramedical staff were included in study and the study population was 582. Workshop was conducted for 3 days. Same training method were used for all the batches of training to maintain the same intensity of training. The training cum workshop was divided in two sections. Theoretical part - PowerPoint presentation and standees were used for better visual impact on the participants. Practicle part - Mannequin training were given to the participants.

Evaluation of Training

A questionnaire (10 questions) for evaluation. The aspects on which they were interrogated like basic classification, site selection, maintenance, complications. The participant were asked to fill up questionnaire paper before and after the training session done.

Analysis

The data were entered to computer and analyzed using SPSS software. Paired *t* - test was used to establish statistical significance between pre and posttraining score. The difference is said to be statistically significant at 95% confidence interval when *p* - value is < 0.05 (0.0001).

Results

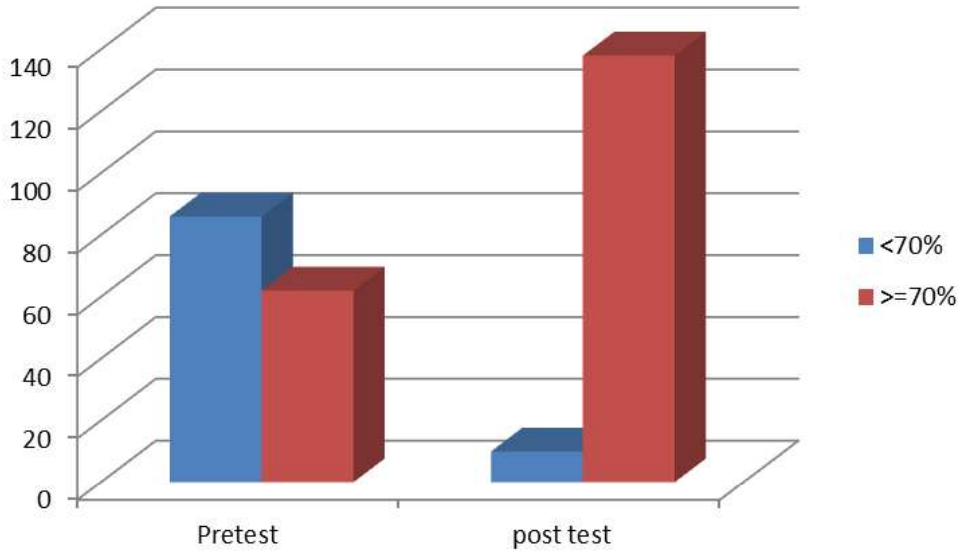
Out of 582 responders 148 were doctors and 434 were paramedical staff. Pre and posttests were conducted with same questionnaire. In pretest out of 582 members, only 16% secured ≥ 70% marks. In posttest evaluation was done through same questionnaires that showed 94% secured ≥ 70%. The data were entered to computer and analyzed using SPSS software and Paired *t* - test was used to establish statistical significance between pre and posttraining score. Which was statistically significant at 95% confidence interval (*p* - value < 0.0001).

Among doctors 41.89% secured ≥ 70% marks in pretest assessment whereas in postworkshop assessment 93.24% secured ≥ 70% marks, (Graph 1).

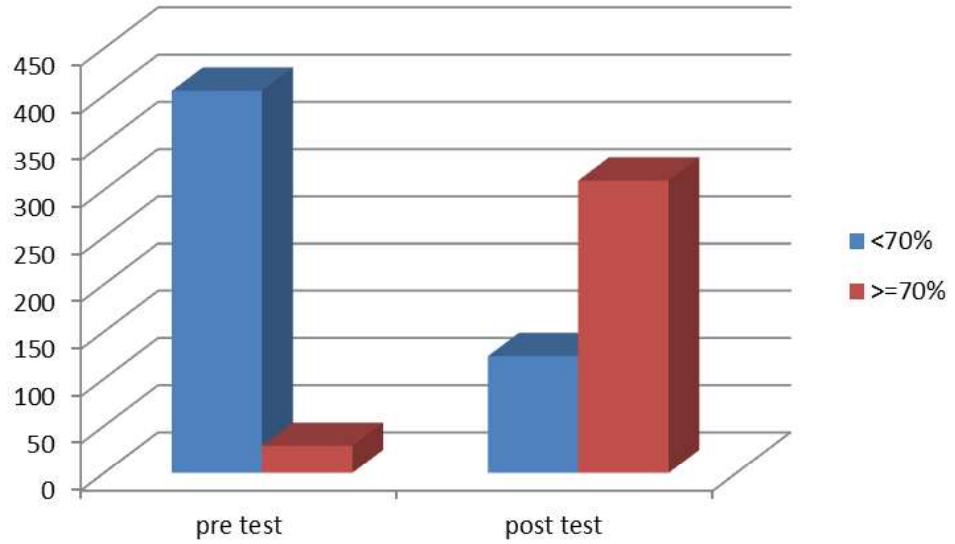
For paramedical staff 6.68% secured ≥ 70% in pretest assessment whereas in posttest assessment 71.49% of them secured 70–90%, (Graph 2 and Table 1).

Table 1: Showing numerical comparision between doctors and paramedical staff and comparision between pretest and posttest result shows *p* - value < 0.01, means it indicates significant difference between two results.

Workshop participants	n (sample size)	Pre-test Mean	Post-test mean	Paired t - test p - value
Doctors	148	13.26	16.63	< 0.01
Paramedical staff	434	7.39	15.77	< 0.01



Graph 1: Showing comparative results of pretraining and posttraining among Doctors (*n* = 148)



Graph 2: Showing comparative results of pretraining and posttraining among Paramedical Staff (n = 434)

Discussion

A workshop was conducted on intravenous line insertion among 582 (Doctors and Paramedical) staff in medical college to see the effectiveness of workshop. In pretest only 16% secured ≥ 70%. In posttest workshop 94% candidates secured ≥ 70%. Which shows significant difference ($p < 0.05$). The comparison was done in the same group for pre and posttest (i.e. doctors pretest and posttest only comparable). That shows that programme with teaching in person along with hands on methods are effective enough for medical and paramedical persons for improvement in knowledge regarding a skill like intravenous cannulation.

- Naomi P Gredy *et al*.[4] had published an article in Feb' 11 stated that guidelines have been developed for healthcare personnel who insert intravascular catheters and for persons responsible for surveillance and control of infections in hospital, outpatient, and home healthcare settings. They emphasized mainly on educating and training healthcare personnel who insert and maintain catheters.
- A study done[5] an educational intervention to prevent catheter-associated bloodstream infections in a nonteaching, community medical center in July 2003 concluded that, a focused educational intervention among nurses and physicians in a nonteaching community hospital resulted in a significant, sustained reduction in the incidence of catheter-associated bloodstream infection.[6,7]
- Dave Davis and his friends did study in 1999 about impact of Formal Continuing Medical Education and gave conclusion that interactive CME sessions that enhance participant activity and provide the opportunity to practice skills can effect change in professional practice and, on occasion, healthcare outcomes.[8]
- One more study done on impact of an educational program and policy changes on decreasing catheter-associated bloodstream infections in a medical intensive care unit in Brazil[2] Stated that AAmultiple approach included an educational strategy, targeted to specific problems observed during a careful evaluation of CVC care practices, and policy changes can decrease rates of CVC-BSI.
- Margaret G. Lyons *et al*. A randomized, pretest posttest experimental STU DY done by Scott A Engum to assess Computer-based education *vs* traditional learning methods for Intravenous catheter training suggested combination of these two methods of education to enhance the trainee's satisfaction and skill acquisition level.[3] assessed the success of an IV catheter insertion continuing education class aimed at improving experienced nurses' skills levels, confidence, and knowledge regarding IV catheter insertion, maintenance, and infection prevention.[10] Other studies done on complications of peripheral intravenous (IV) catheters in the hand and forearm in a hospital[11-14] over a period of time n demanded the need of education n teaching to decrease incidence of complications related to intravenous catheter.

- Webster J and his couligues suggested that to minimise peripheral catheter-related complications, the insertion site should be inspected at each shift change and the catheter removed if signs of inflammation, infiltration, or blockage are present.[15]
- Education in evidence-based care and handling gives nurses and doctors the opportunity to improve their ability to use theoretical knowledge in clinical problems.[2,16]

Conclusion

- Hence, we concluded that intravenous cannulation workshop is essential to improve knowledge and skill of intravenous line insertion among medical and paramedical staff.

Key Messages

Need of such study to increase awareness about care of intravenous cannulation to decrease intravenous cannulation related infection and complication and thereby, decreasing hospital stay and mortality.

Acknowledgement: Nil.

Conflict of Interest: Nil.

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Original Research Article

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Fractionated Dose Vs Conventional Method of Drug Administration in Spinal Anesthesia for Pregnant Women Undergoing Cesarean Section: A Comparative Study

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Abstract

Background: Spinal Anesthesia (SA) is the routine and safe method of administering anesthesia for performing Elective or emergency cesarean sections. SA with conventional (bolus dose) method of injection provides rapid onset of action with high spinal blockade leading to hypotension, compromised the uteroplacental circulation and fetal acid-base imbalance. Our study aimed to compare, low dose bupivacaine injection by conventional to fractionated method to achieve the desired level of anesthesia with stable hemodynamic in SA. Onset of sensory and motor blockade, and duration of analgesia were monitored in patients undergoing elective Lower Segment Cesarean Section (LSCS). *Methods:* Sixty pregnant women undergoing elective Lower Segment Cesarean Section (LSCS) were included in the study and they were randomly allocated into two Groups. Group C patients received bolus dose of bupivacaine (0.5%) heavy by conventional method and Group F received the same dose of Bupivacaine in fractionated manner with two third of it initially followed by remaining one third dose after 30 secs. The hemodynamic monitoring consisted of Mean Arterial Pressure (MAP), Heart Rate (HR). Other variables recorded were time of onset, duration of analgesia, and regression of sensory and motor blockade. The vasopressor required as rescue drug for hypotension when fall of MAP below 20% of the basal value were observed and noted. *Results:* The hemodynamics were statistically comparable in both the Groups. The onset of sensory block was slightly delayed (2.50 ± 0.68 vs 3.47 ± 1.53), duration of analgesia was prolonged (141.10 ± 24.32 vs 166.80 ± 52.11) and the vasopressor requirement was less (5.33 ± 3.93 vs 2.20 ± 4.02) in Group F as compared to Group C and these results were statistically significant. The Apgar scores between the two Groups ($p > 0.05$) were not significant. *Conclusion:* SA in pregnant women for LSCS by fractionated technique of drug injection provided slightly slower onset of only sensory blockade with prolonged duration of analgesia. The statistically significant less vasopressor requirement in the study group was observed as compared to the conventional group which in turn concludes the hemodynamics more stable in the study group.

Keywords: LSCS; Fractionation; Conventional bolus dose; SA block; Hemodynamics.

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Introduction

Elective and emergency Lower Segment Cesarean Section (LSCS) under spinal anesthesia is the safe and most adopted technique for day to day practice. The required dosage of effective block for LSCS has been associated with maternal arterial hypotension of 60–90% with maternal and neonatal

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morbidity.[1] Maternal hypotension and subsequent consequences are reduced to some extent by various measures like preloading or coloading of crystalloids or colloids, low dose bupivacaine, left uterine displacement, prophylactic use of vasopressors etc but with less benefit.[2–4]

Intensity and duration of spinal block is influenced by numerous factors like anatomical and physiological changes associated with pregnancy, height, weight, and dose of local anesthetic drug.[5] The SA related hypotension can be prevented by possible and relevant technique by modifying the dose administration of the hyperbaric local anesthetic drug intrathecally.[6–8] hemodynamic stability and prolonged duration of analgesia were observed by injecting the local anesthetic drug in divided doses in to the subarachnoid space.[8,9]

The present study was done to compare the spinal anesthetic blockade (onset and recovery of sensory and motor blockade, highest sensory block and duration of analgesia) and hemodynamic (HR and MAP) parameters, vasopressor requirement and APGAR score with modification of dose injection by fractionationvs conventional method.

Materials and Methods

The present study was carried out in our hospital after the Institutional ethics committee approval in sixty pregnant women (thirty in each group).

Study population

As the hemodynamic parameters were recorded repeatedly the sample size was calculated for repeated measures of ANOVA, taking Cohen's effect size of f = 0.20 with alpha = 0.05 and 1-beta (power) = 0.99, total sample size was 54, however to compensate for the dropout cases total of 60 cases (30 in each group) were considered.

The study was done in our hospital as a prospective randomised double blinded controlled study. Singleton pregnant women posted for elective LSCS under SA with American Society of Anesthesiologists' (ASA) physical status I–II, age between *18* and *35 years* and height between *145* and *175 cm* were included. The women with pregnancy induced hypertension, preexisting cerebrovascular or cardiovascular disease, any contraindication to SA, weight less *than 50 kg* or more than *110 kg*, taller than *175 cm* or shorter than *140 cm*, severely altered mental status, uncooperative patients, and history of spine surgery or spine deformities were excluded from the study.

Study Procedure

All the pregnant women coming for Cesarean section had undergone preanesthetic checkup day before surgery. On the day of surgery premedication was given with pantoprazole *40 mg* IV after securing the intravenous line. In the operation theatre the monitoring consisted of electrocardiogram (ECG), pulse oximeter (SpO_2) and Noninvasive Blood Pressure (NIBP) for all the patients. The baseline blood pressure and Heart Rate (HR) were recorded. Preloading was done with *10 ml/kg* Ringer's Lactate (RL) solution over period of *10 min*. Procedure of spinal anesthesia was done in sitting position using all aseptic precautions with 25 G quincke spinal needle through L3–L4 space. Bupivacaine 0.5% heavy *2 ml* (*10 mg*) was injected intrathecally after free flow of CSF. Randomization into two Groups was done using computer generated sequential number and placed in sealed envelopes to be opened only before the study. The study was double blinded so that, the women and the assessor were unaware of the group. Only the attending consultant administering the SA knew the group allocation.

Group C - received the drug injection in conventional method over *10 second*.

Group F - received the drug injection in fractionation method [two thirds of the drug was injected initially and the remaining one third was given after *30 seconds*].

The drug was injected with *5 ml* syringe. In Group C, all received the bupivacaine injection in the conventional manner over the period of *10 seconds*. Where as in Group F, two thirds of the dose was given initially followed by the remaining dose after *30 seconds*. The syringe was kept in situ for remaining *30 seconds* to avoid the CSF leak before the full dose is injected. Immediately after the injection all women were made supine with a wedge under the right hip in both the Groups and were supplemented with oxygen by Hudson mask at *5 L/min*.

Continuous ECG, HR, NIBP and SpO_2 were monitored intraoperatively. The HR and BP were monitored at base line, just before subarachnoid block, then at *2, 4, 6, 8, 10, 15, 20, 30, 40, 50,* and *60 minutes* after giving SA.

Hypotension was treated with injection mephentarmine *6 mg* IV whenever mean arterial pressure (MAP) decreased to ≤ 20% of baseline and repeated as and when required. Atropine *0.6 mg* was given for episodes of bradycardia (HR of < *50 beats/min*). The amount of these two drugs given were recorded in both Groups.

Time of onset, highest level and two segment regression of sensory and motor block were assessed and hemodynamic (MAP and HR) parameters were recorded. Loss of sensation to pinprick was considered as the level of sensory block. Modified Bromage scale was used to assess the motor blockade. These tests were performed every min till the achievement of maximum sensory and motor block (Bromage scale 3) and every *30 minutes* later on postoperatively until the recovery of sensory and motor blockade returned back to normal. The onset time of sensory or motor blockade was defined as the interval between intrathecal administration and time to achieve T10 and a modified Bromage score of 3 respectively.

Onset of sensory block was considered with loss of sensation to pinprick at T10 from the start of drug injection. Time from the highest level of sensory blockade to two segment regression was considered as duration of sensory blockade and fromthe onset of motor block to the complete motor recovery or achievement of modified Bromage scale zero (0) as duration of motor blockade. Time for first request to rescue analgesic demand from the start of drug injection is taken as duration of analgesia.

Motor block was assessed by Modified Bromage scale: Grade 0 – No motor block, Grade 1 – Inability to raise an extended leg, able to move knees and feet, Grade 2 – Inability to raise an extended leg, unable to move knees but able to move feet and Grade 3 – Complete motor block of lower limb.

Surgery was allowed only when the sensory blockade reached at least T6 dermatome level and Bromage scale of three or more. Those requiring conversion to general anesthesia were excluded from the study. After the baby delivery, IV oxytocin 5 IU IV slowly and 15 IU in *500 ml* RL was given. Episodes of nausea, vomiting, respiratory distress, shivering, pruritus, urinary retention were monitored and recorded postoperatively for *24h* and treated accordingly. Apgar scores were assessed at *1, 5* and *10 minutes* and noted.

Visual Analog Scale (VAS) [*0 to 10 cm* where 0 = no pain and 10 = worst pain ever felt] was used to assess pain postoperatively. Pain was assessed every *30 min* initially for the first *2 hrs* and then hourly for *6 hrs*. VAS score ≥ 4 was considered as the rescue analgesic demand. Diclofenac sodium *75 mg* IM/IV was used as rescue analgesic in our study.

Statistical Analysis

Kolmogorov-Smirnov test was used to confirm the normal distribution of the data recorded. The continuous data was displayed by mean and standard deviation and discrete data as Median and Interquartile Range (IQR). Unpaired *t* - test was used to compare continuous data. ANOVA (repeated measures) was performed for hemodynamic parameters. The discrete data Apgar score was compared by using Mann-Whitney *U* test. The Fischer test was performed for numerical discrete data. Results with *p* - value < 0.05 were considered statistically significant.

Results

Demographic observations (age, height and weight) were comparable in two Groups (Table 1).

Table 1: Demographic data in two groups

Demographic data	Group C (Mean ± SD)	Group F (Mean ± SD)	*p* - values
Age in *years*	24.1 ± 3.61	24.67 ± 3.37	0.532
Height in *cm*	156.73 ± 4.89	154.76 ± 5.81	0.057
Weight in *kg*	61.97 ± 8.85	65.6 ± 7.56	0.084

p - values < than 0.05 is statistically significant

Table 2: Characteristric of the Spinal block both the Groups

Observations	Group C Mean ± SD	Group F Mean ± SD	*p* - values
Onset of sensory block (*min*)	2.5 ± 0.68	3.47 ± 1.54	0.002
Onset of motor block (*min*)	4.97 ± 1.57	5.23 ± 1.89	0.556
Sensory block level (number of patients)			
T2	6 (20%)	1 (3.33%)	0.001
T4	8 (26.67%)	4 (13.33%)	
T5	5 (16.67%)	6 (20%)	
T6	11 (36.67%)	19 (63.33%)	
Two segment regression of sensory block (*min*)	97.13 ± 24.85	93.87 ± 32.81	0.665
Motor Recovery (*min*)	180.0 ± 26.73	192.57 ± 53.04	0.251
Duration of Analgesia (*min*)	141.1 ± 24.31	166.80 ± 52.10	0.017
Vasopressors Required (*min*)	5.33 ± 3.92	2.2 ± 4.01	0.003
APGAR score (*IQR*)	8.3 ± 10	8.5 ± 5	0.259

p - values < than 0.05 is statistically significant

The onset of sensory block (2.50 ± 0.68 *vs* 3.47 ± 1.53 *min*) was delayed in the Group F than the control group (conventional method). Similarly the duration of analgesia was significantly prolonged (141.10 ± 24.32 *vs* 166.80 ± 52.11) in Group F as compared to Group C ($p < 0.05$). The vasopressor requirement was much less (5.33 ± 3.93 *vs* 2.20 ± 4.02) in Group F in comparison to Group C and is statistically significant (Table 2). Our results showed that hemodynamic parameters (Table 3) were comparable in both the groups and this may be because of the increased requirement of vasopressor in the conventional method. Onset of motor blockade, two segment regression of sensory and motor recovery were statistically insignificant ($p > 0.05$). APGAR scores were same in both the Groups (Table 4).

Table 3: Heart Rate changes (beats/min) in both the groups

Heart rate	Group C Mean ± SD	Group F Mean ± SD	*p* - values
BL	99.17 ± 15.59	92.8 ± 15.59	0.096
SAB	99.4 ± 14.41	94.17 ± 13.35	0.151
2 min	100.07 ± 19.11	91.54 ± 14.68	0.057
4 min	95 ± 17.43	89.7 ± 16.51	0.229
6 min	87.8 ± 17.49	89 ± 17.04	0.789
8 min	80.77 ± 15.72	80.84 ± 17.22	0.102
10 min	84.73 ± 15.84	87.33 ± 15.28	0.522
20 min	90.37± 13.31	91.6± 14.79	0.735
30 min	92.87± 16.74	91.37± 12.91	0.699
40 min	91.23 v 14.21	91.03 ± 13.21	0.955
50 min	88.5 ± 11.96	86.43 ± 12.42	0.514
60 min	85.86 ± 9.81	85.5 ± 12.76	0.901

p - values < than 0.05 is statistically significant

Table 4: Mean Arterial Pressure (mm of Hg)

Map	Group C Mean ± SD	Group F Mean ± SD	*p*-values
BL	84.9 ± 9.58	82.13 ± 6.06	0.187
SAB	83.53 ± 12.65	81.33 ± 7.97	0.424
2 min	74.43 ± 17.14	75.57 ± 9.31	0.751
4 min	75.3 ± 11.91	73 ± 9.71	0.329
6 min	68.03 ± 13.67	70.03 ± 9.51	0.513
8 min	71.5 ± 13.24	69.73 ± 11.63	0.585
10 min	74.27 ± 13.23	73.57 ± 9.37	0.814
20 min	70.83 ± 12.67	72.6 ± 9.02	0.536
30 min	71.27 ± 10.72	71.87 ± 10.95	0.831
40 min	71.7 ± 9.89	73.5 ± 7.69	0.435
50 min	74.87 ± 10.22	76.23 ± 8.73	0.581
60 min	75.93 ± 9.22	75.43 ± 8.35	0.827

p - values < than 0.05 is statistically significant

Discussion

Subarachnoid block is the most preferred technique of anesthesia because of its safety and economical purpose for both elective and emergency Lower Segment Cesarean Section (LSCS). Maternal hypotension, impaired uteroplacental circulation with maternal and neonatal morbidity[1] are common side effects with conventional method of SA. A large variety of dosage regimes (National survey at UK) were in use for SA to improve the neonatal outcome by maintaining normotension during LSCS. The incidence of hypotension is reported to be 60–90% of cases, if preventive measures (preloading or coloading of crystalloids or colloids, low dose bupivacaine, left uterine displacement, prophylactic use of vasopressors etc) are not taken.[2,11]

Height[5] and weight[12] are considered to be significant variables in predicting the level of spinal blockade. Dose adjustment as per height and weight proved to be having less maternal hypotension as compared to the fixed dose.[13] Pregnancy itself (hormonal changes alter the action of neurotransmitters and permeability in the spinal column).[14,15]

Use of opioid as an additive to the local anesthetics in SA proved to have faster onset of sensory blockade, stable hemodynamics and longer duration of analgesia,[16] (Fig. 1).

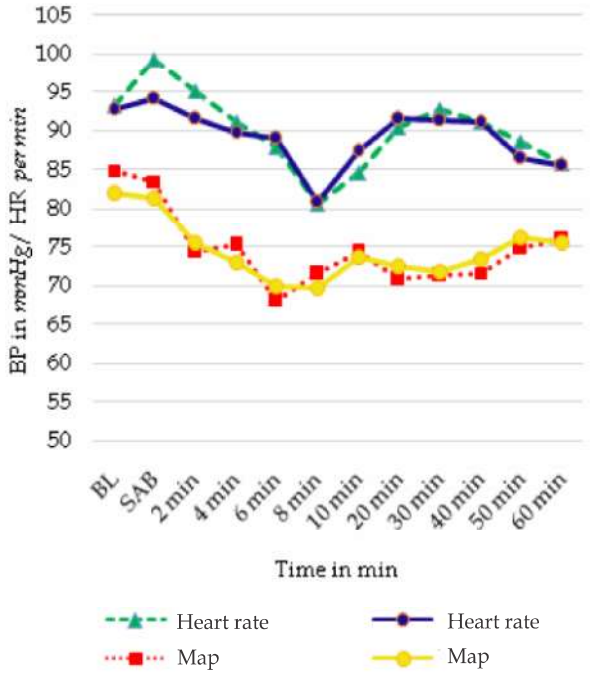

Fig. 1: Hemodynamic changes

Fractionated [initial two thirds of the dose injection followed by one third dose after *90 sec* of bupivacaine heavy (0.5%)] dose was compared with bolus dose in SA for elective LSCS by Badheka Jigisha *et al*.[8] and found to have stable hemodynamics, longer duration of analgesia and dense blockade with fractionated dose injection method. Similar method was used in PIH patients by Bina Patel *et al*.[17] giving the second half of the drug after after *90 secs* in sitting position and observed stable hemodynamics, dense block and longer duration of analgesia in the fractionated method. In another study, fractionated dose of one third of the remaining total drug injection after sixty seconds proved to have stable hemodynamics with longer duration of analgesia compared to bolus dose injection.[9]

As per our hospital settings, to get higher level of sensory blockade we reduced the waiting time (*30 seconds*) in fractionation method.

Onset of sensory blockade was slightly delayed with the fractionated method in comparison to the conventional method of SA in our study. Same results were observed with the study of Agarwal N *et al*.[18] Essam E *et al*.[19] concluded that in their study in pregnant women undergoing LSCS the onset of sensory blockade was faster in the conventional method than the patients kept sitting for longer time. Fractionated method of SA by injecting the remaining one third of the drug after *60 sec*. also showed delayed onset of sensory block.[9] Our study results are in concurrent with the above studies. In contradiction to our study results Bina Patel *et al*.[17] and Bhadeka Jigisha *et al*.[8] had faster onset of sensory block in the fractionated method.

Studies have shown that with the fractionated method of drug injection for SA, sensory and motor blockade and recovery was delayed in the fractionated method of SA.[8,9,17] In contrast our study results had no difference in both the two Groups in regards to two segment sensory regression, onset of motor blockade and motor recovery. This explains that shorter duration of time fractionation of drug injection does not alter much in the above said characteristics.

Paramaters of MAP were comparable in both the Groups throughout the study, probably because the BP were maintained with the use of mephenteramine. Whereas other studies proved to have statistically significant stable hemodynamics in fractionated group than the control group.[8,20] As compared to the single bolus dose of SA in LSC Sby Bina Patel *et al*.[17] showed stable hemodynamics and less vasopressors requirement with fractionated dose SA. In another study with titrated dose of Bupivacaine in patients undergoing hip fracture surgery, safe, efficient and better cardiovascular stability was observed than with a single bolus dose.[21]

Studies have observed stable HR with fractionated method of administration of bupivacaine in SA.[8,9,20] in contrast our study did not show significant difference between the two Groups because of the lesser time duration of fractionated (*30 sec*) drug injection. Our study results are in concurrence with the study of Agrawal N *et al*.[18] who concluded that sitting position for *30 seconds* after spinal anesthesia helps to prevent high spinal and gives better hemodynamic stability.

The fractionated dose of Bupivacaine prolonged the duration of sensory and motor blockade in the study of Fahmy and colleagues[20] and this not in agreement with our study results of insignificant difference between the two groups. Our observations are in concurrence with the various other studies[8,9,17] with regard to prolonged duration of analgesia and the first rescue for analgesic requirement. Even with lesser time duration of fractionation of drug injection, the prolonged duration of analgesia was observed in our study which was be very much useful in postoperative period decreasing the total analgesic requirement and patient comfort.

Apgar scores were comparable in both the groups in our study and the results of Bhadeka Jigisha *et al*.[8] and Bina Patel *et al*.[17] were similar to observations of our study.

Conclusion

Fractionated dose method of spinal anesthesia technique proved to have adequate spinal anesthetic blockade, stable hemodynamics and better outcome in terms of uteroplacental circulation in comparison to the conventional method in patients undergoing LSCS. Profound hypotension and high level spinal block can be avoided by using this method where ever hemodynamic stability is desired. This makes the fractionated dose method as safe alternative and acceptable technique of local anesthetic drug injection for SA in pregnant women undergoing LSCS.

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Original Research Article

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A Prospective Comparative Study of Efficacy of Bupivacaine Alone or in Combination with Dexamethasone in Fascia Iliaca Compartment Block Prior to Subarachnoid Block for Fracture Femur Surgeries

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Abstract

Context: Femur fractures patients are in considerable pain on attempted hip flexion. Fascia Iliaca Compartment Block (FICB) is an effective means of providing analgesia during transit and positioning for spinal anesthesia which also persists postoperatively. *Aims:* To assess the preoperative and postoperative analgesic effect of Dexamethasone as adjuvant to Bupivacaine in FICB. *Settings and Design:* After obtaining ethical committee clearance, minimum sample size calculated from pilot studies was 64. Between Dec 2016–Feb 2017, 70 patients with proximal femur fractures posted for open reduction and internal fixation surgery were recruited for the study. *Methods and Materials:* Patients were randomly distributed into Control and Test Groups 35 patients received USG guided FICB with 28 *ml* 0.25% Bupivacaine + 2 *ml* Normal Saline and remaining received block with 28 *ml* 0.25% Bupivacaine + 2 *ml* (8 *mg*) Dexamethasone 20 *minutes* prior to being moved into position for spinal anesthesia. VAS score is used to assess pain during positioning, and in the postoperative period for duration of analgesia and requirement of rescue analgesics. *Statistical analysis used:* Paired "*t*" test, and ANOVA for parametric data and Fischer's test for categorical data. *Results:* Patients who received Dexamethasone as an adjuvant had significant prolongation of analgesia and required fewer rescue analgesics in the first postoperative day. No significant difference noticed in analgesia while positioning for spinal anesthesia. *Conclusions:* This study shows that FICB (total vol; 30 *ml*) provides preoperative analgesia, and Dexamethasone as adjuvant significantly prolongs the duration of block reducing the need for rescue analgesics over the first postoperative day.

Keywords: Proximal Femur Fractures; Fascia Iliaca Compartment Block; Dexamethasone; Postoperative analgesia.

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Introduction

Femur fractures are severely painful, especially fractures of the proximal femur, which limit mobility at the hip joint making it more difficult for the patient to sit up.[1] Surgical reduction of the fracture and fixation with an implant is the most common treatment modality and these surgeries are usually performed under central neuraxial blockade, frequently spinal anesthesia.[2]

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In the presence of pain, positioning for the neuraxial block is suboptimal and hence requires analgesia either through intravenous opioids or Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), or the use of peripheral nerve blocks. Patients also experience a lot of postoperative pain and conventionally require multiple doses of analgesics typically opioids or NSAIDs.

Instead, a single dose of local anesthetic given as a peripheral nerve block prior to surgery can improve patient comfort during transit and positioning in the preoperative period and also provide long lasting analgesia in the postoperative setting.[3] Commonly used nerve block techniques include Femoral nerve block, 3-in-1 block and Fascia Iliaca Compartment Block (FICB). FICB is superior in terms of efficacy, safety and easy administration providing unilateral analgesia, reducing sideeffects, without motor blockade and fewer neurological complications.[3–5]

The duration of analgesia is prolonged by the addition of adjuvants. The efficacy of the glucocorticoid Dexamethasone in prolonging FICB has been studied previously. It has been postulated that steroid injections produce a degree of vasoconstriction, and hence, one theory suggests that the drug acts by reducing local anesthetic absorption. Another theory suggests that dexamethasone potentiates the activity of inhibitory potassium channels on nociceptive C-fibres (*via* glucocorticoid receptors), thereby decreasing their activity.[6] The use of Ultrasonography (USG) guided FICB has been noted to increase the ease of administration and safety of the technique.[7]

Objectives

1. To assess the duration and quality of postoperative analgesia in the first *24 hrs*;
2. To assess preoperative pain relief and patient comfort while shifting into OT and while positioning for anesthesia.

Materials and Methods

Inclusion Criteria

- Patients aged *18–80 yrs*;
- Patients with proximal femoral fractures planned for open reduction and internal fixation;
- Patients with ASA-PS (American Society of Anesthesiologists-Physical Status) Grade 1 and 2.

Exclusion criteria

- Patients refusing to participate in the study;
- Patients weighing <*50 kg*;
- Patients with allergy to local anesthetics, peripheral neuropathy, bleeding diathesis, previous femoral bypass surgery, inguinal hernia, inflammation or infection over injection site;
- Patients with psychiatric disorders and polytrauma.

Sample size

With reference to the previous studies,[8] a sample size was calculated based on SSME calculator available on the website: http://www.Openepi.Com/samplesize/ssmean.Htm using

Level of alpha: 0.05 (two sided);

Power: 0.80 (80%);

Expected mean difference in VAS scores: 4;

Standard deviation between means: 5.5;

Total sample size: 70, with 35 patients in each group.

Procedure

After obtaining Institutional ethical committee approval and informed written consent from the patients, 70 patients were studied. Patients were randomly divided based on computer generated random numbers into one of the Two Groups: Dexamethasone Group (D), and Control Group (B).

Group B: Received *2 ml* of normal saline with *28 ml* of 0.25% Bupivacaine. Total volume- *30 ml*.

Group D: Received *8 mg* dexamethasone made up to *2 ml* with *28 ml* of 0.25% Bupivacaine. Total volume:*30 ml*.

All patients were subjected to preanesthetic evaluation including medical history, physical examination and laboratory tests.

The patients were premedicated with tablet alprazolam *0.5 mg* the night before surgery.

In the preoperative waiting room, patients were put on standard monitoring including Non-invasive Blood Pressure (NIBP), pulse oximetry, electrocardiogram and baseline readings were noted. Baseline VAS (Visual Analogue Scale) score for pain was noted.

USG guided Fascia Iliaca Compartment Block was administered to all patients *30 min* prior to

shifting into Operation Theatre (OT), (Fig. 1). A short beveled, 23G Quincke's spinal needle is used. After puncturing Fascia Iliaca and negative aspiration, *30 ml* of predetermined drug was injected in *5 ml* aliquots over *2–3 minutes*. An expanding anechoic collection just below Fascia Iliaca was the visual confirmation of correct placement of drug, (Fig. 2).

Patients were shifted into the operating room *30 minutes* after administering the block.

All vital parameters, and VAS score for pain were noted when patient was positioned for Subarachnoid block. The SAB was then administered using Inj Bupivacaine 0.5% (Heavy)-*3ml*, and surgery was started after confirming the level of subarachnoid block.

Postoperatively, complaints of pain were assessed using VAS scores for the first postoperative day at immediate postop time, *2, 6, 12, 18* and *24 hrs* postoperatively and scores of '4' or more were given Inj Tramadol *100 mg* IV as rescue analgesia.

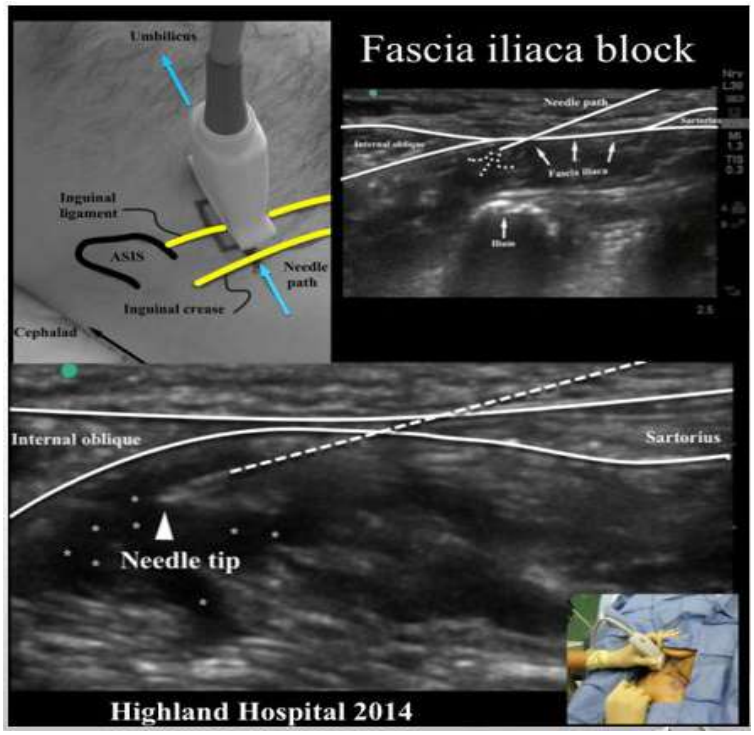

Fig. 1: Ultrasound image of front of thigh at level of groin crease, to demonstrate injection of drug for FICB

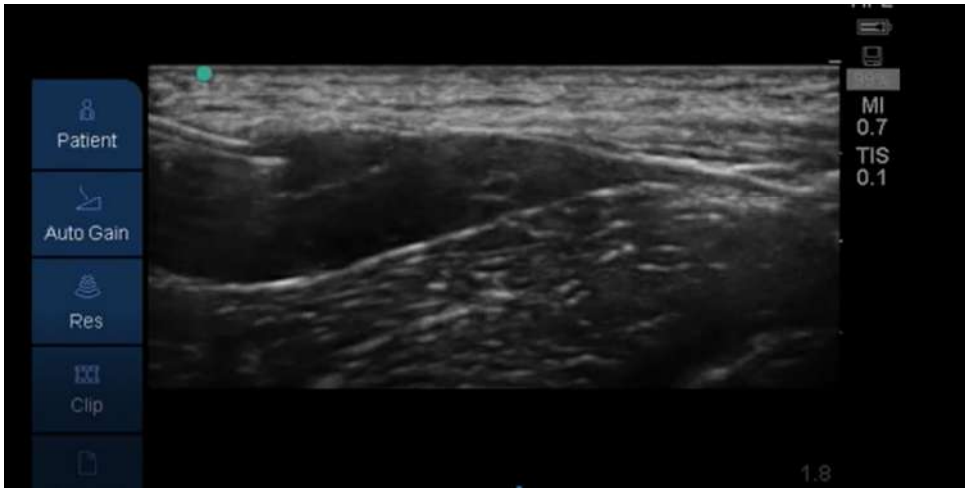

Fig. 2: Ultrasound image demonstrating spreading anechoic shadow- drug deposition in FICB

Statistical Analysis

- Results obtained were analyzed using descriptive statistics.
- Results on continuous measurements are presented on Mean + SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance.
- Student *t*-test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two Groups. Inter Group analysis on metric parameters.
- Chi-square/Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more Groups.
- The 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 were used for the analysis of the data and Microsoft Word and Excel have been used to generate graphs, tables etc.

Significant values: $p < 0.1$.

Results

- Mean time to rescue analgesia in Group B is *5.81 hrs*, and in Group D is *15.98 hrs*, (Fig. 3).
- Mean VAS score in Group B at *6 hrs* and *12 hrs* was 3.95 and 5.57, and in Group D 1.55 and 3.16. VAS scores decreased from 7.16 and 7.21 prior to block to 1.76 and 2.13 *30 minutes* after block in Group B and Group D respectively, (Fig. 4).

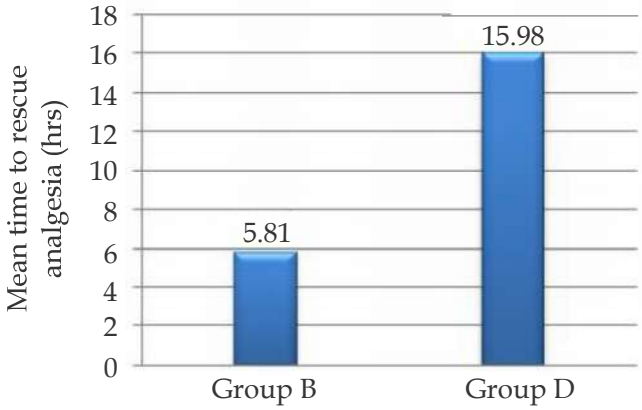

Fig. 3: Bar graph of mean time to rescue analgesia among both groups

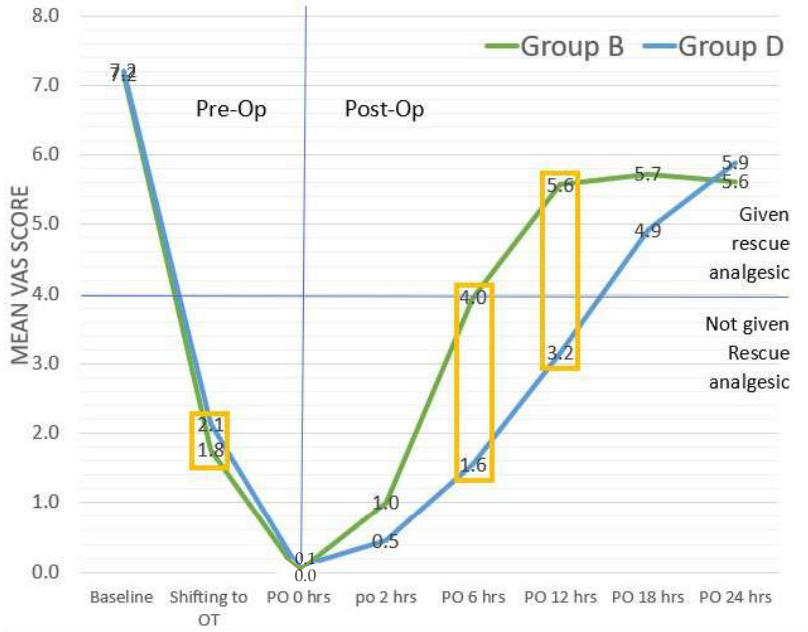

Fig. 4: Ling graph of the mean VAS in both groups in pre- operative and post operative periods

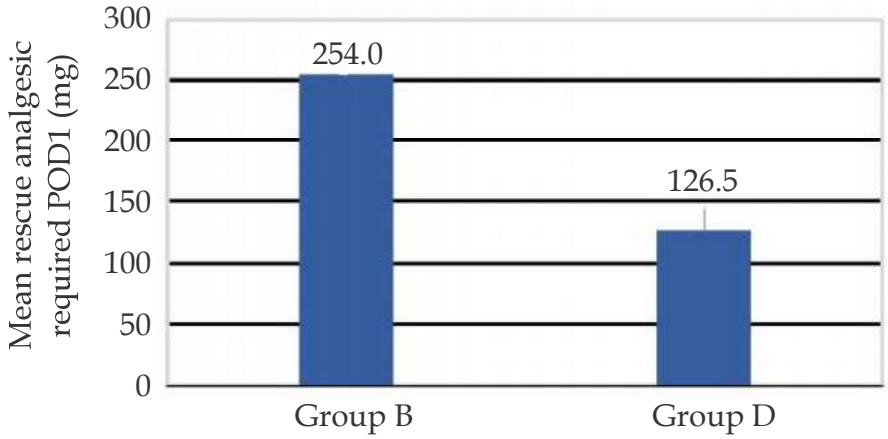

Fig. 5: Bar graph of the average amount of rescue analgesic consumed per patient in first postoperative day across both groups.

- Mean requirement of rescue analgesia (on POD1) in Group B was *254.0 mg* and in Group D was *126.5 mg*, (Fig. 5).
- Mean age being 60.2 and 57.9 in Group B and Group D respectively. $p = 0.6$, (Table 1).
- 62.2% of patients in Group B were male, and 57.9% in Group D, $p = 0.7$ (Table 2).
- 64.9% of patients in Group B were ASA-I, while 50% in Group D are ASA-I, $p = 0.2$ (Table 3).
- No adverse neurological outcome was noted in the study.
- No instances of Local Anesthetic Systemic Toxicity.
- All patients were noted to have recovered normal sensory function over the operated limb at *24 hrs* postoperatively.

Table 1: Age distribution of patients in either groups. $p=0$

		Drug Group			
		B		D	
		Count	Column n %	Count	Column n %
AGE Category	<50	6	16.2%	6	15.8%
	51–60	13	35.1%	19	50.0%
	61–70	15	40.5%	11	28.9%
	>71	3	8.1%	2	5.3%

Table 2: Gender distribution of patients in either groups. $p = 0.7$

		Drug Group			
		B		D	
		Count	Column n %	Count	Column n %
Gender	Female	14	37.8%	16	42.1%
	Male	23	62.2%	22	57.9%

Table 3: Distribution of patients based on American Society of Anesthesiologist's Physical Status Classes. $p = 0.2$.

		Drug Group			
		B		D	
		Count	Column n %	Count	Column n %
ASA Grade	I	24	64.9%	19	50.0%
	II	13	35.1%	19	50.0%

Discussion

The Fascia Iliaca Compartment block was first described by Dalens *et al*. in 1989 on children using landmark technique as a means to block the Femoral, Lateral Cutaneous and Obturator nerves[9] and was described as providing a consistent block of the femoral and lateral cutaneous nerves, and a block of obturator nerve (4–47%), providing good analgesia for fractures at the hip joint and proximal femur.[9]

It has since been used as a means of analgesia following surgical procedures in the hip, femur and knee, treatment of burns on the thigh and in prehospital treatment of fracture femur.[3,10] It is a safe alternative to the 3-in-1 Block and is more efficacious than the femoral/lateral cutaneous nerve blocks administered individually.[4,11] It has been demonstrated to provide better quality and longer duration of analgesia when compared to intravenous opioids and NSAIDs.[3,4] By administering the block *30 minutes* prior to shifting, patients are comfortable during shifting and positioning[7].

In a study done in 2009, Yun MJ *et al*.[5] found that FICB decreases mean VAS score from 7.4 to 2, compared to IV alfentanil- 7.3 to 3.5. Similarly,

in a study conducted in 2005 on preoperative patients by Candal-Couto JJ, McVie JL *et al.*,[12] the visual analogue scores were found to be improved significantly from 7.2 to 4.6 (SD 2.4). This is comparable to our study where mean VAS score decreased from 7.16 and 7.21 in study and control groups to 1.67 and 2.13 respectively which is statistically significant at $p < 0.0001$. However, there is no significant difference between the two groups ($p = 0.3$), (Fig. 4).

Hence, FICB as a preoperative analgesic, improves patient comfort, but the addition of Dexamethasone doesn't improve the outcome in the preoperative setting. In 2016, Kumie FT *et al.*[4] concluded that the use of FICB provided adequate postoperative analgesia, reduced the total analgesic consumption and prolonged the time to first analgesic requirement after surgery for femur fractures. These findings are similar in our study, where mean rescue analgesic requirement was *254.0 mg* of Inj Tramadol when using Bupivacaine alone in FICB, but only *126.5 mg* of Inj Tramadol when Dexamethasone is added ($p < 0.0001$), (Fig. 5).

This study compares the use of Bupivacaine to Bupivacaine with Dexamethasone in FICB. A similar study conducted by Suresh N, Kiran N, *et al*. in 2014[8] used a total drug volume of *40 ml* and found that the addition of Dexamethasone significantly increases the duration of block. This study uses a total drug volume of *30 ml* as described by Yun MJ, Kim YH *et al*.[5] to assess if the addition of dexamethasone as an adjuvant is useful in reducing the total volume of drug required. It was found that the mean duration of block in the Dexamethasone group was increased to *3 times* that of the Control Group ($p < 0.001$), (Fig. 3). This is similar to the findings of Suresh N *et al*., and is in keeping with previous clinical data, that suggest that the addition of Dexamethasone to peripheral nerve blocks significantly prolongs the duration of block.[8]

Conclusion

FICB with Bupivacaine and Dexamethasone has significant perioperative analgesia and decreases need for rescue analgesia in first postoperative day.

Key Messages

The addition of Dexamethasone to FICB significantly prolongs the quality and duration of analgesia on POD1 while USG guidance reduces the volume required for an adequate block.

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Decreased Incidence of C_8, T_1 Dermatomal Sparing in Interscalene Block with the Use of Magnesium Sulphate as an Adjuvant: An Interesting Fact

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Abstract

Background: Interscalene brachial plexus block is usually associated with sparing of C_8, T_1 dermatomes and ulnar nerve. This study have compared the effect of adding magnesium sulphate with bupivacaine on the blockade of individual dermatomes in interscalene block. *Materials and Methods:* 60 patients were randomly divided into two Groups. Interscalene block was given to all the patients. Group 1 received 20 *ml* of 0.5% bupivacaine with 0.5 *ml* of 50% $MgSO_4$ (Total volume = 20.5 *ml*). Group 2 received 20 *ml* of 0.5% bupivacaine with 0.5 *ml* of normal saline (Total volume = 20.5 *ml*). Block was evaluated every 3 *minutes* till 15 *minutes* after the injection of local anesthetic or till minimum Grade 3 sensory and motor blockade was achieved. *Results:* In our study, the mean time of onset of sensory and motor blockade (achievement of minimum Grade 2 blockade) was comparable between the two Groups. The mean time of onset of complete sensory blockade (achievement of minimum Grade 3 sensory blockade) was also comparable between the two Groups ($p > 0.05$). Grade 3 sensory blockade to C_8 and T_1 dermatomes was achieved in 70% of patients ($n = 21$) in Group I and 23.3% of patients ($n = 7$) in Group II at 15 minutes and the difference was significant ($p = 0.001$). Grade 3 motor blockade (by Modified Bromage Scale) was achieved in 70% of patients ($n = 21$) in Group I and 23.3% of patients ($n = 7$) in Group II at 15 *minutes* which was statistically significant ($p = 0.001$). *Conclusion:* Magnesium sulphate as an adjuvant tobupivacaine in interscalene block decreases the incidence of C_8 and T_1 dermatomal sparing and increases the chances of complete motor blockade.

Keywords: Magnesium sulphate; Interscalene block; Dermatomal sparing; Ultrasound guided.

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Introduction

Interscalene brachial plexus block is used commonly for the surgeries involving the shoulder, proximal humerus as well as latral two third of clavicle.[1] In this technique, brachial plexus is blocked at the level of the nerve roots or trunks which lie between anterior scalene and middle scalene muscle.[2] Roots C_5–C_7 are most densely blocked with this approach, however, the ulnar nerve originating from C_8 and T_1 may be spared.[3,4] It may provide inadequate analgesia in the ulnar distribution which limits its usefulness for distal surgical procedures and may need supplementation during the surgery.[5,6]

In this study, we have used magnesium sulphate as an adjuvant to bupivacaine in ultrasound guided interscalene brachial plexus block. We have studied the blockade of individual dermatomes after giving

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interscalene block. We found out that the incidence of sparing of C_8, T_1 dermatomes is decreased when we used magnesium sulphate as an adjuvant to local anesthetic.

To the best of our knowledge, this is the first reported study which showed that addition of an adjuvant in interscalene block can decrease the incidence of dermatomal sparing of C_8, T_1. This can further improve its effectiveness in upper limb surgeries and will decrease the incidence of partial effect.

Materials and Methods

It was a prospective, randomized, double blinded study. 60 patients aged *20–60 years*, of either sex with ASA Grade I-II were scheduled for upper limb surgery. The patients were allocated to one of the two Groups using computer generated random number list. The investigator administering the drug and observing the effects was unaware of the drug injected. The drug was loaded in the syringes by a person not involved in administering the injections and in further evaluation of the patients and the drugs given were disclosed at end of the study. The study was commenced after obtaining institutional ethical committee approval and written informed patient consent. Patients were allocated in two Groups of 30 patients each by using computer generated random number list.

Preanesthetic evaluation and written informed consent was taken from the patients one day prior to the surgery. After routine fasting and premedication, patients were shifted to operation theatre. Standard monitors were attached and intravenous line was secured. Premedication with midazolam *2 mg* was given intravenously before procedure. Ultrasound guided, in plane interscalene brachial plexus block was given to all the patients. Group 1 received *20 ml* of 0.5% bupivacaine with *0.5 ml* of 50% magnesium sulphate (total volume = *20.5 ml*). Group 2 received *20 ml* of 0.5% bupivacaine with *0.5 ml* of normal saline (total volume = *20.5 ml*). Block was evaluated every *3 minutes* till *15 minutes* after the injection of local anesthetic or till minimum Grade 3 sensory and motor blockade was achieved. Motor blockade assessment was performed with modified bromage scale (Grade 1 - Able to raise the extended arm to *90 degrees* for a full two seconds, Grade 2 - Able to flex the elbow and move the fingers but unable to raise the extended arm, Grade 3 - Unable to flex the elbow but able to move the fingers, Grade 4 - Unable to move the arm, elbow or the fingers). Onset of motor blockade means minimum Grade 2 and complete blockade means minimum Grade 3.

Assessment of sensory block was done by using Hollmen's scale (Grade 1 - Normal sensation of pin prick, Grade 2 - Pin prick felt as sharp pointed but weaker compared with the same area in other extremity, Grade 3 - Pin prick felt as touch with blunt object, Grade 4 - No perception of pin prick). Onset of sensory blockade means minimum Grade 2 and complete blockade means minimum Grade 3. Sensory block assessment of sensory dermatomes was performed by pin prick method at specific test points: C_5 - Lateral Antecubital Fossa, C_6 - Thumb, C_7 - Middle Finger, C_8 - Little Finger, T_1 - Medial Antecubital Fossa.

After confirmation of Grade 3 of sensory and motor blockade or completion of *15 minutes*, patients were given general anesthesia with the standard drugs. Patients were extubated at the end of surgery and shifted to post anesthesia care unit. All the patients were observed intraoperatively and postoperatively.

Statistical Analysis

The data of the study was recorded in the record chart and results were evaluated using statistical tests (Student *t* - test and Chi-square test).

Results

Demographic data and baseline parameters were comparable between both the groups. In our study, the mean time of onset of sensory blockade (achievement of minimum Grade 2 by Hollmen's scale) was *6.56 ± 0.306 minutes* in Group I and *6.68 ± 0.280 minutes* in Group II ($p > 0.05$) which was comparable, (Table 1). The mean time of onset of complete sensory blockade (achievement of minimum Grade 3 sensory blockade) to C_5 and C_6 dermatomes was *10.87 ± 0.77 minutes* for Group I and *11.08 ± 0.46 minutes* for Group II and the difference was not statistically significant ($p > 0.05$). The mean time of onset of complete sensory blockade to C_7 dermatome was *13.28 ± 1.10 minutes* for Group I and *13.44 ± 0.70 minutes* for Group II, which was also statistically insignificant ($p > 0.05$). Grade 3 sensory blockade to C_8 and T_1 dermatomes was achieved in 70% of patients ($n = 21$) in Group I and 23.3% of patients ($n = 7$) in Group II at *15 minutes* ($p = 0.001$), (Table 3). Minimum time for onset of complete sensory blockade to C_8 and T_1 dermatomes was *13.99 ± 0.82 minutes* in 21 patients of Group I and *14.46 ± 0.34 minutes* for 7 patients of

Group II ($p > 0.05$), (Table 2). Only 28 out of total 60 patients (46.67% of patients) included in the study achieved Grade 3 sensory blockade within *15 minutes* for C_8 and T_1 dermatomes. Thus, there was sparing of C_8 and T_1 dermatomes for sensory blockade in 53.33% of patients at *15 minutes*, (Table 3). But the sparing was less in Group I in which magnesium sulphate was used as an adjuvant (30%) as compared to Group II (76.7%).

The mean time of onset of motor block (achievement of minimum Grade 2 by modified bromage scale) was *7.81 ± 0.291 minutes* in Group I as compared to *7.92 ± 0.289 minutes* in Group II ($p > 0.05$) and was comparable between the two Groups, (Table 1). Grade 3 motor blockade (by Modified Bromage Scale) was achieved in 70% of patients ($n = 21$) in Group I and 23.3% of patients ($n = 7$) in Group II at 15 minutes which was statistically significant ($p = 0.001$) (Table 4). So, minimum time of onset of complete motor blockade for 21 patients in Group I was *14.48 ± 0.65 minutes* and *14.82 ± 0.19 minutes* for 7 patients in Group II which was statistically insignificant ($p > 0.05$), (Table 1). Thus, only 28 patients out of 60 patients (46.67% of patients) achieved Grade 3 motor blockade within *15 minutes*.

Table 1: Comparison of block characteristics between the two groups

	Group I Mean ± SD	Group II Mean ± SD	*p* - value
Mean onset time for sensory block - Grade 2 *(in min)*	6.56 ± 0.306	6.68 ± 0.280	0.128
Mean onset time for motor block - Grade 2 *(in min)*	7.81 ± 0.291	7.92 ± 0.289	0.153
Mean completion time for motor block onset - Grade 3 *(in min)*	14.48 ± 0.65	14.82 ± 0.19	0.180

$p > 0.05$ = not significant, $p < 0.05$ = significant, $p < 0.00$ = highly significant.

Table 2: Comparison of completion of sensory blockade onset (Grade 3 by Hollmen's Scale) in different dermatomes (at *15 minutes*).

Dermatomes	Group	n	Mean completion time of sensory block onset (min) Mean ± SD (*Grade 3 by Hollmen's Scale*)	*p* - value
C_5	I	30	10.87 ± 0.77	0.209
	II	30	11.08 ± 0.46	
C_6	I	30	10.87 ± 0.77	0.209
	II	30	11.08 ± 0.46	
C_7	I	30	13.28 ± 1.10	0.520
	II	29	13.44 ± 0.70	
C_8	I	21	13.99 ± 0.82	0.152
	II	7	14.46 ± 0.34	
T_1	I	21	13.99 ± 0.82	0.152
	II	7	14.46 ± 0.34	

$p > 0.05$ = not significant, $p < 0.05$ = significant, $p < 0.00$ = highly significant.

Table 3: Comparison of Sensory block evaluation for quality of sensory block (at *15 minutes*) between the two groups.

Dermatomes (No %)	Group I		Group II		*p* - value
	Grade 2	Grade 3	Grade 2	Grade 3	
C_5	0	30 (100%)	0	30 (100%)	
C_6	0	30 (100%)	0	30 (100%)	
C_7	0	30 (100%)	2 (6.7%)	28 (93.3%)	0.49
C_8	9 (30%)	21 (70%)	23 (76.7%)	7 (23.3%)	0.001
T_1	9 (30%)	21 (70%)	23 (76.7%)	7 (23.3%)	0.001

$p > 0.05$ = not significant, $p < 0.05$ = significant, $p < 0.00$ = highly significant.

Table 4: Comparison of motor block evaluation for quality of motor block (at *15 minutes*) between the two groups.

	Group I		Group II		*p* - value
	Grade 2	Grade 3	Grade 2	Grade 3	
Modified Bromage Scale (No %)	9 (30%)	21 (70%)	23 (76.7%)	7 (23.3%)	0.001

$p > 0.05$ = not significant, $p < 0.05$ = significant, $p < 0.00$ = highly significant.

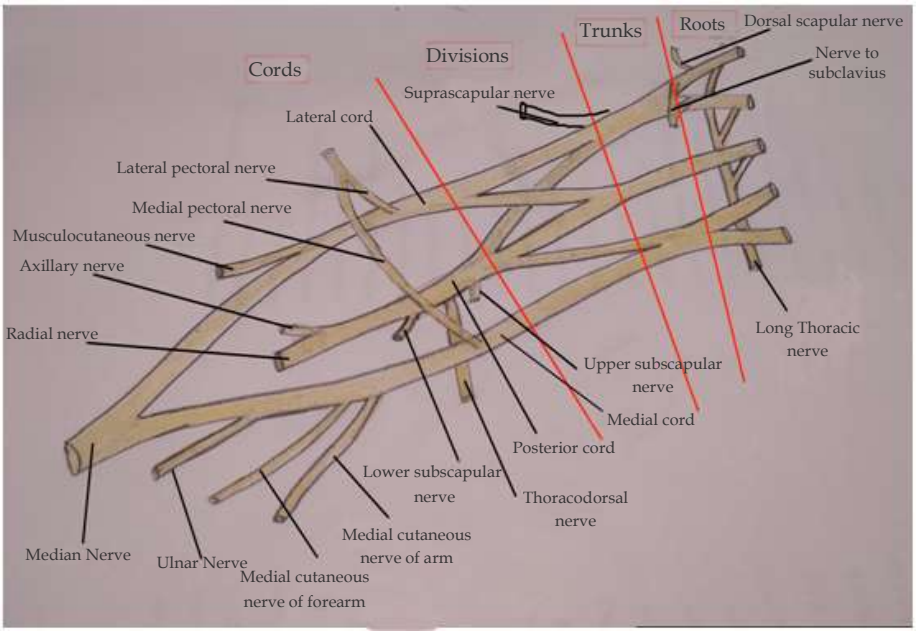

Fig. 1: Anatomy of Brachial Plexus

Discussion

The brachial plexus is a somatic nerve plexus which provides nerve supply to the upper extremity.[7] It originates from the anterior divisions of the lower 4 cervical spinal nerves (C_5–C_8) and the first thoracic spinal nerve (T_1). After coming out of the cervical and thoracic foramina, the nerve roots unite and branch in a well described pattern in the following order: Roots, trunks, divisions, cords, terminal branches and peripheral nerves, (Fig. 1).[7,8] The proximal shoulder girdle muscles receive innervation from the level of the roots, trunks and cords, whereas the terminal branches supply the arm onwards. The shoulder muscles are predominantly supplied by C_5 and C_6 spinal roots, while C_7 contributes to the elbow, wrist and finger extensors; C_8 and T_1 contribute to the long finger flexors and intrinsic muscles of the hand.[9]

In interscalene brachial plexus block, local anesthetic blocks at the level of nerve roots and trunks.[10] It provides anesthesia around the shoulder. But the high incidence of C_8 - T_1 and ulnar nerve sparing limits its effectiveness as sole anesthetic technique for upper limb surgeries.[6,10] We have used magnesium sulphate as an adjuvant to bupivacaine for interscalene block and found out that the incidence of dermatomal sparing is significantly less in the group receiving magnesium sulphate. Moreover, it also increases the incidence of complete motor block (Grade 3 modified bromade scale).

For many decades, magnesium salts have been used as an adjuvant to general anesthesia and in critical care.[11] Magnesium sulphate has been reported to be effective in perioperative pain treatment and in blunting somatic, autonomic and endocrine reflexes provoked by noxious stimuli.[12] Magnesium, by virtue of its NMDA receptor antagonist property, is being investigated by various routes for providing preemptive analgesia and also to prolong postoperative analgesia.[13] The NMDA receptors play an important role in central nociceptive transmission, modulation and sensitization of acute pain states. In addition to central location, NMDA receptors are found in the muscle and skin, knee joint, and play a role in sensory transmission of noxious signal. The mechanism of magnesium is by its direct action on the peripheral nerve by blocking the release of

excitatory neurotransmitter at the synaptic junction or by potentiating the effect of local anesthetic.[14] Magnesium has shown greater analgesic potential when added to local anesthetics in peripheral nerve blocks, and would appear to have analgesic benefit with minimal adverse effects.[15]

In our study, complete blockade (Grade 3 sensory blockade by Hollmen's Scale) to C_5 and C_6 dermatomes was achieved in 100% of patients in both groups at *15 minutes*. Whereas Grade 3 sensory blockade to C_7 dermatome was achieved in 100% of patients in Group I and 93.3% of patients in Group II at *15 minutes*. Grade 3 sensory blockade to C_8 and T_1 dermatomes was achieved in 70% of patients (n = 21) in Group I and 23.3% of patients (n = 7) in Group II at *15 minutes* and the difference was significant statistically. Thus, there was sparing of ulnar nerve (C_8 and T_1 dermatomes) in 53.33% of patients. Thus to avoid blockade failure by interscalene approach alone, we combined interscalene block with general anesthesia after *15 minutes*.

We could achieve 100% successful sensory blockade of C_5, C_6 and C_7 dermatomes at *15 minutes*. But for C_8 and T_1 dermatomes, sensory blockade failure was 30% in Group I and 76.7% in Group II at *15 minutes*. Similarly, Grade 3 motor blockade failure was 30% in Group I and 76.7% in Group II at *15 minutes*. Hence, addition of magnesium sulphate seems to have increased the incidence of complete sensory blockade for C_8 and T_1 dermatomes and complete motor blockade (Grade 3 modified bromage scale). It decreases the chances of dermatomal sparing with interscalene block.

The time to onset of sensory and motor block was comparable in our study ($p > 0.05$) which was similar to a studies done by Lee[16] and Famay *et al*.[17] Time of onset of sensory block was between *14* and *16 minutes* in these studies whereas it was *6–8 min* in our study for Grade 2 hollman and modified bromage scale. Onset of Grade 3 block in our study was also at *10–15 min* interval. Our results were not concurrent with those of Klein *et al*.[18] and Casati *et al*.[19] Klein *et al*. had reported shorter onset of less than *6 minutes* but they had used larger volume (*30 ml*) of the drugs with freshly prepared ephinephrine and used premedicants as midazolam (*1–5 mg*) with fentanyl (*50–250 micrgram*) in their patients.[18] Casati *et al*. reported longer onset of blocks (*22–28 minutes*) as they had not used ultrasound but had used nerve stimulators and their patients were not premedicated.[19] In these studies, they had only taken into account Grade 3 sensory blockade and blockade of individual dermatomal level was not mentioned.

In our study, we have checked for effect on individual dermatomes and found out that the chances of incomplete block can be decreased with if we use magnesium sulphate with local anesthetic in ultrasound guided interscalene brachial plexus block.

Conclusion

To conclude, the use of magnesium sulphate (*250 mg*) as an adjuvant to 0.5% bupivacaine in ultrasound guided interscalene brachial plexus block have increased the incidence of complete blockade in C_8 and T_1 dermatomes also. It decreases the incidence of dermatomal sparing and increases the chances of complete motor blockade with interscalene block.

Hence, we strongly recommend the addition of magnesium sulphate (*250 mg*) as an adjuvant to 0.5% bupivacaine in ultrasound guided interscalene brachial plexus block in view of better quality of blockade, decreased C_8 - T_1 dermatomal sparing and increased chances of complete motor blockade.

Limitation of study

In the present study, general anesthesia was given to all the patients after *15 minutes*. Hence, we could not elicit the sensory and motor blockade after *15 min*.

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To Assess the Efficacy and Safety Profile of Pre-emptive Epidural Dexmedetomidine in the Patients Undergoing Upper Abdominal Surgery Under General Anesthesia: A Prospective Randomized Double Blind Study

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Abstract

Introduction: Effective pain control is the mainstay of treatment in patients who have undergone upper abdominal surgeries as pain has many adverse effects on various systems of body. Epidural analgesia provides not only pain relief but also reduces postoperative stress response, pulmonary complications and duration of hospital stay. *Aims and Objectives:* To assess the efficacy of epidural dexmedetomidine as an adjuvant to Ropivacaine on analgesia, perioperative hemodynamics and requirement of anesthetic agents in patients undergoing upper abdominal surgeries under general anesthesia. *Materials and Methods:* 70, ASA Grade I and II patients, 18–60 *years* of either sex planned for upper abdominal surgery were included and randomly allocated into two Groups: Group RD - Patients received 1 *mcg/kg* Dexmedetomidine hydrochloride with 0.25% isobaric Ropivacaine hydrochloride (total volume 20 *ml*). Group R - Patients received 20 *ml* of 0.25% isobaric Ropivacaine hydrochloride. Prior to induction of anesthesia with injection Midazolam 20 *mcg/kg*, injection Fentanyl citrate 2 *mcg/kg*, injection Propofol 2 *mg/kg* and injection Atracurium 0.5 *mg/kg* to facilitate endotracheal intubation, epidural catheterization was done. Then, the epidural study medications were injected. Anesthesia was maintained with O_2:N_2O 1:2, Sevoflurane upto 3% and Atracurium as necessary to achieve muscle relaxation. Pain characteristics, sedation level, intraoperative hemodynamics and requirement of sevoflurane were noted. At end of surgery, patients were extubated and shifted to PACU. Categorical (qualitative) data were presented as number (percentage) and compared using Chi-square test. Continuous variables (quantitative) were presented as mean ± SD and compared using *t* – test. *p* value < 0.05 was considered as statistically significant. *Result:* The duration of analgesia was prolonged in the patients who received Dexmedetomidine as an adjuvant with Ropivacaine (472.14 ± 44.90 *mins* v/s 309.85 ± 35.72, *p* – value - 0.000). Number of rescue analgesia doses needed in Group RD was less than Group R (2.11 ± 0.323 v/s 3.14 ± 0.550, *p* - 0.00). The mean concentration of sevoflurane in Group RD was 2.380 ± 0.22% and in Group R was 2.680 ± 0.278%, and this difference was statistically highly significant (*p* - 0.000). Vitals remained stable in both the Groups. *Conclusion:* Epidural Ropivacaine with dexmedetomidine give better and longer postoperative pain relief in upper abdominal surgeries and also reduce requirement of anesthetic agents intraoperatively.

Keywords: Dexmedetomidine; Ropivacaine; Epidural Anesthesia; General Anesthesia.

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Introduction

Pain is an unpleasant subjective sensation that originates from ongoing and impending tissue damage and can be experienced not expressed.[1] Effective pain control is the mainstay of treatment in patients who have undergone upper abdominal surgeries as pain has many adverse effects on various systems of body.[2] Research continues concerning different techniques and drugs that could provide better surgical anesthesia and postoperative pain relief. Epidural analgesia provides not only pain relief but also reduces postoperative stress response, pulmonary complications and duration of hospital stay.[3]

Sedation, stable hemodynamics and an ability to provide smooth and prolong postoperative analgesia are the main qualities of an adjuvant in neuraxial anesthesia.[4] Alpha-2 adrenergic agonists have both analgesic and sedative properties when used as an adjuvant in regional anesthesia.[5–10] However, there is limited literature evaluating the effect of epidural Dexmedetomidine (a highly selective alpha-2 agonist) on perioperative hemodynamics, surgical relaxation and requirement of other anesthetic agents along with postoperative follow up in patients undergoing upper abdominal surgery under general anesthesia.[11–13]

We undertook a study on epidurally administered dexmedetomidine as an adjuvant to ropivacaine in patients undergoing upper abdominal surgeries under general anesthesia with regard to its effect on perioperative analgesia and hemodynamics, requirement of anesthetic agents intraoperatively as well as rescue analgesic requirement postoperatively.

Materials and Methods

After institutional ethical committee approval, this prospective, randomized, double blinded, comparative case - control clinical study was conducted in the Department of Anesthesiology, MB Government Hospital affiliated to RNT Medical College, Udaipur (Rajasthan).

To ensure double blindness to the study, the study drugs were prepared according to group allocation by an independent anesthesiologist not involved in the study. Data were recorded by another anesthesiologist who was conducting the study himself and was not aware of group allocation. Patient, surgeon and postoperative ward staffs were also not aware of the group allocation.

A prior study conducted by Sarabjit Kaur *et al*. reported that the mean dosages of rescue analgesics required for patients undergoing lower limb orthopedic surgery with epidural Ropivacaine were 2.56 ± 0.675. We postulated that the addition of dexmedetomidine to epidural Ropivacaine given preoperatively in the patients undergoing upper abdominal surgery will result in a reduction of the number of dosages by at least *0.5/day* for it to be clinically significant.

For the study to have 2 sided confidence interval of 95% and a power of 80%, 29 patients were required in each group. To compensate for possible drop outs, we decided to include 35 patients in each group.

The study group comprised of ASA physical status I and II patients aged *18–60 years* of either sex planned for elective upper abdominal surgeries.

Patients with known allergy to the study drug, suspected coagulopathy, and infection at the site of epidural block, cardiac and renal diseases, neurological illness, mental illness and deformity of spinal cord were excluded from the study.

All the patients under study were subjected to detailed preanesthetic evaluation to rule out any anatomical or systemic disorder. Written informed consent was obtained from all patients after explaining about the procedure and benefits of epidural analgesia and details about 10 - point VAS[14] in the preoperative period.

Seventy patients were randomly allocated into two Groups (35 patients in each group) using a sealed envelope technique and computer generated sequence of random numbers.

Group RD: Patients received *1 mcg/kg* Dexmedetomidine hydrochloride added to 0.25% isobaric Ropivacaine hydrochloride to make a total volume of *20 ml*.

Group R: Patients received *20 ml* of 0.25% isobaric Ropivacaine hydrochloride.

Prior to induction of anesthesia under strict aseptic precautions an epidural catheterization was performed in T11-12 space in lateral or sitting position using *8–9 cm* long, 18 G Tuohy needle. The catheter was secured *3 to 4 cm* into epidural space. The patients were then positioned supine. All epidural study medications were injected after induction of general anesthesia. General anesthesia was induced with injection Propofol *2 mg/kg*, injection Midazolam *20 mcg/kg*, injection Fentanyl citrate *2 mcg/kg* and injection Atracurium *0.5 mg/kg* to facilitate endotracheal intubation.

Anesthesia was maintained with O_2:N_2O (1:2), Sevoflurane upto 3% and Atracurium as necessary to achieve muscle relaxation. Vital parameters were monitored continuously and recordings were made after tracheal intubation and epidural anesthesia and then after *15 minutes* until the end of surgery.

The inhaled concentration of Sevoflurane was adjusted to achieve hemodynamic changes less than 20% of the baseline value. If the target hemodynamics were not achieved with the maximum Sevoflurane concentration (3%), Injection Fentanyl *1 mcg/kg* was administered and repeated as needed. Maintenance concentration of Sevoflurane in volume % and total dose of Fentanyl administered were also recorded.

The occurrence of intraoperative hypotension (defined as Mean arterial blood pressure < *65 mm Hg*) was treated with injection Ephedrine *6 mg* and bradycardia (Heart rate < *50/min*) was treated with *0.3–0.6 mg* injection Atropine. The time from epidural block to the end of surgery was noted.

After the end of surgery, patients were reversed with inj Neostigmine (*0.05 mg/kg*) and inj Glycopyrrolate (*0.01 mg/kg*). After extubation patients were transferred to Postanesthesic Care Unit (PACU) and were monitored for respiratory rate, SpO_2, heart rate and blood pressure.

The intensity of postoperative pain was measured with Visual Analogue Scale (VAS) (a *10 cm* scale, with '0' indicating no pain and 10 indicating worst pain ever) and was assessed at the end of surgery and then every *4 hour* for *24 hours* postoperatively. Rescue analgesia (inj tramadol *100 mg* diluted to *10 ml*) *via* epidural was given on demand when pain scores were 4 or more (VAS ≥ 4).

The duration of analgesia (from the time of epidural injection to the time to first request for analgesia) was noted. Total dose of rescue analgesic consumption was also recorded for *24 hours* postoperatively.

The degree of sedation was assessed *30 min* and *120 min* after admission to recovery room using modified Ramsay scale.

Modified Ramsay Scale[2]

Awake levels

1. Anxious, agitated or both
2. Cooperative oriented, tranquil
3. Response to commands only

Asleep levels

1. Brisk response to loud auditory stimulus
2. Sluggish response to loud auditory stimulus
3. No response to loud auditory stimulus

Statistical analysis

Data were entered into MS Excel and analysed using Statistical Package for Social Sciences (SPSS) version 16 [International Business Management (IBM), Corporations, New York, USA]. Categorical (qualitative) data were presented as number (percentage) and compared using Chi-square test. Continuous variables (quantitative) were presented as mean ± SD and compared using *t* - test. *p* - value i.e. $p < 0.05$ was considered as statistically significant and $p < 0.01$ was considered as statistically highly significant.

The primary outcome measured was to assess the analgesic efficacy of epidural dexmedetomidine as an adjuvant to ropivacaine in patients undergoing upper abdominal surgeries.

The secondary outcomes measured were evaluation of the effect of dexmedetomidine on perioperative hemodynamics and requirement of anesthetic agents.

Results

The mean age of patients in Group R and RD were *42.71 ± 13.63* and *41.89 ± 11.47 years* respectively whereas the mean weight was *55.46 ± 8.59* and *54.71 ± 7.49 kg* in Group R and RD respectively. The demographic data was comparable in both the Groups ($p > 0.05$). The duration of surgery in the two Groups was comparable (*125.71 ± 16.19 min* in Group R *vs* 127.00 ± 17.95 *min* in Group RD, $p = 0.754$).

The time to first request for rescue analgesia was significantly higher in group RD as compared to Group R (472.14 ± 44.90 *vs* 309.85 ± 35.72, $p = 0.000$). The total dose of rescue analgesia consumed in *24 hours* was more in Group R (*314.29 ± 55 mg*) as compared to Group RD (*214.29 ± 35.50 mg*) and this was statistically significant, $p = 0.000$, (Table 1).

Majority of patients ($n = 24$, 68.6%) in Group R required 3 doses of rescue analgesia in *24 hours* where as maximum number of patients ($n = 31$, 88.6%) in Group RD required only 2 doses of rescue analgesia, (Table 2). Moreover, total number of rescue analgesic requirement in Group RD (2.11 ± 0.323) was less than Group R (3.14 ± 0.550) which was statistically significant ($p = 0.000$), (Table 1).

VAS score measured in our study was lower in Group RD as compared to Group R at all time intervals in our study although statistically significance was achieved at time of end of surgery [Group R (2 ± 0.42) *v/s* Group RD (1.63 ± 0.55), *p* 0.002], at 4th hour [Group R (4.37 ± 0.55) *v/s* Group RD (1.91 ± 0.92), p 0.00], at *12th hour* [Group R (3.89 ± 0.47) *v/s* Group RD (3.49 ± 0.89), *p* 0.021] and at *20th hour* [Group R (2.03 ± 0.6) *v/s* Group RD (1.31 ± 0.53), *p* 0.000]. The mean *24 hour* VAS was 3.041 ± 0.468 in Group R and 2.342 ± 0.74 in Group RD and the difference was statistically significant (*p* 0.009), (Fig. 1).

Thiry-four out of 35 patients in Group RD had Modified Ramsay Sedation Score of 3 (i.e. patients were awake and responding to verbal commands) at *30 min* as compared to score of 2 (i.e. patients were awake, cooperative and oriented) in all 35 patients of Group R. This difference was highly significant, (*p* = 0.00), (Fig. 2). All the 35 patients of both the Groups had Modified Ramsay Sedation Score of 2 at *120 mins*. Thus all the patients were awake and comfortable.

The heart rate in Group RD was statistically significantly lower than Group R from *15 min* of epidural drug administration to *120 minutes* of

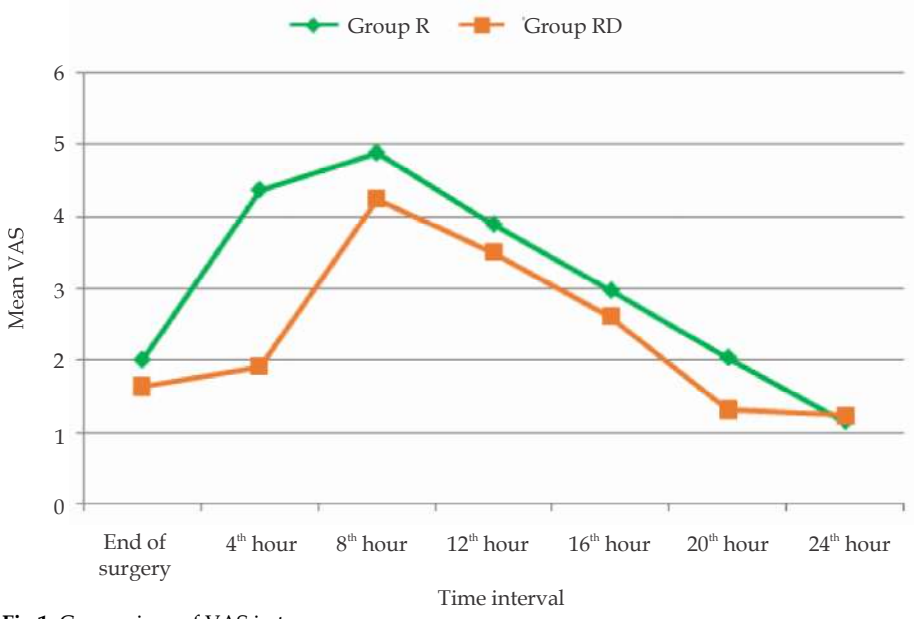

Fig 1: Comparison of VAS in two groups

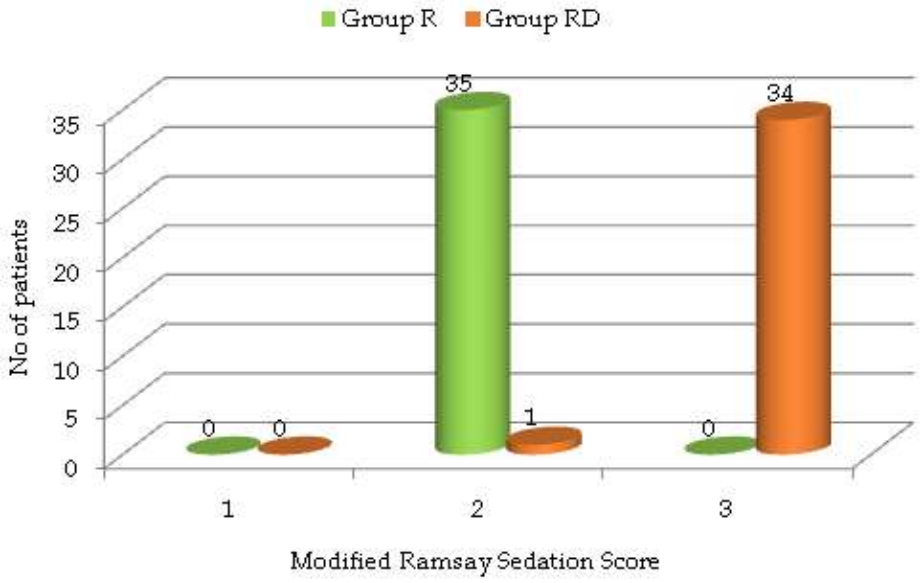

Fig. 2: Modified Ramsay Sedation Score at *30 min*

intraoperative period. The heart rate was also lower in Group RD during the remaining intraoperative period although the difference was not statistically significant. 3 patients in Group RD had episode of bradycardia which was managed with intravenous atropine. There were no episodes of bradycardia in Group R, (Fig. 3).

The mean blood pressure in Group RD was statistically significantly lower than Group R from *60 mins* of epidural drug administration to *105 minutes* of intraoperative period. The MAP was also lower in group RD during the remaining intraoperative period although the difference was not statistically significant, (Fig. 4). There were no episode of hypotension in any of the two Groups.

The concentration of sevoflurane needed was lower in Group RD as compared to Group R throughout the intraoperative period although statistical significance was reached at *30,45,60,75,90,105* and *120 mins* only. The mean concentration of sevoflurane in Group RD was 2.380 ± 0.22% and in Group R was 2.680 ± 0.278%, and this difference was statistically highly significant (*p* 0.000), (Fig. 5). None of the patients in any of the groups required additional doses of fentanyl. 3 patients in Group R and 6 patients in Group RD had complaints of nausea which was managed with administration of injection ondansetron *4 mg* IV.

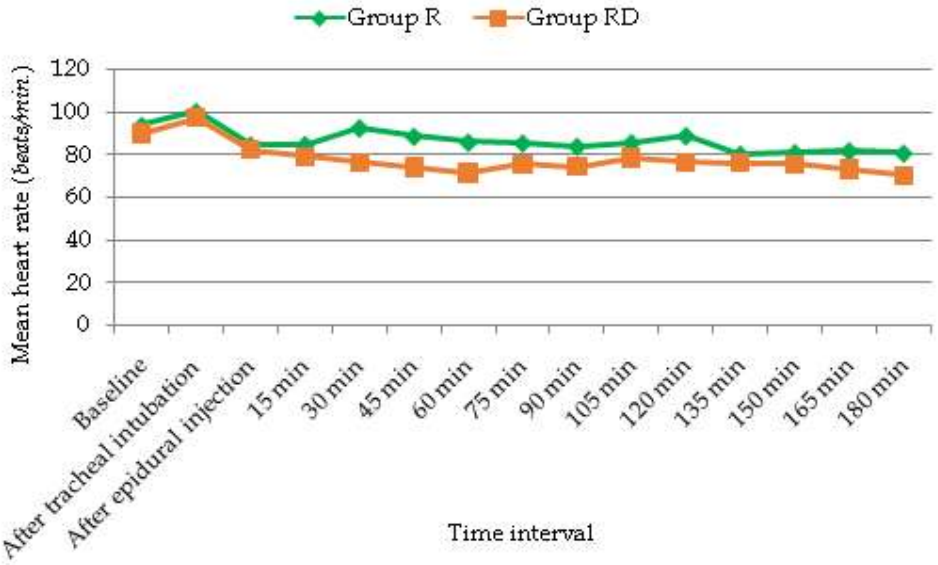

Fig. 3: Comparison of heart rate in two groups

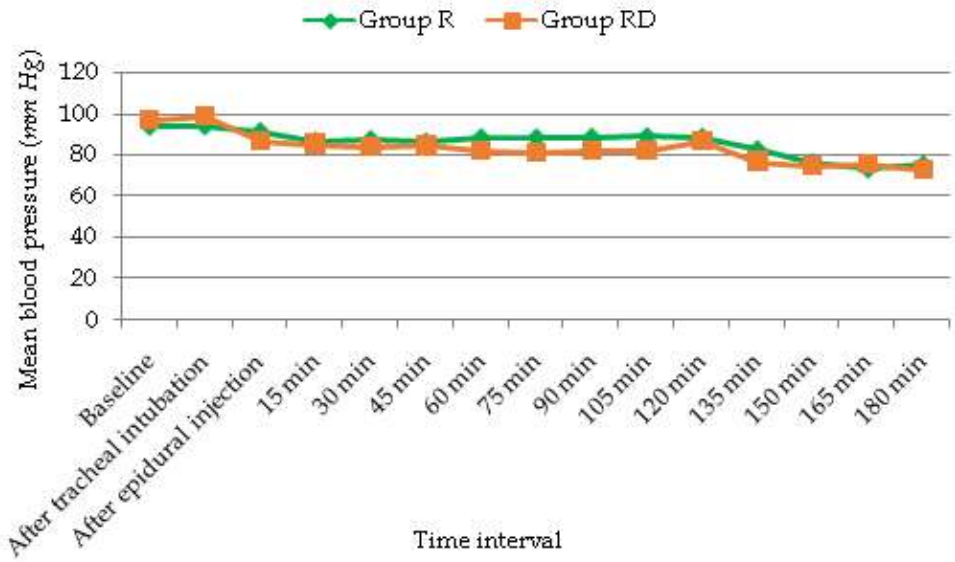

Fig. 4: Comparison of mean blood pressure in two groups

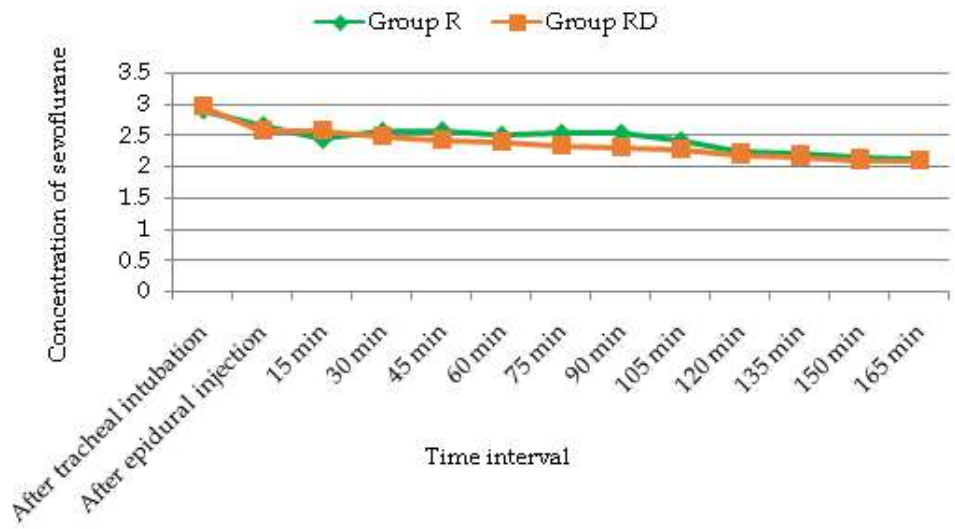

Fig. 5: Comparison of concentration of sevoflurane in two groups

Discussion

Upper abdominal surgeries are associated with significant amount of pain which can cause considerable amount of morbidity in form of pulmonary complications like atelectasis of lower lung fields, postoperative stress and prolonged hospital stay.

Epidural analgesia is a safe and effective means for providing perioperative analgesia. The commonly used local anesthetic drugs for epidural analgesia like Ropivacaine, Bupivacaine and Lignocaine, have shorter duration of action which necessitates frequent dosing. So, there is a need for addition of adjuvants to increase the duration of analgesia as well as quality of analgesia and to minimize the adverse effects of high doses of local anesthetic agent.

Dexmedetomidine is a centrally acting highly selective α-2 adrenergic agonist with α-2: α-1 selectivity ratio of 1620:1 especially for the α-2a subtype, which makes Dexmedetomidine more effective for analgesia and sedation. The mechanism by which α-2 adrenergic agonists prolong the motor and sensory block of local anesthetics may be an additive or synergistic effect secondary to the different mechanisms of action of local anesthetics. Dexmedetomidine acts by binding to the presynaptic C-fibers and postsynaptic dorsal horn neurons. They produce analgesia by depressing the release of C-fiber transmitters and by hyperpolarization of postsynaptic dorsal horn neurons.[15–17] The complimentary action of local anesthetics and α-2 adrenergic agonists accounts for their profound analgesic properties. The use of Dexmedetomidine has been studied as an epidural adjuvant by various authors who have observed its synergism with local anesthetics without any additional morbidity.[4,18]

In our study, the demographic parameters like age distribution, gender distribution were similar in two Groups and were comparable. This helped to eliminate the variability due to demographic differences which could lead to error in interpretation of data.

Time duration from time to epidural injection of study drug to first request for rescue analgesia (VAS ≥ 4) by the patient was defined as duration of analgesia. The mean duration of analgesia in our study was *309.85 ± 35.72 min* in Group R as compare to Group RD in which the mean duration was *472.14 ± 44.90 min* and this difference was statistically significant, (p = 0.000, shown as (Table 1).

Table 1: Rescue analgesia characteristics

	Group R	Group RD	*p* - value
Time to first request for rescue analgesia (*min*)	309.85 ± 35.72	472.14 ± 44.90	0.000
Total dose of rescue analgesia (*mg*)	314.29 ± 55.00	214.29 ± 35.50	0.000
Total number of rescue analgesia doses in *24 hours*	2.11 ± 0.323	3.14 ± 0.550	0.000
Total number of rescue analgesics required	3.14±0.550	2.11± 0.323	0.000

Kaur S *et al*.[19] observed in their study that mean time at which patient demanded first dose of rescue analgesia was delayed in Group B (Ropivacaine

+ Dexmedetomidine) (*496.56 ± 16.086 min*) as compared to Group A (Ropivacaine) (*312.64 ± 16.217 min*). The first dose of rescue analgesia was demanded between *8th* and *9th hour* in Group RD and between *4th* and 5th hour in Group R. In our study the first dose of rescue analgesia was demanded between 6th and *7th hour* in Group RD and between *3rd* and *4th hour* in Group R. This difference is attributed to the difference in concentration of Ropivacaine administered epidurally. Kaur S *et al*. had used 0.75% *20 ml* ropivacaine as compared to *0.25% 20 ml* ropivacaine used in our study.

Thangavelu S *et al*.[2] conducted a comparative study on adding Dexmedetomidine *vs* Clonidine to epidural 0.125% Bupivacaine for postoperative analgesia in patients undergoing upper abdominal surgeries and found that the mean duration for *1st* rescue analgesia (defined as the time at which patient demands some mode of pain relief i.e. when VAS more than 4) was *425.6 ± 64.27 minutes* in Group D and *226 ± 24.83 minutes* in Group C. Their results are similar to our study, shown as (Table 2).

Table 2: Distribution of patients according to number of doses of rescue analgesia

No of rescue analgesia doses	Group R (*n* = 35)	Group RD (*n* = 35)
2	3 (8.6%)	31 (88.6%)
3	24 (68.6%)	4 (11.4%)
4	8 (22.9%)	0 (0%)
Total	35 (100%)	35 (100%)

Anand VG *et al*.[20] studied the effect of Dexmedetomidine to caudal Ropivacaine for lower abdominal surgery in pediatric population and found that duration of postoperative analgesia was prolonged in Dexmedetomidine group with a median of *14.5 hours* (13.90–15.09) in Group RD compared with *5.5 hours* (4.97–6.03) in Group R, with a *p* - value of < 0.001.

Our study showed total number of rescue analgesia doses needed in *24 hours* was less in Group RD (2.11 ± 0.323) as compared to Group R (3.14 ± 0.550). In study by Kaur S *et al*.,[19] they observed that patients in Group B (Ropivacaine + Dexmedetomidine) required significantly less number of doses of rescue analgesia as compared to Group A (Ropivacaine) (1.44 ± 0.501 *vs* 2.56 ± 0.675) in the postoperative period (*p* < 0.001). Their study supports our findings.

In the present study, the VAS score was lower in Group RD as compared to Group R during the *24 hour* of postoperative period. At the end of surgery the VAS score was [Group R (2.00 ± 0.42) *v/s* (1.63 ± 0.55) in Group RD, *p* 0.002], at *4th hour* [Group R (437 ± 0.55) *v/s* Group RD (1.91 ± 0.92), *p* 0.00], at *12th hour* [Group R (3.89 ± 0.47) *v/s* Group RD (3.49 ± 0.89), *p* 0.021], and at *20th hour* [Group R (2.03 ± 0.6) *v/s* Group RD (1.31 ± 0.53), *p* 0.000]. In our study mean VAS score in Group R was 3.041 ± 0.468 and in Group RD was 2.342 ± 0.74, (*p* 0.009).

In study by Thangavelu S *et al*.,[2] at *360 minutes*, the mean VAS score in Group D was 0.84 ± 0.89 and in Group C was 1.76 ± 0.99. There was statistical significant difference in both Groups (*p* < 0.05). The mean VAS score in Group D was 2.96 ± 1.01 and in Group C was 2.08 ± 1.07 at *720 minutes* which was found to be statistically significant (*p* < 0.05). At *1440 minutes*, the mean VAS score in Group D was 3.48 ± 0.82 and in Group C was 3.52 ± 1.04 and was found to be statistically not significant. Their result supported our finding

In study conducted by Kaur S *et al*.,[19] in Group A (0.75% Ropivacaine), VAS score increased more rapidly and patient demanded first dose of rescue analgesia (injection diclofenac sodium *75 mg* I/M) between *4th* and *5th h* (mean VAS was 2.93 ± 1.04 and 3.13 ± 1.00 respectively). At *5th h*, mean VAS score in Group A was 3.13 ± 1.00 and in Group B was 0.57 ± 0.62 and the difference between the two Groups was highly significant (*p* = 0.00). In Group B (0.75% Ropivacaine with *1 mcg/kg* Dexmedetomidine), VAS started increasing at *4th h* (0.10 ± 0.30) and patient demanded first dose of rescue analgesia (injection diclofenac sodium *75 mg* I/M) between *8th* and *9th h* (mean VAS was 3.03 ± 1.21 and 3.27 ± 0.78 respectively). Thus requirement of rescue analgesia was delayed in Group B as compared to Group A. The mean VAS score in Group A (R) was 3.13 ±1 and in Group B (RD) was 0.57 ± 0.62 and the difference between the two Groups was significant with *p* value of 0.00. Their study results support our findings.

The result of our study clearly indicates that the sedation score at *30 min* was higher in Group RD as compared to Group R and this was statistically significant. At *30 min* of postoperative period majority of the patients (i.e. 34 out of 35) in Group RD had MRSS 3 as compared to score of 2 in all the patients in Group R. We observed that none of the patients in our study had respiratory depression or any fall in saturation. Patients of Group RD had arousable sedation, awaken by gentle tactile stimulation. We further noted that all the patients of both the Groups had MRSS 2 at *120 min* of postoperative period.

Bajwa S et al.[4] showed epidural dexmedetomidine produced more sedation as compared to epidural clonidine. 36% of patients in dexmedetomidine Group (MRSS 2) and were arousable by gentle

tactile stimulation compared to achievement of similar sedation level in 16% patients in clonidine Group. Their results were similar to our study.

Kaur S *et al*.[19] showed that after *30 min*, patients were more sedated in Dexmedetomidine Group as compared to plain Ropivacaine Group and the difference in sedation score was statistically highly significant. This was in accordance with our study which showed significant sedation produced by addition of dexmedetomidine to ropivacaine.

The hypnotic effect of Dexmedetomidine is mediated by hyper-polarization of noradrenergic neurons in the locus ceruleus of the brain stem (a small bilateral nucleus that contains many adrenergic receptors), which is the primary site in modulating wakefulness.[6]

In our study, heart rate was less in Group RD as compared to Group R. The fall in heart rate is due to postsynaptic activation of α-2 adreno receptors in CNS resulting in decreased sympathetic activity both centrally and peripherally. 3 patients in Group RD had bradycardia whereas none of the patients had bradycardia in Group R.

In study by Kaur S *et al*.,[19] heart rate remained stable in both the Groups at all time interval and was comparable. Although 2 patients in Group A (Ropivacaine) and 5 patients in Group B (Ropivacaine-Dexmedetomidine) had bradycardia intraoperatively which was managed with inj atropine. This difference can be explained due to difference in concentration of ropivacaine which was 0.75% (*20 ml*) in Kaur S *et al*. as compared to 0.25% (*20 ml*) in our study.

In study by Jain *et al*.,[21] they noticed a significant fall in pulse rate *5* to *10 minutes* following administration of epidural dexmedetomidine as compared epidural saline at all time intervals. Their finding supports our results.

In our study the mean blood pressure remained stable in both the Groups. Although the MBP was lower in Group RD as compared to Group R, none of the patients had hypotensive episode requiring inj Ephedrine. The difference in MBP was statistically significant from *60 mins* to *105 mins* of observation period but that was clinically of no significance.

In the study by Shahi V *et al*.,[22] there was no statistically significant difference between the Groups ($p > 0.05$) in MBP. This difference can be attributed to the difference in the dose of inj Dexmedetomidine which was *1 mcg/kg* in our study as compared to *0.5 mcg/kg* in Shahi V *et al*.

In our study, lower concentration of sevoflurane was needed in Group RD as compared to Group R. The mean concentration of Sevoflurane in Group RD was 2.380 ± 0.22 and in Group R was 2.680 ± 0.278, and this difference was statistically highly significant, p 0.000.

In study by Schnaider TB *et al*.,[23] control group patient who received 0.75% (*20 ml*) ropivacaine the concentration of inspired isoflurane was higher [> 1,< 3] as compared to the inspired isoflurane concentration in dexmedetomidine Group [0.84 + 0.12%]. These results supports our finding.

Limitations

The patients with comorbidities were excluded, so, the results of this study should not be generalized to other patients with severe underlying disease. Further studies should consider this limitation.

Conclusion

We conclude that the addition of dexmedetomidine to epidural ropivacaine not only reduces the requirement of anesthetic agents intraoperatively but also gives better and longer postoperative pain relief in patients undergoing upper abdominal surgeries.

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Conflict of interest: None.

Ethical approval: Institute Ethics Committee.

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Effect of Intravenous Dexmedetomidine for Intranasal Surgeries under General Anesthesia

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Abstract

Background and Objectives: Controlled hypotension has been used to reduce bleeding and to optimize visualization of surgical field during intranasal surgeries. Dexmedetomidine, an alpha-2 agonist can be an effective agent to provide controlled hypotension and it also provides sedation and analgesia with minimal side effects. The present study was undertaken to evaluate the effect of intravenous dexmedetomidine for intranasal surgeries under general anesthesia. *Materials and Methods:* Sixty patients aged 20 to 60 *years*, belonging to ASA I & II and undergoing elective intranasal surgeries under general anesthesia were included in the study. Patients were randomly allocated to two Groups (30 each), Group D and Group P. Patients in Group D received intravenous dexmedetomidine 1 *mcg/kg* in 10 *ml* of normal saline and Group P received placebo. Data obtained were subjected to analysis using statistical software SPSS vs 24. *Results:* Bleeding score was significantly lower in Group D (86.7% with bleeding Score 1) vs in Group P (46.7% with bleeding Score 3 and 40% with a Score 2) with a *p* value < 0.001. The Mean arterial pressure was significantly lower in Group D than Group P throughout the surgery with p value 0.035. The Heart rate was also lower throughout surgery in Group D than Group P significant with *p* value < 0.001. *Conclusion:* Intravenous dexmedetomidine for intranasal surgeries under general anesthesia reduces bleeding at surgical site and provides better visibility of operative field and helps achieve controlled hypotension with minimal side effects.

Keywords: Dexmedetomidine; Controlled hypotension; Placebo; Bleeding score.

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Introduction

During intranasal surgeries, bleeding in the surgical site is a major problem due to increased vascularity of nasal mucosa. General anesthesia with controlled hypotension is the preferred technique to achieve good visualization of surgical field with reduced blood loss.[1]

Dexmedetomidine is a centrally acting alpha-2 agonist and can be effectively used to achieve controlled hypotension with general anesthesia during intranasal surgeries. An ideal hypotensive agent for controlled hypotension must be easy to administer, have shorter onset time, has an effect that disappears quickly on discontinuation of the drug, rapid elimination without toxic metabolites, negligible adverse effects and predictable dose dependent effect.[2,3]

Dexmedetomidine is a highly specific and selective, potent alpha-2 adrenergic agonist and

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it inhibits the release of nor epinephrine[4,5,6] at presynaptic levels at the alpha-2 receptors in the brain and spinal cord. Dexmedetomidine also cause sedation and analgesia acting at alpha-2A, 2B & 2C receptors in the brain and spinal cord.[7,8]

Dexmedetomidine causes minimal respiratory depression[9] and sedation produced is more akin to natural sleep and patients are easy to arouse.[10,11,12] It is used to provide controlled hypotension with better hemodynamic and cardiovascular stability as it does not cause reflex tachycardia and also avoids rebound hypertension on discontinuation of the drug.[13,14]

This study was designed to evaluate the effect of intravenous dexmedetomidine for intranasal surgeries under general anesthesia, intraoperative and postoperative hemodynamic stability, intraoperative blood loss and perioperative adverse effects.

Materials and Methods

This study was conducted as a prospective randomized controlled study at the department of anesthesiology, Rajah Muthiah Medical College and Hospital, Annamalainagar.

Approval for study was obtained from the ethics committee for human experiments and informed consent obtained from the willing patients before study. The study was conducted during the period august 2018 to July 2019.

Sixty patients belonging to ASA Grade I & II, aged 20 to *60 years* undergoing elective intranasal surgery under General anesthesia were included in the study. Patients with hypertension, cardiovascular disease, hematological disorder, pregnant and lactating mothers, patients on chronic medications, with systemic illness and those who refused were excluded from the study.

The sixty patients were randomly allocated into two Groups, Group D and Group P. A preoperative assessment was carried out and informed written consent obtained.

In the operation theatre, the baseline heart rate, blood pressure (systolic, diastolic, mean arterial), SpO_2 were recorded. Two separate intravenous lines secured with *18 gauge* canula.

Group D patients received IV Dexmedetomidine *1 mcg/kg* in *10 ml* normal saline over *15 minutes* before induction of General Anesthesia. Group P patients received placebo with IV normal saline (*10 ml*) over *15 minutes* before induction of General Anesthesia.

Patients in both the Groups were premedicated with IV fentanyl *1 mcg/kg* and preoxygenated with 100% O_2 for *5 minutes*. Patients were induced with Inj Thiopental *5 mg/kg* IV and Inj Succinylcholine *2 mg/kg* IV and intubated. Anesthesia was maintained with 65% N_2O in O_2 and Inj Vecuronium *0.08 mg/kg* IV was used as muscle relaxant.

Intraoperative monitoring of Heart rate, Systolic BP, Diastolic BP and Mean Arterial Pressure was done at *2, 4, 6, 8, 10, 15, 20, 25, 30, 45, 60 minutes* and every *15 minutes* thereafter till the end of surgery.

Bleeding at the surgical site was assessed with a bleeding score (Grade 0 no bleeding, Grade 1 minor bleeding with no suctioning, Grade 2 minor bleeding requiring suctioning, Grade 3 minor bleeding requiring frequent suctioning, Grade 4 moderate bleeding with surgical field visible only with suctioning and Grade 5 severe bleeding requiring very frequent suctioning for surgery to proceed).

At the end of surgery, residual neuromuscular block was antagonized with Inj Glycopyrrolate *0.008 mg/kg* IV and Inj neostigmine *0.05 mg/kg* IV and after adequate motor recovery, trachea was extubated.

At the end of the study, data were compiled and statistical analysis done using student's *t* - test, Chi-square test, Repeat Measures ANOVA and two factor repeated measures ANOVA. SPSS version 24 was used for analysis. A statistical value of $p < 0.05$ was considered significant.

Results

Both the Groups were comparable with respect to demographic variables (age, weight, sex) (Tables 1,2,3) and ASA status (Table 4) did not vary significantly between the two Groups.

Table 1: Comparison of the Two Groups in Terms of Age

	Group				Student's *t* - test	
	Group D		Group P			
	Mean	SD	Mean	SD	t	p value
Age (Years)	31.37	9.70	31.07	9.42	0.122	0.904

In the Group D, 86.7% patients had Bleeding Score 1 (No Suctioning Required). In the Group P, 40% patients had Bleeding Score 2 (Suctioning required) and 46.7% patients in the Group P had Bleeding Score 3 (Frequent Suctioning Required). There was a significant difference in the two Groups in terms of Bleeding Score ($\chi^2 = 34.133$, $p < 0.001$), (Fig. 2).

There was a significantly greater decrease in Heart Rate in the Group D as compared to the Group P ($p < 0.001$), (Fig. 3). There was a significantly greater decrease in SBP (*mm Hg*) in the Group D as compared to the Group P ($p < 0.001$), (Fig. 4). There was a significantly greater decrease in DBP (*mm Hg*) in the Group D as compared to the Group P ($p < 0.001$), (Fig. 5). There was a significantly greater decrease in MAP (*mm Hg*) in the Group D as compared to the Group P ($p < 0.001$), (Fig. 6).

Table 2: Comparison of the Two Groups in Terms of Gender

Gender	Group				Total		Chi-Square Test	
	Group D		Group P					
	n	%	n	%	n	%	χ^2	*p* - Value
Male	13	43.3%	17	56.7%	30	50.0%	1.067	0.439
Female	17	56.7%	13	43.3%	30	50.0%		
Total	30	100.0%	30	100.0%	60	100.0%		

Table 3: Comparison of the Two Groups in Terms of Weight

	Group				Student's *t* - test	
	Group D		Group P			
	Mean	SD	Mean	SD	t	*p* - value
Weight (Kgs)	55.37	6.43	57.13	5.19	-1.171	0.246

Table 4: Comparison of the Two Groups in Terms of ASA

ASA	Group				Total		Chi-Square Test	
	Group D		Group P					
	n	%	n	%	n	%	χ^2	*p* - Value
I	21	70.0%	23	76.7%	44	73.3%	0.341	0.771
II	9	30.0%	7	23.3%	16	26.7%		
Total	30	100.0%	30	100.0%	60	100.0%		

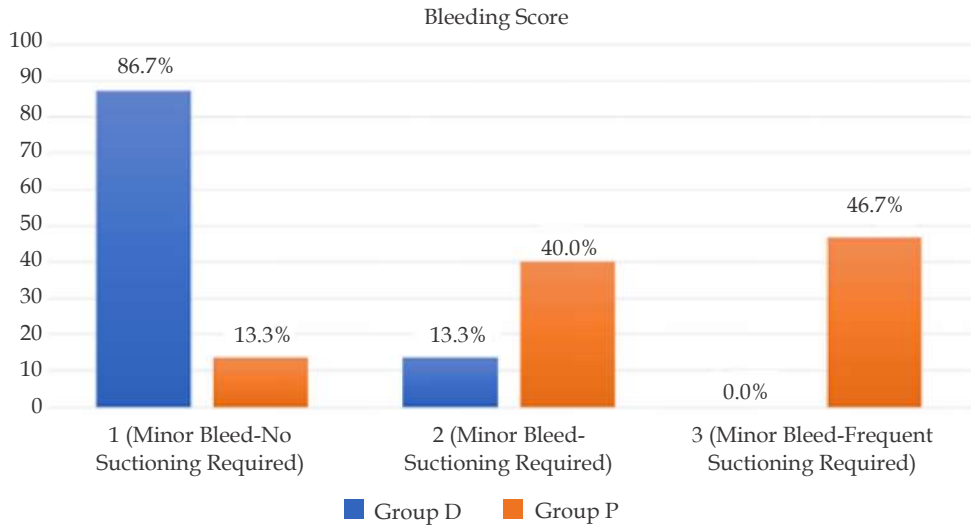

Fig. 2: Bleeding Score Bleeding

Fig. 3: Comparison of Heart rate between Two Groups

Fig. 4: Comparison of Systolic Blood Pressure between Two Groups

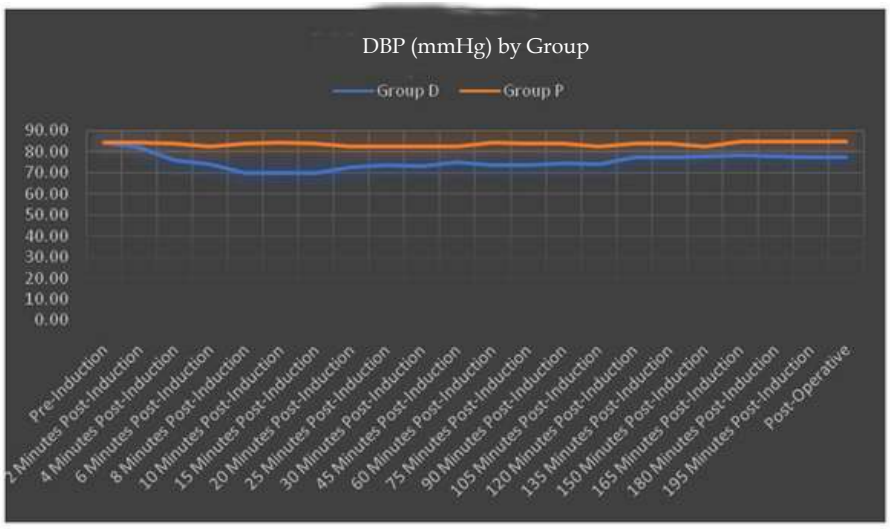

Fig. 5: Comparison of Diastolic Blood Pressure between Two Groups

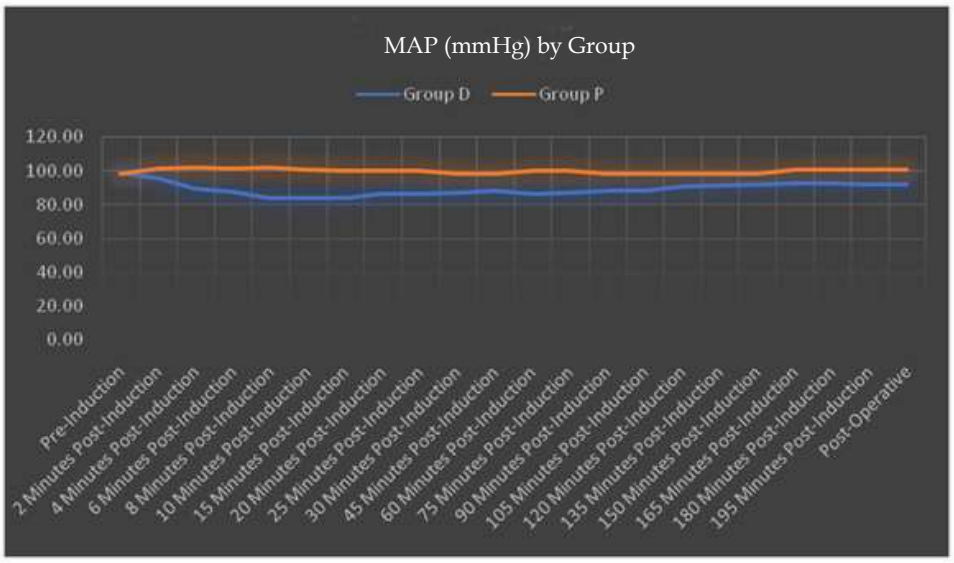

Fig. 6: Comparison of Mean Arterial Pressure between Two Groups

Discussion

Intranasal surgeries require better visualization of surgical field and it can be achieved by controlled hypotension under general anesthesia, using Dexmedetomidine, alpha-2 agonist with minimal side effects. In a study by Gupta *et al*.[15] intravenous dexmedetomidine was shown to reduce the blood loss with minimal adverse effects in intranasal surgeries, which is in concurrence with our study. Harick shah *et al*.[16] compared the blood loss, hemodynamic and operative field visibility between Dexmedetomidine infusion and propofol infusion used for maintenance of anesthesia during Functional endoscopic sinus surgery. As dexmedetomidine causes postsynaptic activation of alpha-2 receptors in CNS and inhibits sympathetic activity decreasing nor epinephrine levels, it can decrease both blood pressure and heart rate. Whereas propofol resets or inhibits the baroreceptor reflex mechanism reducing tachycardia response to hypotension.[16,17]

The study concluded that dexmedetomidine is better in controlling heart rate and was assosciated with lesser blood loss and better operative field visibility. In a study by Vineela *et al*.[18] Dexmedetomidine Group had reduced blood loss compared to nitroglycerine Group during functional endoscopic sinus surgeries. The patients in nitroglycerine Group also had reflex tachycardia and increased blood loss, while those in dexmedetomidine Group had reduced heart rates and less blood loss during surgery, which is similar and in concurrence with our study.

Ahmed Z Mohamed *et al*.[19] compared the effects of dexmedetomidine and $MgSO_4$ on surgical Field visualization in middle ear surgeries. This study concluded that Dexmedetomidine provided better quality of surgical field vision and less bleeding compared to $MgSO_4$.

Shams *et al*.[20] conducted a comparative study of dexmedetomidine *vs* esmolol for induced hypotension for functional endoscopic sinus surgery. It was concluded that dexmedetomidine or esmolol with sevoflurane are safe agents for controlled hypotension and both are effective in providing ideal surgical field during FESS and that dexmedetomidine offers the advantage of inherent analgesic, sedative and anesthetic sparing effect than esmolol.

DK Bharathwaj *et al*.[21] found in their study that the mean heart rate was lower in Dexmedetomidine Group patients compared with propofol Group patients and also dexmedetomidine Group patients had no episodes of significant bradycardia. They concluded that dexmedetomidine is better than propofol in controlling heart rate, mean arterial pressure and blood loss throughout the intranasal surgeries, which is also in concurrence with our study.

In our study, the duration of surgery, shows as (Fig. 1) was significantly lesser in dexmedetomidine Group compared to placebo Group, which could have been due to lesser bleeding in dexmedetomidine Group. No significant adverse effects were observed in any of the patients in our study.

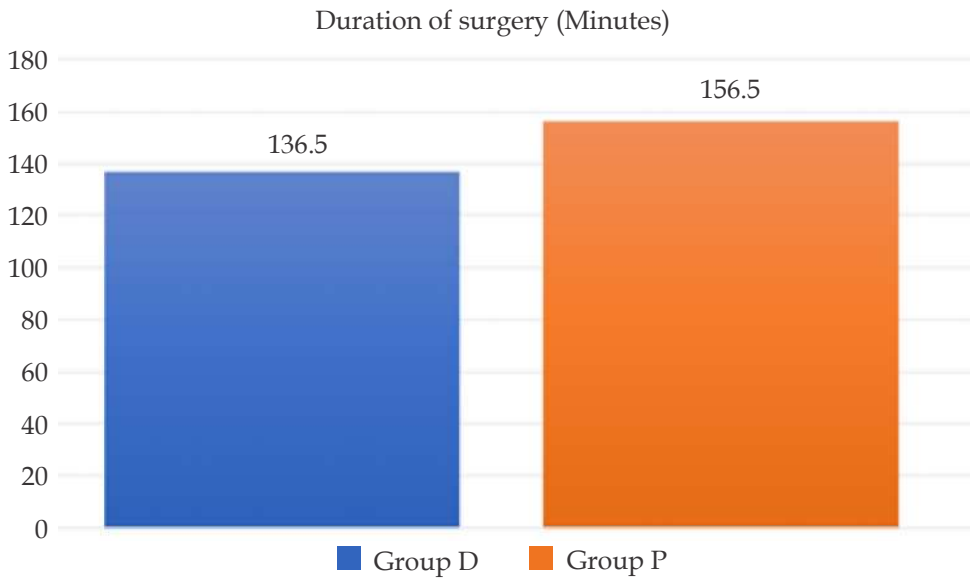

Fig. 1: Duration of Surgery.

Intraoperative bleeding score was significantly lower in dexmedetomidine Group with *p* value < 0.001 in our study, (Fig. 2). There was statistically significant reduction in heart rate, systolic blood pressure, diastolic and mean blood pressure in dexmedetomidine Group compared to placebo Group with *p* value < 0.001.

Conclusion

From our study we concluded that intravenous dexmedetomidine at *1 mcg/kg* during general anesthesia in intranasal surgeries reduces bleeding at surgical site and provides better visibility of the operative field than placebo. Intravenous Dexmedetomidine helps to achieve controlled hypotension with minimal side effects.

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Original Research Article

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Postdural Puncture Headache: A Comparison between Median and Paramedian Approach under Spinal Anesthesia in Cesarean Section

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Abstract

Aims and Objectives: To compare the incidence of Postdural Puncture Headache (PDPH) with spinal anesthesia using median and paramedian approach in pregnant women undergoing elective cesarean section. *Materials and Methods:* One Hundred patients with American Society of Anesthesiologists Physical Status I and II scheduled for elective cesarean section under spinal anesthesia were randomly allocated into two groups with fifty patients each. Group M: Received the subarachnoid block with median approach using 25G Quinke spinal needle and 10 *mg* Inj Bupivacaine heavy 0.5% at L3–L4 intervertebral space. Group P: Received the subarachnoid block with paramedian approach using 25G Quinke spinal needle and 10 *mg* Inj Bupivacaine heavy 0.5% at L3–L4 intervertebral space. Patients were assessed for hemodynamic changes, sensory and motor block and adverse effects in the intraoperative period. Postoperatively patients were monitored for PDPH, low backache, nausea, vomiting, first attempt success rate and the need for rescue analgesia. *Results:* The incidence of Postdural Puncture Headache (PDPH) was 18% in Group M as compared to 4% in Group P with *p* - value of 0.025 which is statistically significant. While the incidence of low backache was 14% in Group M as compared to 0% in Group P with *p* - value of 0.006 which is also statistically significant. *Conclusion:* The paramedian approach of subarachnoid block has lesser tendency to cause post dural puncture headache and low backache as compared to median approach in patients undergoing elective caesarean section.

Keywords: Post dural puncture headache; Median spinal approach; Paramedian spinal approach; Elective cesarean section.

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Introduction

Subarachnoid Block (SAB), a form of regional anesthesia is most commonly practiced for cesarean delivery. It is considered simple, safe, cost-effective with lesser complications as compared to general anesthesia.[1]

Postdural Puncture Headache (PDPH) is a common iatrogenic complication assosciated with subarachnoid block. According to International Headache Society, PDPH is defined as "bilateral frontal/occipital headache that develops within *7 days* after a lumbar puncture and disappears within *14 days*. The headache worsens within *15 min* of resuming the upright position, disappears or improves within *30 min* of resuming the recumbent position".[2] PDPH usually occurs *48–72 hours* after dural puncture and last for several days.[2] Associated symptoms include stiff neck, hearing loss, tinnitus, nausea, vomiting and photophobia.[3]

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Risk factors for developing PDPH include young adults (*18–30 years*), female sex, pregnancy, large size spinal needle, cutting needle tip design and multiple attempts of lumbar puncture.[4–6] The exact mechanism involved in the development of postdural puncture headache is unclear. There are two hypothesis put forward for its development.

First, the CSF leakage resulting in fall of CSF volume and pressure causes gravitational traction on the pain sensitive structures in upright position causing headache. Second, the loss of CSF may result in compensatory intracranial venodilatation *via* the Monro–Kellie doctrine.[7,8]

Subarachnoid block can be achieved by either median or paramedian approach. The median approach is most commonly used for administration of spinal anesthesia. The paramedian approach is a useful technique that allows for successful identification of epidural or subarachnoid space, especially in difficult cases, obese, pregnant and geriatric patients.[9,10]

Behery *et al*. had done a similar study for incidence of PDPH on cesarean section patients under spinal anesthesia. The study concluded that the incidence of PDPH was less in paramedian (5.2%) than median approach (19.6%), which was statistically significant.[11]

However, completely contrarary results were found in a study conducted by Sadeghi A *et al*. done on cesarean section patients where the PDPH incidence was more in paramedian than median approach (9.8% *vs* 9.4%) though the results were statistically insignificant (p - value > 0.05).[12]

Based on the above studies, we hypothesized to conduct this study to evaluate the safety and efficacy of both approaches of subaracnoid block. The rationale of this study was to compare the frequency of PDPH with median and paramedian approach in elective cesarean section using 25G Quincke needle for subarachnoid block. The study was conducted with a hope to bring change in clinical practice of using better approach (median or paramedian) to reduce PDPH associated morbidity.

Materials and Methods

Randomized, prospective, double blind study was conducted on 100 patients scheduled to undergo elective cesarean section at Major operation theatre MIMS, Mandya, Karnataka, India after obtaining approval from Institutional Ethical Committee and informed consent from patients.

Inclusion Criteria

1. ASA I and II patients undergoing elective cesarean section
2. Age 20–40 *years*
3. Weight 50–100 *kgs*
4. BMI < 30

Exclusion Criteria

1. Spinal deformities
2. Coagulation abnormalities
3. Medical comorbidities
4. Any chronic preoperative headache
5. Neurological or psychiatric disorders
6. Patients who had PDPH in previous surgery
7. Infection at lumbar puncture site
8. Allergic to local anesthetics
9. Lumbar Puncture attempt failure more than two.

Preoperative assessment of patient including routine blood investigations and electrocardiogram (ECG) was done a day prior to surgery. Patient was briefed about details of the study and informed consent was taken.

On the day of surgery, patient was shifted to operation theatre and connected to multiparameter monitor to record pulse rate, non-invasive blood pressure, ECG, and oxygen saturation.

An 18G intravenous cannula was inserted in the non-dominant hand and premedicated with *50 mg* Inj Ranitidine and *4 mg* Inj Ondensetron. Ringer lactate was infused at *15 ml/kg* as preload fluid over *30 min*.

Selected patients were randomly divided into two groups Group M and Group P, comprising 50 patients each using computer randomization programs.

Group M received subaracnoid block with median approach while Group P received subarachnoid block with paramedian approach.Under strict aseptic precautions, subarachnoid block was given in sitting position, using 25G Quinke needle at L3–L4 intervertebral space.

In Group M (median approach), subarachnoid block was given with spinal needle introduced at L3–L4 intervertebral space below the spinous process of L3, whereas in Group P (paramedian approach), the spinal needle was introduced *10 to 15°* in a cephalo medial plane at *1 cm* lateral and caudal to the spinous process of L3. In both the groups, *10 mg* of Inj Bupivacaine heavy 0.5% was

used to achieve subarachnoid block. Immediately after spinal anesthesia, the patient was positioned in supine position and a *>15°* wedge was placed under the right hip to avoid supine hypotension. The level of anesthesia and time to achieve were noted. Hypotension was treated with rapid administration of intravenous fluids and Inj Phenylephrine *0.5 mcg/kg*. In case of failure or insufficient block, general anesthesia was given and patient was excluded from the study.

An independent observer not involved in the study followed the patients for *7 days* for PDPH, low backache, nausea, vomiting, first attempt success rate and the need for rescue analgesia. Numeric Visual Analogue Scale (VAS) was used to assess the severity of PDPH, shown as in Figure 1.

Score 0 was considered as No pain due to PDPH while Score 1–3 as Mild, 4–6 as Moderate, 7–9 as severe and 10 Very severe. Mild pain was treated with bed rest and intravenous fluids while moderate to severe form with intravenous Inj Paracetamol *1g* as rescue analgesia.

Statistical Analysis

All the collected data were entered into SPSS version 16. Quantitative variables such as age, weight and BMI were presented by mean ± SD using student *t* - test. Qualitative variables such as PDPH, low backache, nausea and vomiting and use of rescue analgesia were presented as frequency and percentage using Chi-square test. A *p* - value of ≤ 0.05 was considered statistically significant.

Results

The demographic data variables of the patients were comparable in both the groups as shown in Table 1. The mean age of patients in Group M was 25.22 ± 2.562 *vs* 24.80 ± 2.755 in Group P with *p* - value of 0.439 which is statistically insignificant. The mean weight in Group M was 68.56 ± 6.899 while in Group P it was *69.04 ± 6.305 kg* with *p* - value of 0.717 which is statistically insignificant. The mean BMI in Group M was 23.374 ± 1.778 *vs* 22.906 ±1.460 with *p* - value of 0.154 which is statistically insignificant.

In Group M, the failure rate of first spinal attempt was more (14%) when compared to Group P (4%) though the *p* - value is statistically insignificant 0.081, (Table 2, Graph 1).

Nausea and vomiting was more with Group M (16%) when compared to Group P (4%) with

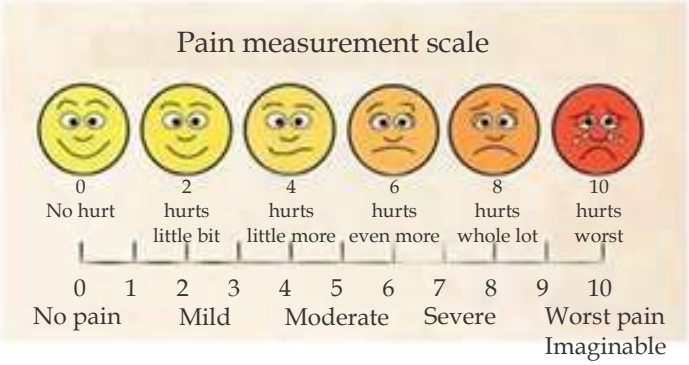


Fig. 1: Pain measurement scale

Table 1: Demographic variables

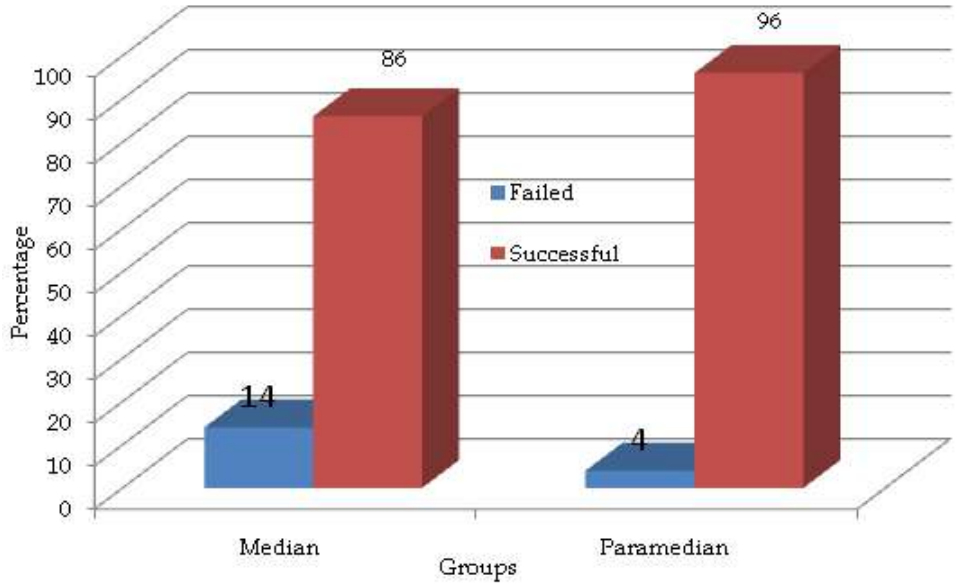
	Group M	Group P	*t*-test value	*p* - value
Age	25.22 + 2.562	24.80 + 2.755	0.777	0.439
Weight	68.56 + 6.899	69.04 + 6.305	0.363	0.717
Gestational Age	38.694 + 0.450	38.454 + 0.404	2.804	0.006
BMI	23.374 + 1.778	22.906 + 1.460	1.438	0.154

Table 2: Distribution according to failure of first spinal attempt in the study group subjects

First Spinal attempt	Group M	Group P	Chi-square value, df and *p* - Value
Failed	07 (14.0)	02(04.0)	
Successful	43 (86.0)	48 (96.0)	3.053; 1; 0.081
Total	50	50	

p - value of 0.046 which is statistically significant, (Table 3, Graph 2).

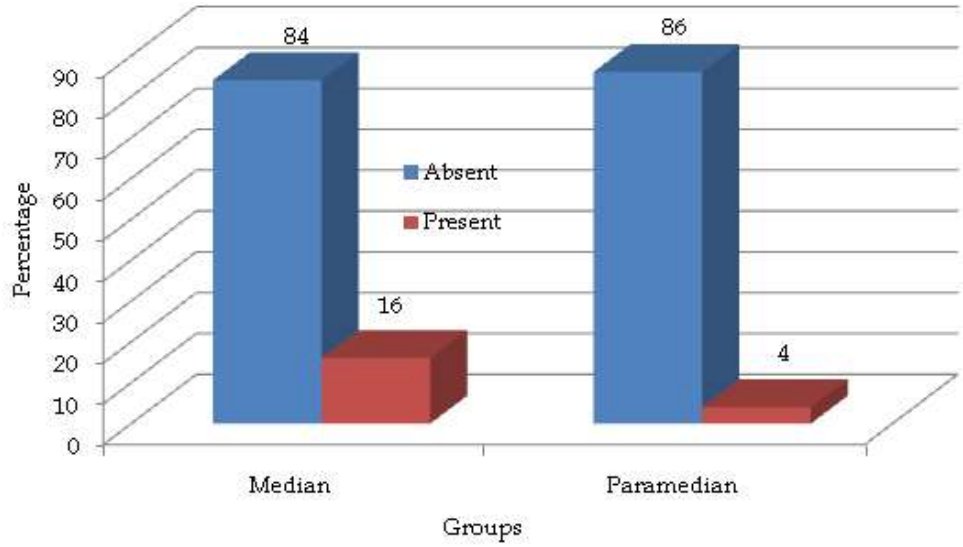
Postdural Puncture Headache (PDPH) was more with Group M (18%) when compared to Group P (4%) with *p* - value of 0.025 which is statistically significant, (Table 4, Graph 3). In Group M total 9 patients developed PDPH, out of which 4 patients had mild form (VAS Score 1–3) and other 5 patients had moderate form (VAS Score 4–6). In Group P total 2 patients developed PDPH, out of which one patient had mild form and the other had moderate form.



Graph 1: Multiple Bar diagram showing failure of First Spinal attempt among Group M and Group P.

Table 3: Distribution according to Nausea and vomiting in the study group subjects

Nausea and Vomiting	Group M	Group P	Chi-square value, df and *p* - Value
Absent	42 (84.0)	48(96.0)	4.00; 1; 0.046
Present	08 (16.0)	02 (04.0)	
Total	50	50	

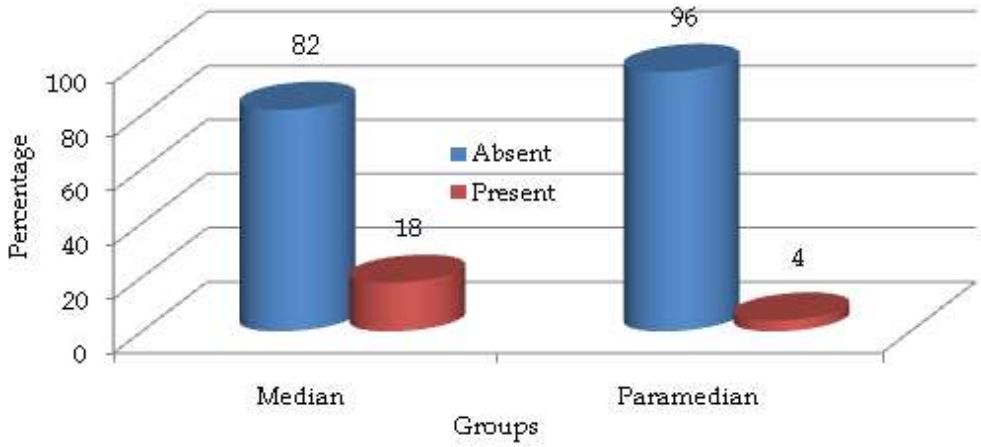


Graph 2: Multiple Bar diagram showing nausea and vomiting among Group M and Group P

Low backache was more in Group M (14%) when compared to Group P (0%) with p - value of 0.006 which is statistically significant, (Table 5, Graph 4).

Table 4: Distribution according to PDPH among the study group subjects

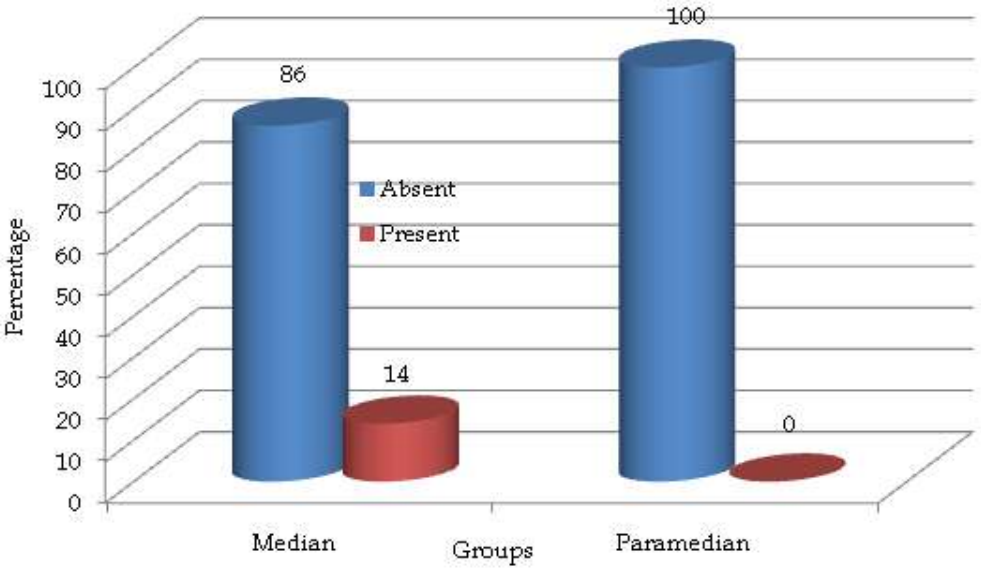
Postdural Puncture Headache	Group M	Group P	Chi-square value, df and p - Value
Absent	41 (82.0)	48(96.0)	5.005; 1; 0.025
Present	09 (18.0)	02 (04.0)	
Total	50	50	



Graph 3: Multiple Bar diagram showing postdural puncture headache among Group M and Group P.

Table 5: Distribution according to low backache among the study group subjects

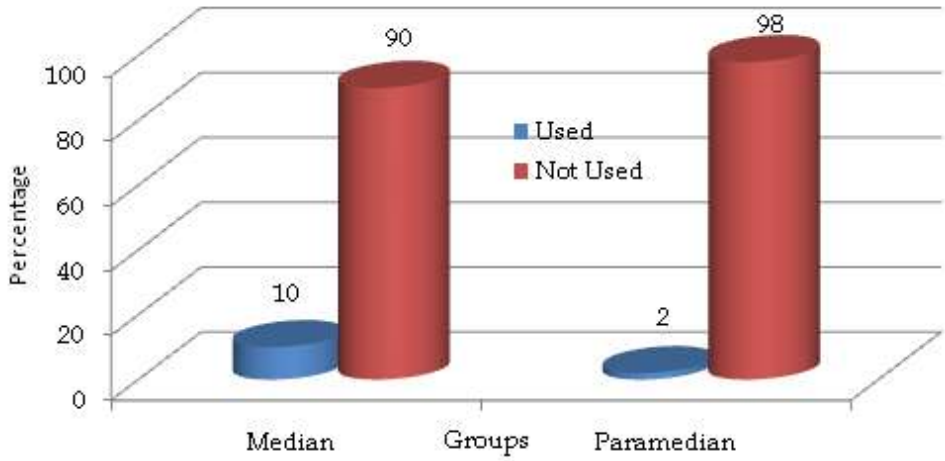
Backache	Group M	Group P	Chi-square value, df and p - Value
Absent	43 (86.0)	50 (100.0)	7.527; 1; 0.006
Present	07 (14.0)	0	
Total	50	50	



Graph 4: Multiple Bar diagram showing Backache among Group M and Group P

Table 6: Distribution according to use rescue analgesia among the study group subjects

Rescue Analgesia	Group M	Group P	Chi-square value, df and p- Value
Used	05 (10.0)	01 (02.0)	
Not Used	45 (90.0)	49 (98.0)	2.837; 1; 0.092
Total	50	50	



Graph 5: Multiple Bar diagram showing use of rescue analgesia among Group M and Group P study groups subjects.

In Group M, use of rescue analgesia was more (10%) when compared to Group P (2%) though the difference between two groups is statistically insignificant, (p – value= 0.092), (Table 6, Graph 5).

Discussion

Postdural Puncture Headache (PDPH) is the most common complication following spinal anesthesia and presents within *48–72 hours* after dural puncture and last for several days.[2]

The loss of CSF from the intrathecal space is the main causative factor. The CSF leakage results in fall in intracranial CSF volume and CSF pressure causing gravitational traction on the pain sensitive structures causing headache.[7,8]

The loss of CSF may result in compensatory adenosine receptor mediated intracranial vasodilatation leading to PDPH.[13,14]

Spinal anesthesia is performed using either median or paramedian approach. The median approach is the most commonly used.[15] Midline approach involves passage of the needle through supraspinous, interspinous and ligamentum flavum. Technically it may be difficult to perform the midline approach especially in elderly patients (calcified ligaments), obese individuals and in parturients (difficulty in positioning).[16]

Alternatively, paramedian approach which is technically easier can be used which avoids the midline ligamentous structures and hits the ligamentum flavum directly after passing through the paraspinal muscles. The paramedian approach does not require flexed position as in midline approach.[16,17]

The paramedian approach may result in decreased incidence of PDPH as there is less leakage of CSF because of valvular mechanism created due to perforation of dura matter and arachnoid matter at different angles.[18,19] As female gender and pregnancy are well-known risk factors for PDPH, we hypothesized to conduct our study on obstetric patients posted for elective cesarean section under spinal anesthesia.

Rabinowitz A *et al*. conducted a prospective randomized study on 40 patients posted for hip surgery under Continous Spinal Anesthesia (CSA) and compared the two approaches for success rate of CSA which revealed that the first attempt success rate was 85% in paramedian approach as compared to 45% in median approach.[20] In our study. the first attempt success rate was 96% in Group P as compared to 86% in Group M.

Haider *et al.* conducted a randomized clinical study on 50 patients posted for elective below umbilical surgery and compared the incidence of Postdural Puncture Headache (PDPH) in median

and paramedian approaches. Only 4% in Group P had PDPH as compared to 28% in Group M. Thus they concluded the paramedian approach has lesser incidence of PDPH as compared to median approach.[21] Even in our study, the incidence of PDPH is less in Group P (4%) as compared to Group M (18%).

Sheybani *et al.* also studied two approaches of subarachnoid block for the incidence of postdural puncture headache and low backache. Results of the study showed that the incidence of PDPH is less in paramedian approach (12%) as compared to median approach (15%).[22] Our study results also show lesser incidence of PDPH and low backache in Group P (4% and 0%) as compared to Group M (18% and 14%) respectively.

Behery A and Mohammed E had done a randomized clinical trial on 120 elective cesarean section patients for the incidence of PDPH and low backache. Results of the study showed that the incidence of PDPH was less in paramedian approach (5.2%) as compared to median approach (19.6%). Similarly the incidence of low backache was less in Group P (1.7%) as compared to Group M (7.1%).[11] Our study also revealed the similar results.

Janik R and Dick W conducted a randomized study on 250 patients undergoing transurethral prostate surgery under spinal anesthesia for incidence of PDPH and reported a significantly higher rate of PDPH with paramedian approach than the median approach in younger age patients.[23] However, our study done on young patients shows contrarary results.

Li JY *et al*. compared the incidence of Postdural Puncture Headache (PDPH) between median and paramedian approaches of spinal anesthesia on 700 women posted for cesarean section under spinal anesthesia which revealed lower incidence of PDPH in paramedian approach (0.9%) as compared to median approach (4.3%).[24] Our study, also revealed the similar results.

Mosaffa F *et al*. conducted a double blind randomized controlled trial on 150 patients undergoing orthopedic surgery under spinal anesthesia and compared the incidence of PDPH among median and paramedian approach. The study concluded that there is no significant difference in PDPH incidence between the two and therefore, recommended the use of paramedian approach in elderly patients with degenerative changes in the spine and intervertebral spaces.[25]

The main limitation of this study is smaller sample size. The number of patients may be small to draw any firm conclusion regarding superiority of paramedian approach over median approach in reducing PDPH incidence in patients undergoing elective cesarean section under spinal anesthesia. In fact, the results of our study proposes the need for conducting more studies with larger sample size to establish whether median or paramedian approach is better in reducing PDPH.

Conclusion

We conclude that the incidence of postdural puncture headache and low backache is less in paramedian approach as compared to median approach. However, it needs further investigation with more randomized control trials to know the superiority of paramedian approach over median in reducing the incidence of postdural puncture headache.

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Case Report

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Anticipated Difficult Airway Management in a Known Case of Neurofibromatosis with Normal Pressure Hydrocephalus Posted for V-P Shunt

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Abstract

Introduction: Neurofibromatosis is a rare inherited autosomal dominantdisorder characterized by multiple benign tumours and spots of increased skin pigmentation. The commonest member of the group is neurofibromatosis Type-1. An estimated 5% of patients with NF1 have an intra-oral manifestation of the disease. *Case Report*: A 60-year-old female patient, with neurofibromatosis Type 1 was diagnosed with normal pressure hydrocephalus. She had diffuse dermal neurofibromas, peripheral IV line access proved impossible and central venous catheter in the right subclavian vein. She also had history of previous surgery for attempted V-P shunt which was postponed due to increased scalp bleed in which tracheal narrowing was noted with co-existing cervical spondylosis and altered neck anatomy as predictors for airway difficulty. Successful intubation by flexible fiber-optic was carried out without any airway block and the surgery concluded without any difficulties. *Conclusion:* Flexible fiber-optic laryngoscopy is a well-established and versatile tool for managing patients with known or suspected difficult airway and Neurofibromatosis is a rare pathology in surgical centres, which requires anesthetist to know its peculiarities and give special focus.

Keywords: Difficult airway; Hydrocephalus; Neurofibromatosis.

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Introduction

Neurofibromatosis is a rare inherited autosomal dominantdisorder characterized by multiple benign tumours and spots of increased skin pigmentation. It originates from endoneurium (sheath of Schwann), theoretically originating in all innervated tissues and organs, trachea being rarest.

The commonest member of the group is neurofibromatosis Type 1 (NF1) which varies in severity but can affect all physiological systems. An estimated 5% of patients with NF1 have an intra-oral manifestation of the disease.[1] Discrete neurofibromas may involve the tongue or the larynx.

Even if intra-oral pathology is recognized pre-operatively, elective awake fibreoptic tracheal intubation may fail because of a grossly distorted anatomy. The presence of macroglossia, macrocephaly, specific mandibular abnormalities

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and cervical spine involvement may contribute to difficulties of airway management.

Scoliosis with rotation may also occur and produces a reduction in lung volume, which if severe, may result in respiratory failure. Many reports suggested an increased sensitivity of patients with NF1 to non-depolarizing neuromuscular blocking drugs.[2–5]

In addition cardiovascular abnormalities, such as congenital cardiac malformations, vasculopathy, and hypertension. They may have cognitive disorders and a greater prevalence of other neoplasms, such as rhabdomyosarcomas, Gastrointestinal Stromal Tumors (GIST), pheochromocytomas, carcinoid tumors and ganglioneuromas.[6]

Case Report

A 50-year-old lady, who was a known case of Neurofibromatosis-1 presented to neurosurgery OPD with a history of difficulty in walking since *15 days*, intermittent headache and vomiting since *1 month*, (Fig. 1). She was admitted and diagnosed with normal pressure hydrocephalus and was posted for V-P shunting. No history of any comorbidities. History of previous V-p shunt surgery under GA postponed due to excessive bleeding of the scalp in which mild tracheal narrowing was noted.

The patient was moderately built and nourished, vitals stable. On systemic examination cardiovascular, respiratory, per abdomen were normal. In central nervous systemic examination, there was decreased motor power in both lower extremities (4/5), No sensory deficits, deep tendon reflexes were brisk and bilateral plantars were mute. Blood investigation was within normal limits. She was not co-operative to assess the airway. Due to diffuse dermal neurofibromas, peripheral IV line access proved impossible and central venous catheter was placed in the right subclavian vein. CT brain showed Ventriculomegaly with Normal pressure hydrocephalus, MRI showed cervical and lumbar spondylosis with osteopenia and non-obstructive hydrocephalus (Figs. 2 and 3). On table airway difficulty was anticipated and awake fiber-optic intubation was planned.

The patient was pre-medicated with inj. Glycopyrrolate, inj Fentanyl and sedated with Dexmedetomidine infusion. Airway blocks were not possible due to the distorted anatomy of the neck. Only topical anesthesia was given and she was intubated under fiber-optic visualization, (Fig. 4).

She was maintained with Nitrous oxide, Isoflurane, and inj Vecuronium. After the conclusion of surgery, the patient was reversed with Glycopyrrolate and neostigmine and awake extubation was done.

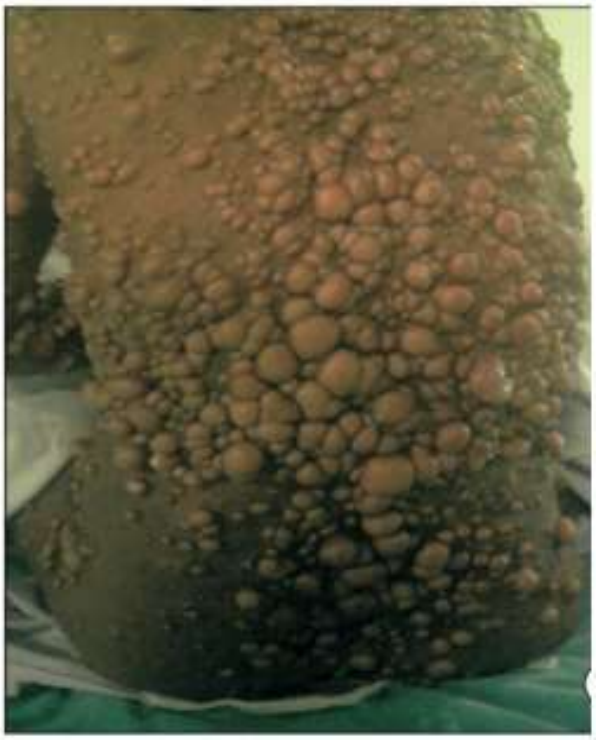

Fig. 1: Patient with multiple neuromas

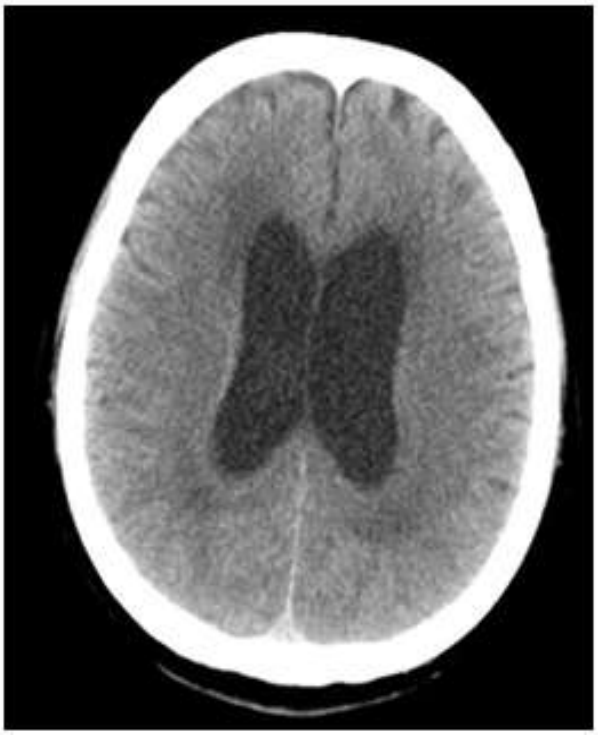

Fig. 2: CT Brain showing Ventriculomegaly

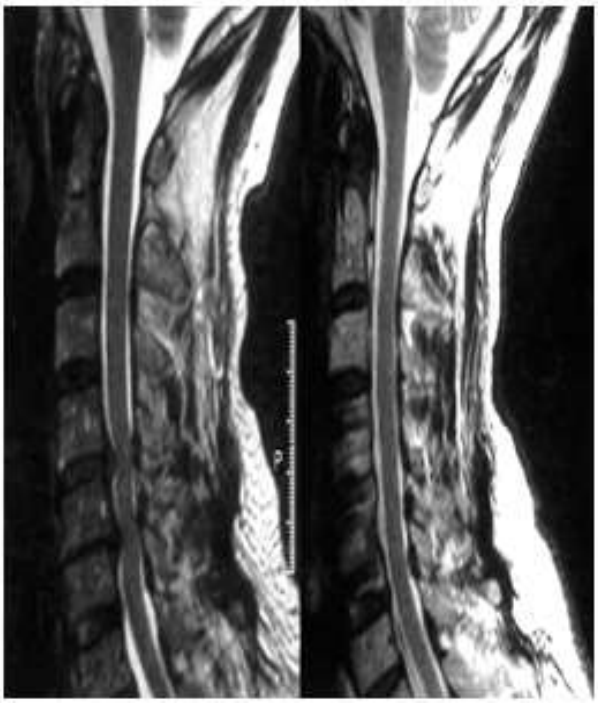

Fig. 3: MRI cervical spine showing Spondylosis

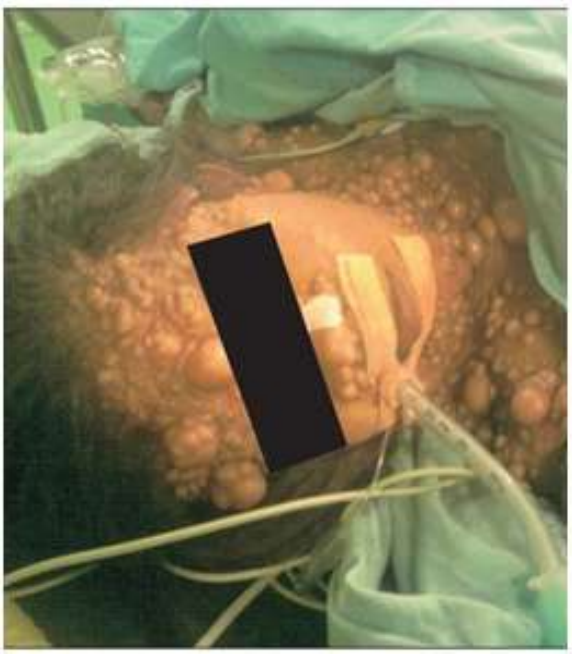

Fig. 4: Intubated patient

Discussion

Neurofibromatosis offers a challenge to the anesthesiologist because of the variety of comorbidities in many organs and systems. Awake intubation using fiberoptic bronchoscope has been considered as the gold standard for the management of such patients.

But in one case report where the anatomy was so severely distorted as to hamper fiber-optic intubation Airtraq was used for awake intubation.[7] Advantages are that it is not necessary to align oral, pharyngeal, and laryngeal axis and also less force is required to visualize glottic opening there is a lesser hemodynamic stress response. Besides, it is cheap, portable, and requires a shorter learning curve[8] compared to the fibre-optic bronchoscope.

Trans-tracheal jet ventilation may be considered when supraglottic ventilation devices fail. If all other measures fail to establish ventilation, cricothyrotomy or tracheostomy may be life-saving.

In another case, Rendell Baker Soucek mask and left molar approach for ventilation and tracheal intubation was done in a patient of massive neurofibroma of face scheduled for debulking of the mass. Abnormal facial anatomy was responsible for ineffective ventilation with a facemask. They concluded that the ability to achieve adequate mask ventilation should always be assessed pre-operatively and in patients with expected difficult mask ventilation, the safest approach is to plan for awake intubation.[9]

In another case of NF direct laryngoscopy revealed a Cormack-Lehane Grade 2 view, and there were bilateral posterior bulges of tissue into the supraglottic region extending into the midline, the patient was intubated with a smaller size tube as the patient was not co-operative for awake fiber-optic intubation hence rigid laryngoscopy with manual inline stabilization was done and surgery was uneventful.[10]

In our case, due to the past intubation history, cervical spondylosis and obvious nature of the disease we anticipated airway difficulty due to lesions in the oropharyngeal region as airway examination was not possible and we went ahead with awake fiber-optic intubation.

Conclusion

Flexible fiber-optic laryngoscopy is a well-established and versatile tool for managing patients with known or suspected difficult airway and we successfully intubated the patient and the surgery commenced and concluded with no difficulties.

Key Messages

Neurofibromatosis can be discreet with isolated

lesions or very diffuse as in our case. We had difficulty in securing IV access, to administer airway blocks, our patient had cervical spondylosis also. We are presenting this case emphasising difficult airway management and use of CVP for IV access.

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Conflicting Interest: Nil

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Case Report

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Intra-operative Anaphylaxis Due to Gelofusine in A Patient Undergoing Emergency Cesarean Section

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Abstract

Background: Anaphylaxis due to a colloid plasma expander can occur peri-operatively even though it is uncommon. *Case Presentation:* This the case report of an intra-operative anaphylaxis due to gelofusine in a 31 year old Caucasian female who underwent emergency lower segment caesarean section. The patient was managed successfully and the procedure was completedly uneventfully. *Conclusion:* A high index of suspicion, immediate diagnosis and rapid institution of treatment are essential for a safe outcome of such incidents.

Keywords: Anaphylaxis; Gelofusine.

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Introduction

Colloid solutions are widely used during surgery and play an essential role in volume resuscitation of the severely hypovolemic patient.[1] They expand the intravascular volume and help reduce the requirement of blood transfusions. They also provide time for full blood cross-matching to be carried out. Anaphylactoid reaction to Gelofusine, which contains succinylated gelatine and other plasma expanders have an estimated incidence of 0.07–0.15%.[1,2] However, this can be life-threatening if not promptly diagnosed and treated accordingly.

These reactions are usually of Type 1, IgE-mediated which cause the production of antibodies through prior sensitization, whereas in many cases they may occur without any previous documented exposure. The reactions are referred anaphylactoid when there is no prior exposure for the production of the antibody-antigen reaction of true anaphylaxis.[1,3]

Case Report

A 31-year old Caucasian female patient G2P1L1 came to the obstetric department with chief complaints of pain in the lower abdomen for *two days* and is perceiving active fetal movements. A complete general and physical examination done, and no abnormalities were detected. Complete routine blood investigations were done, and radiological evaluation in the form of ultrasonography revealed Placenta Previa Type 2B posterior. After a complete evaluation of the patient, the obstetrics department has decided to perform Emergency lower segment cesarean section and informed the same to the department of anesthesia.

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Pre-anesthetic checkup done bedside, and the patient was shifted to operation theatre and connected to standard monitors and baseline vital parameters were noted. IV access secured with 18 gauge cannula and connected to IV fluids. Under strict aseptic conditions a subarachnoid block at a lumbar spine level of L3-L4 with 25 gauge Quincke's needle and *2 ml* (*10 mg*) of 0.5% hyperbaric Bupivacaine. Adequate analgesia was achieved to a level of T6.

Surgeons initiated the procedure within a few minutes a single live male child was delivered with a birth weight of *3.2 kg* and APGAR score between 8 and 9. in view of postpartum hemorrhage along with hypovolemia and hypotension; intravenous gelofusine was started as a prophylactic measure. Within a *few minutes* after starting the infusion patient complained of dyspnea and severe itching. There was swelling of lips and severe facial edema. Dyspnea was progressing in intensity. There was a sudden fall of blood pressure, and immediately, the infusion was stopped. The patient has been given ventilatory assist with bag and mask ventilation. Hypotension was corrected with repeated doses of vasopressor agents like mephentermine and phenylephrine. A total of *200 mg* of Inj Hydrocortisone 300 micrograms of Inj Adrenaline was given. Nebulizations with Adrenaline, ipratropium bromide, salbutamol, budesonide were given. The placenta was delivered entirely, and the remaining intra-operative course was uneventful. The Patient was shifted to the post-operative ward for further care and management.

Discussion

Colloids or plasma expanders play an essential role in volume resuscitationduring the peri-operative period. However, there is debate regarding the relative merits of colloid *vs* crystalloid solutions as colloids can induce an anaphylactoid reaction which could potentially be life-threatening if left untreated.[4]

Such reactions often occur within a *few minutes* of starting the infusion. Therefore, early and frequent monitoring is needed,[1] the reactions have been graded in severity on a scale of 1–5 and tend to be under-reported.

Not all the gelatins share the same molecular structure, Haemaccel and plasma gel are urea linked, whilst Gelofusine is a succinate-linked gelatine. Hepner and Castells described that there is no significant cross-reactivity between various colloids, so a particular allergy to one should not prevent the use of another.[7] However, in the case of Haemaccel and Gelofusine, which differ only in their linkage to urea or succinate, their cross-reactivity has been documented by intradermal skin prick testing.[8] Therefore, any patient known to be allergic to one should be assumed as being allergic to others until proven otherwise.

There were case reports of anaphylactoid reactions to all of gelatine based colloids, with varying degrees of response severity. Often due to the administration of multiple drugs during anesthesia, it may be difficult to elucidate a single agent causing the anaphylactic response. In severe reactions, it is necessary to abandon the operative procedure until the patient has been stabilized and further investigations to be done to identify the cause.[5] Utmost care must be taken once there is a suspicion of allergy due to the possibility of a reaction to other gelatine based colloids or escalating anaphylactic response with further infusion.[6]

Diagnosis can be a challenge in most circumstances. Some of the features of anaphylactic response to an agent are similar to the effects of anesthesia itself. Most anesthetic agents cause vasodilation, hypotension, and potential cardiopulmonary dysfunction due to their direct and indirect effects on the cardiovascular system. This can pose difficulty in distinguishing one from the other. The standard diagnostic technique is skin prick testing. This may be supplemented by detection of specific IgE by radio immune assay.

Apostolou *et al*. stated that the use of *in vitro* Basophil Activation Test (BAT) as a safe and reliable assay test to Detect gelofusine sensitivity. This method utilizes detection of surface expression of lysosomal membrane glycoprotein CD63 on activated basophils.[9] The Leucocyte Histamine Release Test (LHR) which measures histamine release in response to gelatin solutions *in vitro* has been described but remained mostly as a research tool.[5]

Conclusion

Although colloids have a risk of anaphylactoid reaction, this is negligible when compared to other drugs like penicillin, which carries a risk of adverse reaction from 1–5%.[10] Colloids increase the intravascular volume and decrease the requirement for transfusion, but one must be cautious while using colloids. Extreme vigilance diagnosis should ensure prompt resuscitation in the event of anaphylaxis.

Consent: Informed consent obtained from the patient for publication of this case report.

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Case Report

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Management of a Patient with Apical Hypertrophic Cardiomyopathy with Subacute Intestinal Obstruction

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Abstract

Introduction: Apical Hypertrophic Cardiomyopathy (AHCM) is a rare form of Hypertrophic Cardiomyopathy (HCM) which inherits in autosomal dominant pattern affects 1:500 individual, is localized to left ventricular apex with or without formation of apical aneurysm. Although patients are asymptomatic in resting conditions, anesthesia and surgical stress may lead to exacerbation of the left ventricular outflow tract obstruction (LVOT) obstruction and may complicate perioperative course. *Case Report:* A 65 *years* old female patient diagnosed with Apical hypertrophic cardiomyopathy presented with primary peritonitis posted for emergency exploratory laparotomy and proceed on Tab Verapamil 160 *mg* twice daily. We managed this case successfully considering understanding of pathophysiology, hemodynamic changes and anesthetic implications needed for successful perioperative outcome. *Conclusion:* Patients with apical hypertrophic cardiomyopathy undergoing noncardiac surgery require thorough understanding of hemodynamic changes, proper intraoperative vigilance, avoiding factors that may increase left ventricular outflow tract obstruction with proper medication and intravenous fluid therapy.

Keywords: Anesthesia; Apical hypertrophic cardiomyopathy, Intestinal obstruction.

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Introduction

Apical Hypertrophic Cardiomyopathy (AHCM) is a rare form of hypertrophic cardiomyopathy (HCM) in which hypertrophy is localized to left ventricular apex with or without formation of apical aneurysm. Inherited in autosomal dominant pattern involves mutation in MYBPC3 and MYH7 affects 1:500 individual.[1,2] Although majority of patients are asymptomatic throughout life, some present with severe limiting symptoms of dyspnoea, angina and syncope and few may die suddenly because of cardiac arrhythmias. Left Ventricular Outflow Tract obstruction (LVOT) can be precipitated by sympathetic stimulation and decrease in preload and after load to left ventricle,[3] Hence, these patients pose higher risk for perioperative events.

Case Report

A *65 years* old female patient, weighing *58 kgs* presented with complaints of acute pain abdomen

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since, *1 day*, sudden in onset, progressive in nature, not subsided with analgesics and anti-spasmodics, not associated with vomiting, fever and loose stools. She was diagnosed with primary peritonitis posted for emergency exploratory laparotomy and proceed. Past history of irregular bowel habits present since *3 years*. She was diagnosed with Apical cardiomyopathy on regular medication (Tab Verapamil *160 mg* twice daily) presently asymptomatic and diabetes mellitus under dietary control.

Examination revealed mild pallor, pulse rate of *82/min* and blood pressure of *130/90 mm Hg*, respiratory rate of *20 per minute* and was afebrile. Systemic examination of cardiovascular, respiratory, central nervous system was normal with per abdomen examination of soft abdomen with no guarding or rigidity with presence of upper abdomen distension. Laboratory investigations were normal except for hemoglobin *9.1 gm* % and WBC 14,500. Electrocardiogram showed deep negative T waves V1–V6, (Fig. 1).

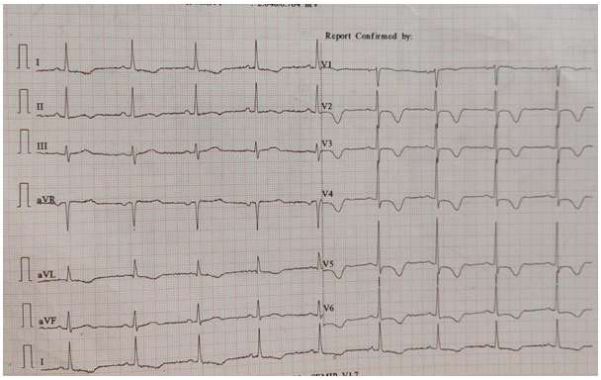

Fig. 1: ECG showing Deep T inversions in V12 to V6 leads

Anesthetic Management

Two 18 G IVC secured in right and left forearm, preloaded with *500 ml* RL. Ryle's tube which was *in situ* was aspirated. Monitoring included pulse oximetry, ECG, invasive blood pressure, end–tidal carbon dioxide and urine output. Premedicated with Inj glycopyrrolate *0.2 mg* IV, Inj Midazolam *1 mg* and Inj fentanyl *80 mcg* IV. Preoxygenation done with 100% oxygen for *3 min*. Induced with Inj Propofol *100 mg* IV. Lignocaine *1.5 mg/kg* was given to attenuate stress response. Endotracheal intubation was facilitated with Inj. Scoline *100 mg*, intubated with 7.0 size ET tube. Anesthesia was maintained with 50% nitrous oxide in oxygen and atracurium bolus dose *0.5 mg/kg* followed by maintenance doses of *0.1 mg/kg*, intermittent propofol with intermittent positive pressure ventilation. Futher analgesia was supplemented by Inj Neomol *1 gm* IV. Anti-arrhythmic drugs and external defibrillator were kept ready to tackle an inadvertent arrhythmic event inj Dexona *8 mg* IV was also given. The hemodynamic parameters were monitored which remained stable throughout the procedure. The procedure lasted for *90 min* during which 1.5l of crystalloids was given. Urine output and blood loss was measured.

Surgical findings were Multiple small intestine diverticula with pnuematocoeles which presented as primary peritonitis and stricture at terminal Ileum which was repaired with transverse ileoplasty (Figs. 2 and 3).

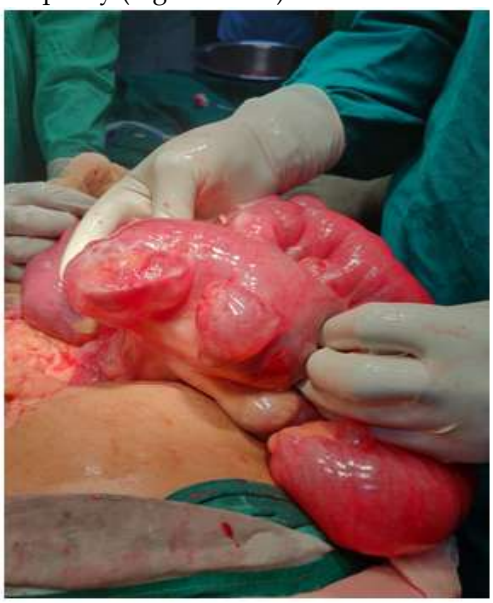

Fig. 2: Small intestine diverticula

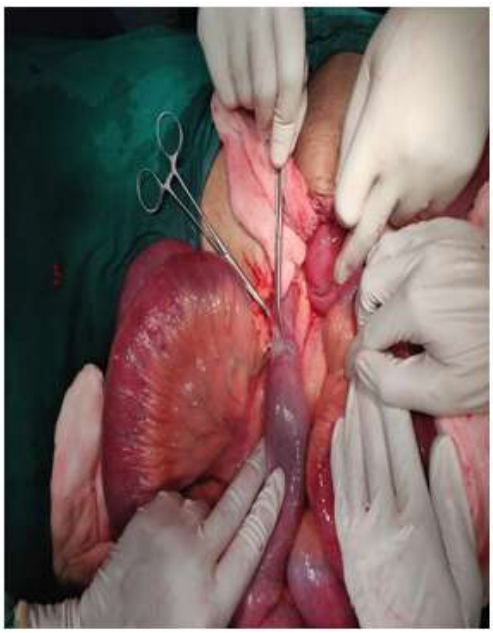

Fig. 3: Stricture at terminal ileum

At the end of surgery ultrasound guided bilateral transversus abdominis plane block was given for postoperative analgesia with Inj Lox 2% + Adrenaline *5cc* + Inj Bupivacaine *0.5% 5cc* each side, neuromuscular block was reversed with Inj Neostigmine *2.5 mg* and Inj Glycopyrrolate *0.4 mg* IV and extubated. Shifted to postoperative intensive care unitfor further observation and management.

Postoperatively Fentanyl patch was applied, Neomol *1 gm* IV TID was continued. 1 PCV was transfused, advised to do Incentive spirometry and fluid management accordingly.

Discussion

Rare form of hypertrophic cardiomyopathy which involves apex of left ventricle.[1] AHCM can be incidental finding, may present with chest pain, palpitation, dyspnoea, syncope, Atrial fibrillation, myocardial infarction, embolic events and congestive heart failure. Inherited in sporadic, autonomic dominant pattern.[2] Most frequent and classic ECG finding are giant negative T wave in precordial leads. Transthoracic–ECHO is initial diagnostic tool in evaluation of AHCM.

Hypertrophy is most common with upper intraventricular septum, below aortic valve leading to LVOT obstruction. This is accentuated by anterior motion of the septal leaflet of mitral valve, may also be diastolic dysfunction due to prolongation of isovolumetric relaxation time and decrease left ventricular volume. B-blocker and calcium channel blocker have been used to treat HCM.

In one of the case report for elective surgery posted for TURP, balanced general anesthesia using oral diazepam as premedication and induction and maintenance with fentanyl, thiopentone, atracurium, nitrous oxide in oxygen and sevoflurane was used.[3]

In another case, posted for PCNL with HCM, it was induced with midazolam *1 mg*, fentany *l100 mcg* and propofol *30 mg*. Esmolol *30 mg 3 min* before intubation to attenuate laryngoscopy response and also repeated during extubation.[4]

In one more case, posted for Modified Radical Neck Dissection, who was a known smoker and hypertensive on oral metoprolol and amlodipine, suddenly developed narrow complex tachycardia with Ventricular tachycardia of *180–200/min*. Halothane and nitrous oxide was discontinued and administered 100% oxygen. *3 mg* metaprolol was given slowly, when no response was observed diltiazem *10 mg* was administered IV and repeated with diltiazem *15 mg*. Ventricular rate decreased to *110/min*. Patient was transferred to ICU and put on ventilator with midazolam infusion and Inj metoprolol was continued *5 mg* thrice daily for heart rate control.[5]

Goal of anesthetic management in a patient with HCM for non-cardiac surgery is to prevent occurrence of LVOT obstruction, arrhythmias and diastolic dysfunction.[6,7]

Concerns during anesthesia and surgery are sympathetic stimulation arising out of laryngoscopy and intubation, incision, surgical stress and blood loss. Inappropriate monitoring may worsen dynamic outflow tract obstruction. Management in these patient is directed towards minimizing LVOT obstruction. Preloading before helps maintain stroke volume and minimizes adverse events of positive pressure ventilation. Premedication with midazolam helps alleviating anxiety and thus avoiding unnecessary sympathetic stimulation. Aggressive maintenance of sinus rhythm, maintaining preload and after load with selective alpha-1 agonist like phenylephrine preferred over ephedrine as it increases SVR without significant effect on myocardial oxygen demand and HR, administration of B-blocker or verapamil and suppression of sympathetic stimulation.

Conclusion

Patients with apical hypertrophic cardiomyopathy undergoing non-cardiac surgery require thorough understanding of hemodynamic changes, proper intraoperative vigilance, avoiding factors that may increase Left Ventricular Outflow Tract obstruction (LVOT) with proper medication and intravenous fluid therapy.

Key Messages

Managing anesthesia in a patient with Apical hypertrophic cardiomyopathy can be very challenging with obstructive symptoms, in our patient Verapamil was used for rate control and for avoiding tacchy–arrhythmias because tachycardia is not tolerated well in these patients, this can reduce cardiac output. Our patient presented with symptoms of acute abdomen with fluid levels in intestines and mild tacchycardia and anesthesia was planned meticulously and the outcome was good.

Prior publication: Nil

Support: Nil

Conflicts of interest: Nil

Permissions: Nil

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