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## Comparative Evaluation of Effect of Dexmedetomidine Versus Normal Saline on Blood Glucose Levels in Diabetes Mellitus Patients Undergoing Spinal Anaesthesia Surgeries

M Amogh<sup>1</sup>, P N Bhosle<sup>2</sup>

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### Abstract

**Context:** Surgical trauma gives rise to a stress response in the human body resulting in hyperglycaemia in the perioperative period. This adversely affects the patient's outcome. Hyperglycaemia is particularly detrimental in patients with diabetes mellitus. Dexmedetomidine, an alpha 2 adrenoreceptor agonist attenuates this surgical stress response and helps in preventing perioperative hyperglycaemia.

**Aims:** The aim of our study was to monitor and compare the effect of dexmedetomidine versus normal saline on blood glucose levels intraoperatively and postoperatively in patients with diabetes mellitus undergoing spinal anaesthesia surgeries. Other objectives were, to compare haemodynamic changes, Ramsay sedation scores intraoperatively and the requirement of analgesia in the postoperative period between both the groups.

**Methods:** A double blind prospective randomized controlled study was conducted in a tertiary hospital. Out of 60 patients with diabetes mellitus, 30 random patients were administered with intravenous dexmedetomidine after giving spinal anaesthesia. The other half of patients received a placebo. Vital parameters and blood glucose levels were monitored and compared in both the groups.

**Statistical analysis used:** Data was tabulated and compared using unpaired T-test.

**Results:** Statistically significant differences were found in mean heart rate and blood pressure between both the groups. The differences in the blood sugar values in the intra operative period and the postoperative period between both the study groups were also statistically significant. Requirement of additional postoperative analgesics were also considerably less in the dexmedetomidine group.

**Conclusion:** Intravenous dexmedetomidine attenuates the surgical stress response by inhibiting the adrenal surge and prevents hyperglycaemia.

**Keywords:** Dexmedetomidine; Surgical stress; Hyperglycaemia.

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### Introduction

Surgery is a stressful condition. In response to skin incision, blood loss, major intercompartmental fluid shifts, pain and infection there is increased cortisol levels along with other catabolic hormones resulting in substrate mobilization,

gluconeogenesis, protein breakdown etc.<sup>1,2</sup> Patients suffering from diabetes mellitus have an impaired glucose metabolism which predisposes them to hyperglycaemia.<sup>3</sup> Alpha 2 adrenoreceptor agonists such as clonidine and dexmedetomidine inhibit the sympathetic response as a result of surgical stress.

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**Email:** amogh2015@gmail.com

Other methods used in this aspect are, high dose benzodiazepines, opioids and regional anaesthetic techniques.<sup>4</sup> Dexmedetomidine is also widely used for procedural sedation and for sedation in the critically ill.<sup>5,6,7</sup>

## Methods

After obtaining approval from the ethical committee, a prospective double blind randomized clinical study was conducted in a tertiary hospital, Pune, India. 60 patients aged 30-70 years with controlled diabetes mellitus and belonging to ASA physical status II, posted for elective surgeries under spinal anaesthesia were enrolled. Preop evaluation was done for each patient and HBA1c values were measured to exclude those with uncontrolled diabetes mellitus. Patients with severe cardiovascular disease, renal or hepatic dysfunction, mental retardation, or coagulation abnormality were excluded from the study.

Written informed consent was obtained from each patient and on the day of surgery, standard monitors were attached in the OR and vital parameters were noted. Blood sugar level was measured as the preop value using a portable glucometer. Patients were preloaded with normal saline and spinal anaesthesia was administered using standard protocol. After obtaining adequate sensory and motor level, 30 patients selected randomly by chit technique were administered with intravenous dexmedetomidine infusion (group D) at 0.5 mcg/kg over 10 minutes. The other 30 patients (group P) were administered normal saline of similar volume as placebo. Vital

parameters along with degree of sedation using Ramsay sedation scores were closely monitored for each patient throughout the intraoperative period. After 1 hour of injection of dexmedetomidine/placebo, an intraoperative measurement of blood glucose level was taken. Further readings of blood glucose levels were taken at 1 hour, 3, 6 and 12 hours postoperatively. Adverse effects such as hypotension, bradycardia, hypoglycaemia, and nausea and vomiting were watched for.

## Statistical analysis

Results were tabulated and were analysed using unpaired T test and SPSS software.

## Results

The gender, age group, and HBA1C values of patients in group D were comparable with those in group P. preoperative Blood glucose levels of all the patients were also comparable amongst both the study groups. Heart rate, systolic, diastolic and mean arterial blood pressures of patients belonging to group D were lower when compared to those of group P and these differences were statistically significant. Ramsay sedation scores of the patients showed that patients in group D were better sedated compared to those in group P and this difference was again statistically significant. Requirement of postoperative analgesia was significantly higher in the patients who did not receive dexmedetomidine intraoperatively. None of the patients in either group had any adverse effects in the postoperative period.

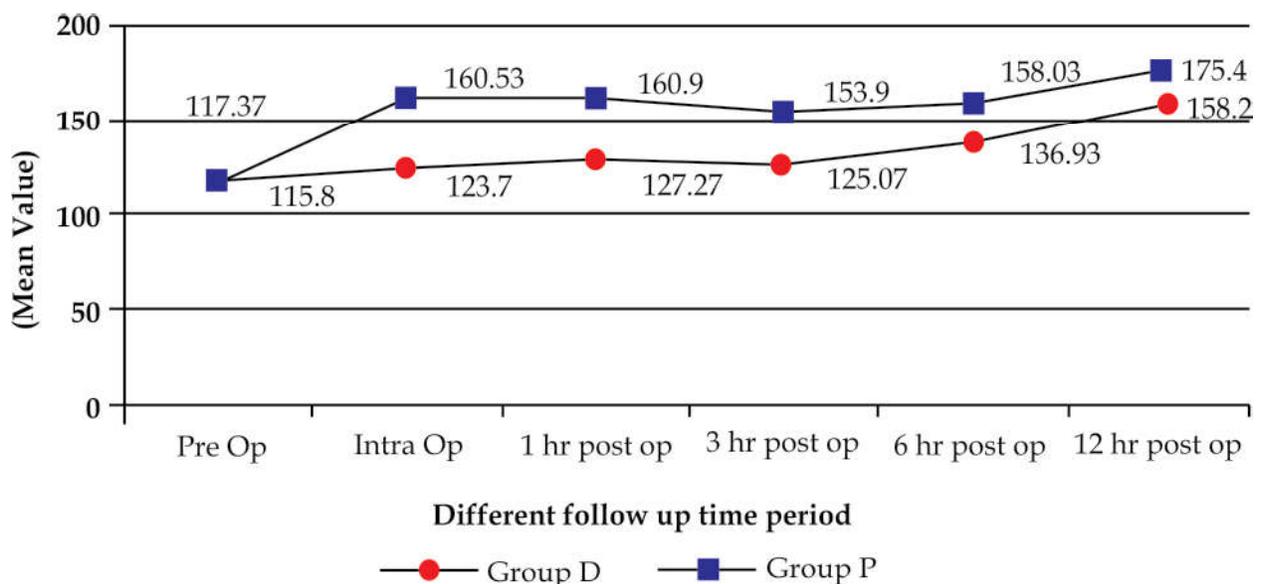


Fig. 1: Trend line diagram of comparison of mean BSL (mg/dl) between two groups.

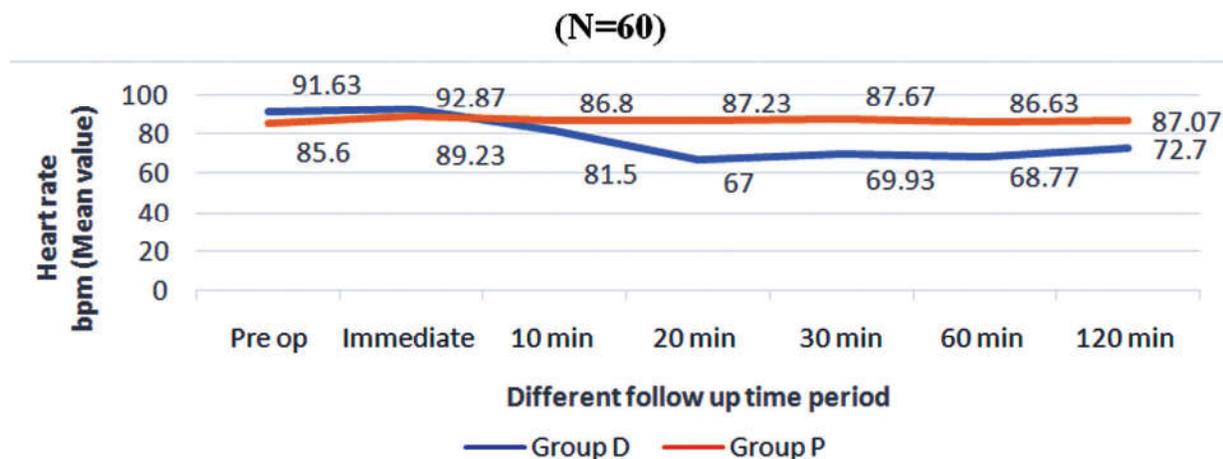


Fig. 2: Trend line diagram of comparison of mean heart rate between two groups.

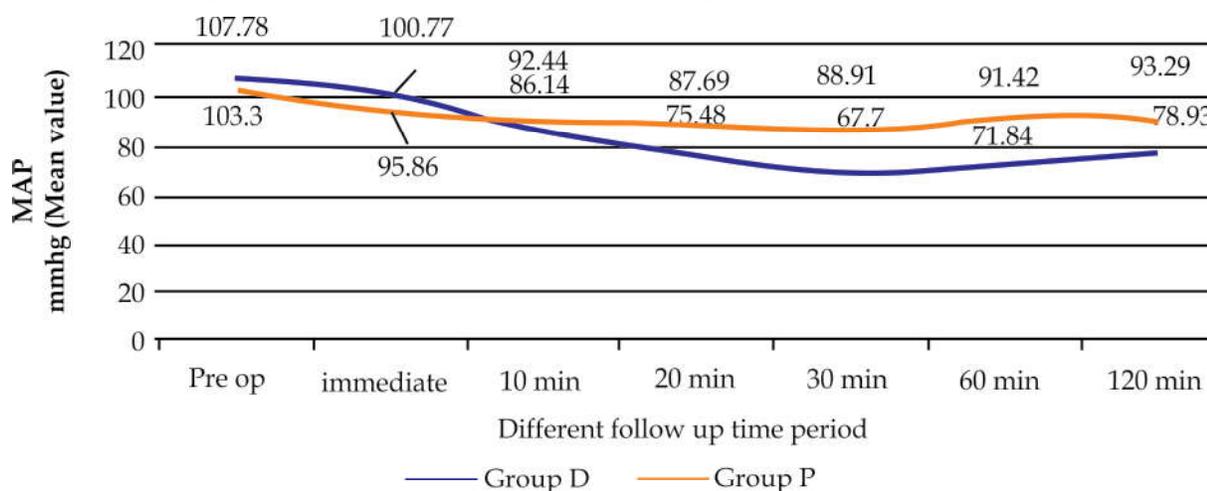


Fig. 3: Trend line diagram of comparison of mean MAP between two groups.

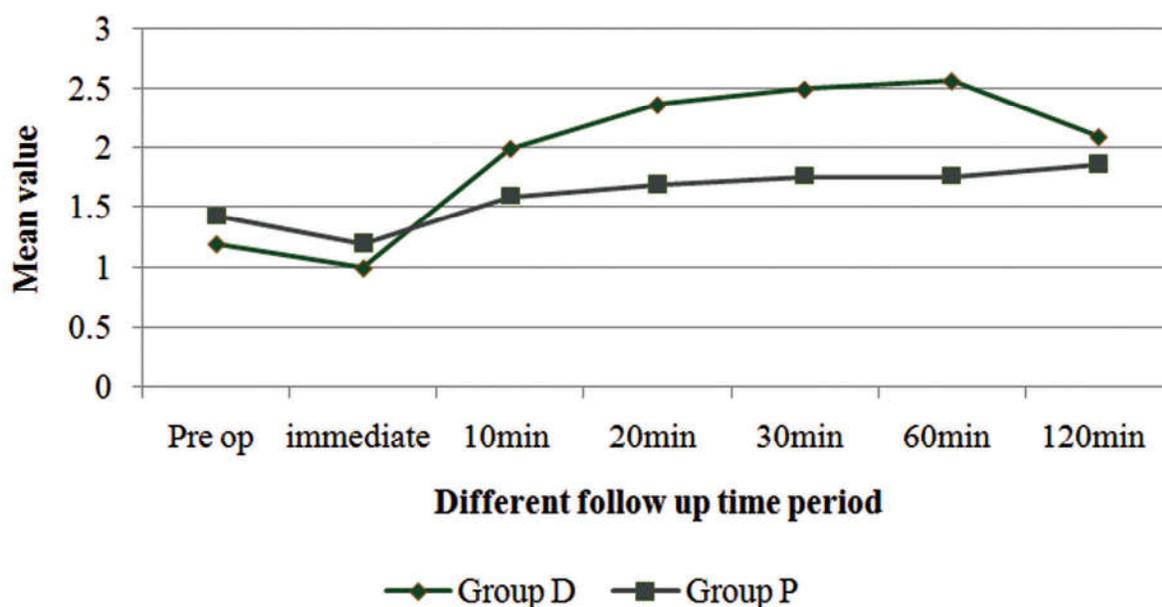


Fig. 4: Trend line diagram of comparison of mean Ramsay Sedation Score(RSS) between two groups (N=60).

## Discussion

Surgical stress response has adverse effects on the patient's outcome depending on the intensity of surgical trauma. Perioperative hyperglycemic response has a direct relation with morbidity and mortality. These surges in blood glucose levels are mostly due to the endogenous sympatho-adrenal response. It is very much necessary to blunt the surgical stress response.

In our study, we have administered intravenous dexmedetomidine in patients undergoing spinal anesthesia surgeries to control the hyperglycemic response intraoperatively. Although, regional anesthetic technique itself controls the BSL rise intraoperatively, additional use of alpha 2 adrenergic receptor agonists has a better outcome.

Total number of patients studied were sixty, of age group of 30-70 years and belonging to ASA physical status II with controlled diabetes mellitus with respect to HBA1C. the surgeries under spinal anaesthesia with a duration of 1.5-2.5 hours were considered. Each patient in Group D received 0.5mcg/kg of intravenous dexmedetomidine after

administration of spinal anaesthesia. All patients of group P received placebo (normal saline). We observed BSL preoperatively, at 1hour post injection intraoperatively and postoperatively at 1,3,6 and 12 hours in both the study groups.

Table 1 shows that mean age of patients (group D -  $54.27 \pm 10.53$  years, group P -  $53.47 \pm 9.13$  years, p value - 0.754) and HBA1C values (Group D - 5.98%, Group P - 5.91%) are comparable in both the groups. In the study conducted by **Hui Yun et al**<sup>8</sup>, the mean HBA1C levels were 7.4% and 7.2% in the saline group and dexmedetomidine, respectively and were at slightly higher levels compared to ours. As shown in table 1, the mean BSL in preoperative period were comparable in both groups (Group D -  $115.80 \pm 11.97$ mg/dl, Group P -  $117.37 \pm 11.58$  mg/dl; p value - 0.608). Mean BSL in the intraoperative period after 1 hour of dexmedetomidine injection was 123.70 mg/dl while in the placebo group it was 160.53 mg/dl. In the post-operative period after the 1st hour, the mean BSL in group D was 127.27mg/dl while it was 160.90 mg/dl in group P. Similarly, the mean BSL values in the subsequent postoperative period i.e., at 3 hours, 6 hours and at

**Table 1:** Comparison of results between Group D and Group P.

		Group D	Group P	p- value
Mean Age(years)		$54.27 \pm 10.53$	$53.47 \pm 9.13$	0.754
Mean HBA1C(%)		$5.98 \pm 0.27$	$5.91 \pm 0.27$	0.372
Mean Blood sugar levels (BSL) (mg/dl)	preop	$115.80 \pm 11.97$	$117.37 \pm 11.58$	0.608
	Intraop	$123.70 \pm 11.14$	$160.53 \pm 12.01$	<0.001*
	1hr post op	$127.27 \pm 12.81$	$160.90 \pm 16.67$	<0.001*
	3hr post op	$125.07 \pm 13.49$	$153.90 \pm 16.37$	<0.001*
	6hr post op	$136.93 \pm 15.69$	$158.03 \pm 17.34$	<0.001*
	12hr post op	$158.20 \pm 14.16$	$175.40 \pm 21.07$	0.001*
Mean Heart Rate (beats per minute)	Immediately after injection	$92.87 \pm 8.52$	$89.23 \pm 8.44$	0.102
	10 min	$81.50 \pm 8.03$	$86.80 \pm 5.93$	0.005*
	30 min	$69.93 \pm 11.69$	$87.67 \pm 7.03$	<0.001*
	120 min	$72.70 \pm 13.32$	$87.07 \pm 11.58$	<0.001*
Mean MAP(mmHg)	Immediately after injection	$100.77 \pm 6.14$	$95.86 \pm 7.27$	0.006*
	10min	$86.14 \pm 10.05$	$92.44 \pm 5.52$	0.004*
	30min	$67.70 \pm 3.38$	$88.91 \pm 8.09$	<0.001*
	120min	$78.93 \pm 6.38$	$93.29 \pm 6.42$	<0.001*
Mean Ramsay sedation score	Immediately after injection	$1.26 \pm 0.44$	$1.20 \pm 0.41$	0.586
	10min	$2.00 \pm 0.00$	$1.60 \pm 0.50$	<0.001*
	30min	$2.50 \pm 0.51$	$1.77 \pm 0.43$	<0.001*
	120min	$2.10 \pm 0.31$	$1.87 \pm 0.35$	0.008*
Requirement of postop analgesia		12 (40%)	20 (66.7%)	0.038*

12 hours were lower in group D when compared to group P and the differences were statistically highly significant. Similar findings were obtained by **Hui Yun et al**<sup>8</sup> where the BSL levels were maintained for upto 24 hours in the Dexmedetomidine group with respect to normal saline. In their study, two patients in the group which had received normal saline were treated with dextrose injection for symptomatic hypoglycemia in the postoperative period while, another two patients had to be treated with insulin for hyperglycemia within first 24 hours of postoperative period. But, in our study we have monitored the BSL upto 12 hours postoperatively and none of our patients had hypoglycemic or hyperglycemic episodes in the observation period. **SS Harsoor et al**<sup>9</sup> in 2014, had studied 40 cases of abdominal surgeries under general anaesthesia. 20 patients received dexmedetomidine i.v infusion throughout the surgery with an initial bolus dose. The findings were compared with the other group which received placebo. It was observed that after the 1<sup>st</sup> hour in the postoperative period, the mean blood glucose level in the placebo group was 136.95 ± 19.76 mg/dL while it was 118.2 ± 16.24 mg/dL in the dexmedetomidine group. It was found that this difference in mean BSL was statistically significant. The vital parameters such as heart rate (HR), systolic (SBP), diastolic (DBP) and mean arterial (MAP) blood pressures were observed and the results are shown in the table.

The observations were statistically, highly significant (p value <0.005) in the intraoperative period. Owing to the sympatholytic action of intravenous dexmedetomidine, the mean HR and mean blood pressure values of patients belonging to the dexmedetomidine group were less when compared to the placebo group and these were statistically significant. **SS Harsoor et al**<sup>9</sup> had observed in their study that there was reduction in heart rate in the dexmedetomidine group as compared to the placebo group and this was statistically significant. Although the mean systolic, diastolic, and mean arterial blood pressures were comparable in both of their study groups.

Dexmedetomidine induces sedation which is usually termed as "cooperative sedation" (conscious sedation).<sup>7</sup> We monitored Ramsay sedation score (RSS) in the intraoperative period and the findings are stated in table 1. It was observed that after 10 minutes intraoperatively in group D, the mean RSS was 2 while mean RSS of patients in group P was 1.60 and this was statistically significant. Patients in group D were better sedated and were cooperative with changes in position and verbal commands.

Few of the patients of the placebo group were found to be anxious regarding the surgical procedure.

Dexmedetomidine is known for its analgesic effect when administered at a dose of 0.5 mcg/kg. In our study, as shown in table 1, 40% of patients of group D required postoperative analgesia while 66.7% of group P patients required postoperative analgesia and this was statistically significant. In the study conducted by **Hui Yun et al**<sup>8</sup>, they found that 60% of normal saline group compared to 10% of dexmedetomidine group required additional analgesics postoperatively, which was a statistically significant. Postoperative pain also contributes to the surgical stress response and may impair the postoperative recovery process. Hence dexmedetomidine administration was found to be beneficial in this aspect.

## Conclusion

This study aimed at studying the role of intravenous dexmedetomidine in preventing the surgical stress response. We conclude that dexmedetomidine, when administered in patients with controlled diabetes mellitus undergoing surgeries under spinal anaesthesia, prevents the hyperglycaemic response in the intraoperative period and upto 12 hours postoperatively. Further, haemodynamic parameters i.e., heart rate and blood pressure are better controlled in the intraoperative period. Dexmedetomidine provides sedation and patients remain cooperative to verbal commands and do not undergo respiratory depression. Careful monitoring while administering dexmedetomidine proves beneficial and the anaesthesiologist can avoid any adverse effects in the intraoperative and postoperative period.

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## A Comparative Study Between Chlorpheniramine Maleate vs Cetirizine in Prevention of Intrathecal Morphine Induced Pruritus in Patients Undergoing Caesarean Section

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### Abstract

**Background and Objectives:** Morphine has been used spinally for postoperative pain management for long time. However post-operative nausea, vomiting and pruritus are some of the common adverse effects of it. The incidence of pruritus being 20-100%, the prevention of pruritus remains a major challenge. This study was conducted to compare the efficacy of chlorpheniramine maleate versus cetirizine in prevention of post-operative pruritus in patients receiving intrathecal morphine for lower segment caesarean section.

**Methods:** 60 parturients undergoing caesarean delivery were randomly allocated in 2 groups. All patients received intrathecal bupivacaine with 100mcg morphine. One group of patients received Inj chlorpheniramine maleate 45.5mg IV and in other group oral tablet cetirizine 10mg was used as antipruritic prophylaxis.

**Results:** In spite of antipruritic prophylaxis the overall incidence of pruritus was high in both the groups, but it was statistically higher in cetirizine group of patients (90%) when compared to CPM group (46.7%) p value =0.001. The number of patients requiring treatment were more in cetirizine group (66.7%) when compared to CPM group (57.1%), in whom pruritus was treated with Inj. Dexamethasone 8mg IV.

**Conclusion:** Inj chlorpheniramine maleate is better when compared to oral tablet cetirizine but neither Inj chlorpheniramine maleate nor tab cetirizine are useful in prophylaxis of intrathecal morphine induced pruritus in patients undergoing lower segment caesarean section.

**Keywords:** Intrathecal morphine; Inj chlorpheniramine maleate; Cetirizine; Pruritus; Antihistamines.

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### Introduction

Neuraxial opioids are one of the most frequently used methods of analgesia after caesarean delivery and other surgical procedures. The beneficial effect of neuraxial opioids used either alone or in combination with the local anesthetics is to augment and prolong intraoperative and postoperative analgesia.<sup>1</sup> Intraoperative administration of spinal

opioids reduce the need for systemic opioids postoperatively.<sup>2</sup> As, a single dose of spinally administered narcotic can provide substantial pain relief up to 18 to 24 hours postoperatively.<sup>3</sup> Hydrophilic opioids such as morphine provide excellent selective spinal analgesia because of small volume of distribution and slow clearance from the spinal cord.<sup>4</sup> Morphine has been used spinally

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for postoperative pain management for long time.<sup>5</sup> However post-operative nausea, vomiting and pruritus are some of the common adverse effects of it. The incidence of post-operative nausea, vomiting in patients with intrathecal opiate is 60-80% and pruritus is 20-100%.<sup>6</sup> Anti-emetics and anti-pruritic drugs are generally used to mitigate these effects. Although many studies have been done to prevent these side effects, prevention of post-operative pruritus remains a major challenge.

### Objective of The Study

To compare the efficacy of chlorpheniramine maleate versus cetirizine in prevention of post-operative pruritus in patients receiving intrathecal morphine for lower segment caesarean section.

### Materials and Methods

#### Inclusion criteria:

- Parturients in age group of 18-35years
- ASA grade II
- Elective caesarean section

#### Exclusion criteria:

- Patients who don't give valid consent
- ASA Grade III and IV patients
- Patients age less than 18 years and above 35 years
- Partuents with bad obstetric history

After obtaining approval from institutional ethics review board and written informed consent taken, we conducted our study on 60 patients who underwent LSCS during the period between November 2018 and November 2019.

Patients were allocated in one of the two groups using computer generated random allocation.

A thorough pre-anaesthetic check-up was done for all patients. Patients were instructed to be nil per oral, 6 hours for solids and 4 hours for liquids before the surgery.

After shifting to operation theatre, an 18 G IV access was obtained. Standard monitors like pulse oximeter, ECG and NIBP were connected and baseline vitals were noted. Subarachnoid block was performed in left lateral position at L3-L4 space using 26G Quincke Babcock spinal needle. All patients received intrathecal Injection of 2ml of 0.5% hyperbaric bupivacaine with 100mcg morphine.

After extraction of baby, Group A patients received intravenous chlorpheniramine maleate

45.5mg for post-operative pruritus.

In Group B patients oral tablet cetirizine 10 mg was given in the preoperative room with sips of water, 5 minutes prior to shifting the patient to operation theatre.

Postoperatively all the patients were shifted to recovery room.

Failure of pruritic prophylaxis was defined as any episode of itching that provokes the desire to scratch or use of rescue antipruritic.<sup>6</sup>

Pruritus was scored as<sup>6</sup>

Grade 0- no pruritus

Grade 1 - pruritus not requiring treatment

Grade 2 - pruritus requiring treatment.

In our study we used Injection Dexamethasone 8 mg IV as rescue antipruritic agent in grade II patients.

*Statistical analysis:* Categorical data were presented as frequency distributions and numeric data were represented as mean and standard error of mean. Statistical comparison between treatment groups was done by using Students t-test, Chi square test and Fischer's exact test. P<0.05 was considered statistically significant. Statistical analysis was performed with the SPSS (statistical package for social sciences) version 16.

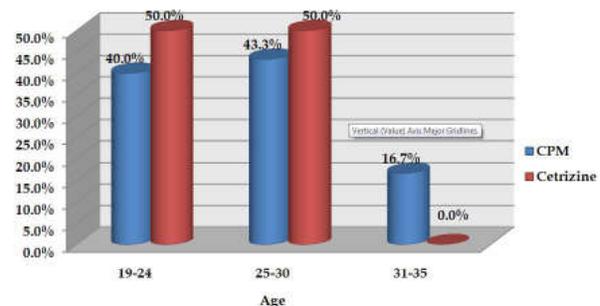
### Results

There was no significant age group difference in both the groups.

**Table 1:** Age Distribution.

Age	Group		Total
	1	2	
19-24	12(40%)	15(50%)	27(45%)
25-30	13(43.3%)	15(50%)	28(46.7%)
31-35	5(16.7%)	0(0%)	5(8.3%)
<b>Total</b>	30(100%)	30(100%)	60(100%)

**Graph 1:** Age Distribution.



**Table 2:** Mean age group difference.

Group	N	Mean	Std. Deviation
CPM	30	26.13	4.289
Cetirizine	30	24.57	2.921

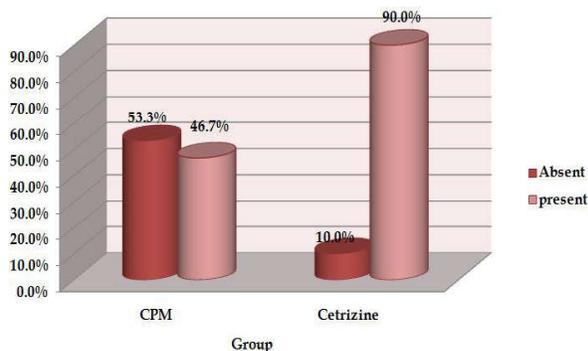
t= 1.65 p= 0.104(NS)

**Table 3:** Incidence of Pruritus in both groups.

Pruritus	Group		Total
	CPM	Cetirizine	
Absent	16(53.3%)	3(10%)	19(31.7%)
present	14(46.7%)	27(90%)	41(68.3%)
Total	30(100%)	30(100%)	60(100%)

$\chi^2 = 13.02$  p= 0.001 (Sig)

**Graph 2:** Incidence of Pruritus.



[Here Unpaired t-test, Chi square test and Fisher’s exact test are applied to find out the significance of the difference between the two groups at 5% level of significance.]

The overall incidence of pruritus was high in both the groups, but it was statistically higher in cetirizine group of patients (90%) when compared to CPM group (46.7%).

**Table 4:** Comparison based on grading of pruritus.

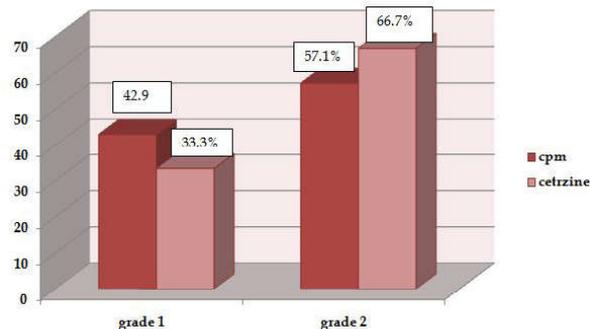
Grade	Group		Total
	CPM	Cetirizine	
1	6(42.9%)	9(33.3%)	15(36.6%)
2	8(57.1%)	18(66.7%)	26(63.4%)
Total	14(100%)	27(100%)	41(100%)

$\chi^2 = 0.36$  p= 0.55(NS)

Grade I pruritus was more in CPM group (42.9%) when compared to cetirizine group (33.3%).

Grade II pruritus was more in cetirizine group (66.7%) when compared to CPM group (57.1%), in whom pruritus was treated with Inj. Dexamethasone 8 mg IV.

**Graph 3:** Comparison of grade 1 and grade 2 pruritus in both the groups.



### Discussion

The addition of opioids to local anaesthetics is widely accepted in anaesthesiology practice in providing postoperative analgesia in patients undergoing spinal anaesthesia.<sup>7</sup> In patients undergoing caesarean section with spinal anaesthesia, intrathecal opioids are known to cause pruritus, nausea, vomiting, respiratory depression and urinary retention due to mu and kappa opioid receptor activation.<sup>7</sup> Pruritus is one of the most commonest side effect of intrathecal morphine and it is more likely to be localised to the face, neck and upper thorax.<sup>8</sup> Pruritus is described as a subjective unpleasant and irritating sensation that often promotes uncontrollable scratching.<sup>1</sup> Although pruritus is not a life-threatening complication,<sup>9</sup> but sometimes it is very distressing to the patient and needs to be treated.

The precise mechanism of pruritus after intrathecal morphine is not yet clear.

Fan<sup>10</sup> studied that morphine could activate serotonin 5HT<sub>3</sub> receptors by a mechanism independent of opioid receptors.

Pruritus is more likely to occur in obstetric patients, due to interaction of oestrogen with opioid receptors.<sup>8</sup>

The basic objective of our study was to see the prophylactic prevention of pruritus by using antistamines like chlorpheniramine maleate and cetirizine. Anti-histamines are often used as first-line treatment, even though the role of histamine in opioid induced pruritus is controversial.<sup>11</sup> First generation H<sub>1</sub> receptor antagonists such as diphenhydramine or hydroxyzine may produce a sedative effect, which could sometimes, be helpful in patients with pruritus.<sup>1</sup> Sedative properties of antihistamines may be helpful because they temporarily allow much needed sleep. They interrupt the itch-scratch cycle, but without

relieving itch sensation.<sup>12</sup> Chlorpheniramine is a first generation anti-histamine whereas cetirizine being second generation antihistamine.<sup>13</sup>

There was no significant age group difference in both the groups (Table 1 and Table 2, Graph 1).

The overall incidence of intrathecal morphine induced pruritus was high in both the groups, but significantly high in cetirizine group (90%, n=30) when compared to CPM group (46.7%, n=30) (Table 3 and Graph 2). The low incidence in CPM group can be attributed to the fact that Inj. CPM produces sedation. First generation antihistamines cross blood brain barrier and produce CNS suppression effects.<sup>14</sup>

Also the number of patients requiring treatment for pruritus was more in cetirizine group 66.7% compared to 57.1% in CPM group (Table 4 and Graph 3).

We demonstrated that neither Inj. chlorpheniramine maleate nor tab cetirizine are effective in management of pruritus in these patients. However, the incidence of pruritus in CPM group of patients is less compared to cetirizine group probably because of the sedative effect of Inj. CPM.

## Conclusion

From the above study it can be inferred that incidence of pruritus is high in patients receiving intrathecal morphine in spite of prophylactic treatment with antihistamines. Hence we conclude that neither Inj. chlorpheniramine maleate nor tab cetirizine are useful in prophylaxis of intrathecal morphine induced pruritus in patients undergoing lower segment caesarean section.

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# Comparison between Dexmedetomidine and Buprenorphine as Adjuvants to Isobaric Levobupivacaine in Spinal Anaesthesia for Elective Lower Limb Surgeries

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## Abstract

**Background:** Levobupivacaine and racemic bupivacaine are equally effective in spinal anaesthesia with less systemic toxicity seen with levobupivacaine. Buprenorphine and Dexmedetomidine now being evaluated as a potential neuraxial adjuvant. This study has been designed to study various effects and any adverse effects of addition of either dexmedetomidine or buprenorphine to 2 ml of 0.5% isobaric levobupivacaine intrathecally for lower limb surgeries.

**Methods:** In this randomized, double-blind prospective study, 60 patients of ASA I and II were randomized into two groups: group LD and LB (n=30). All patients received a drug volume of 2.5 ml containing 2 ml isobaric levobupivacaine (15 mg). They received dexmedetomidine 10 µg (Group LD) or 60 µg of buprenorphine (Group LB) diluted to 0.5 ml with distilled water added to levobupivacaine in the same syringe.

**Results:** It was found that the onset of sensory block upto T10 and motor block is statistically significantly faster in group LD (109.33 and 153.5, in sec) over group LB (133 and 167.67, in sec). The mean time for two segment regression, the mean time to sensory regression to L1, the mean duration of analgesia and the mean duration of motor blockade is significantly prolonged in Group LD (106.67, 322, 343, 330.5, in min) over Group LB (132.67, 259.67, 290.67, 253.34, in min) with p<0.001.

**Conclusion:** 10µg of dexmedetomidine added to local anaesthetic in subarachnoid block has proved to be a better adjuvant in prolonging the sensory and motor blockade intraoperatively and the duration of postoperative analgesia compared to 60µg of buprenorphine, without significant adverse effects.

**Keywords:** Spinal anaesthesia; Levobupivacaine; Buprenorphine; Dexmedetomidine.

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## Introduction

Pain is a complex, multidimensional perception. It is a dynamic process, involves actions at multiple sites starting from peripheral tissue injury provoking peripheral sensitization leading to

central sensitization. Ultimately the inflammatory response leads to release of chemical mediators that act synergistically to convert high thresh-hold nociceptors to low thresh-hold nociceptors.<sup>1</sup>

Prevention and treatment of postoperative pain

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plays an important role. It enables early ambulation, reduces morbidity, duration of hospital stays and improves the surgical outcome. The adequacy of postoperative pain control is one of the most important factors in determining safe discharge from Day care surgery.<sup>2</sup> Systemic analgesia by nature is associated with numerous side effects like drowsiness, dizziness and disorientation. This may not allow the patient to ambulate early. Some drugs may cause nausea, vomiting and itching.

Spinal anaesthesia is the most commonly used technique for lower abdominal and lower limb surgeries. It is easy to administer, has rapid onset of action, low risk of infection as from catheter in situ, less failure rates. Spinal is safe and economical.<sup>3-4</sup> Patient is awake and conscious, so can describe and relate timely indicators of complications.

Spinal anaesthesia using traditional local anaesthetics only, without adjuvants have a shorter duration of action and so lead to an early analgesic requirement in the postoperative period.

Intrathecal narcotics potentiate the sensory blockade of local anaesthetics without affecting the sympathetic activity.<sup>5</sup> They provide prolonged post-operative analgesia but are associated with increased risk of nausea, vomiting, itching and respiratory depression.<sup>6</sup>

Buprenorphine, a  $\mu$  receptor partial agonist with low intrinsic activity can be safely used in subarachnoid block. Buprenorphine is compatible with CSF. It is lipophilic and has high molecular weight. This may prevent its rostral spread and thus respiratory depression.<sup>7</sup>

Dexmedetomidine, a new highly selective 2 - agonist is under evaluation as a neuraxial adjuvant as it provides sedation, stable hemodynamic conditions, good quality of intraoperative and prolonged postoperative analgesia with minimal side effects.<sup>8-9</sup> Dexmedetomidine, has a high ratio of  $\alpha_2/\alpha_1$  activity. It possesses many properties of an ideal adjuvant but lacks respiratory depression thus making Dexmedetomidine a safe adjuvant.<sup>10</sup> Based on the findings in a few human studies, it is hypothesized that intrathecal 10  $\mu\text{g}$  of Dexmedetomidine would produce significant postoperative analgesic effect when combined with hyperbaric Bupivacaine in spinal anaesthesia with minimal side effects.<sup>8-9</sup>

This study has been designed to compare the sensory and motor effects of Dexmedetomidine and Buprenorphine as adjuvants to 0.5% levobupivacaine for spinal anaesthesia in lower limb surgeries.

## Objectives and Aim of the Study

This study aims to investigate and compare the effect of intrathecal administration of Dexmedetomidine (10  $\mu\text{g}$ ) or Buprenorphine (60 $\mu\text{g}$ ) to 2 ml of 0.5% isobaric levobupivacaine intrathecally for elective lower limb surgeries.

The objective of the study was to evaluate the following parameters in both the groups:

- Time to onset of sensory and motor block
- Duration of sensory and motor block
- Duration of effective post-operative analgesia
- Side effects.

## Materials and Methods

### Study setting

This study was conducted at the Basaveshwar Teaching & General Hospital, Gulbarga attached to Mahadevappa Rampure Medical College, Gulbarga between January 2016 to march 2017.

This study was done after Ethical Committee approval and written informed consent from all patients included in the study.

### Study design

This study was done in a prospective double blinded randomized manner.

### Inclusion criteria

- American Society of Anesthesiologists [ASA] grade 1 and 2 patients.
- Adult patients aged between 18-60 years of both sex
- Patients undergoing elective lower limb surgeries

### Exclusion criteria

- Patients belonging to ASA grade III, IV and V
- Patient refusal
- Liver and renal dysfunction
- Patients with cardiac dysarrhythmias
- Patients using adrenergic receptor blockers, calcium channel blockers
- Weight >120 kg or height < 150 cm
- Patients with contraindications for spinal anaesthesia
- Allergy to drugs

### Source of data

This study was conducted in adult patients aged between 18-60 years undergoing elective urological, perineal and lower extremity surgeries under spinal anaesthesia in Basaveshwar Teaching & General Hospital And Sangameshwar Hospital, attached to Mahadevappa Rampure Medical College. 60 patients were divided into 2 groups by permuted block randomisation technique in the ratio 1:1.

Group LD- received 10 milligrams (2 ml) of 0.5% isobaric levobupivacaine and 10 micrograms (in 0.5 ml of distilled water) of Dexmedetomidine. Total volume was made to 2.5 ml.

Group LB- received 10 milligrams (2 ml) of 0.5% isobaric levobupivacaine and 60 micrograms (in 0.5 ml of distilled water) of Buprenorphine was drawn from the ampoule of buprenorphine containing 300 µg/mL. Total volume was made to 2.5 ml.

### Procedure

In the O. T, appropriate equipment for airway management and emergency drugs were kept ready. The horizontal position of the operating table was checked and patient shifted to the table.<sup>18</sup> G i.v cannula was inserted and the patient was preloaded with 500 ml of Lactated Ringer's solution. NIBP, SpO<sub>2</sub>, ECG leads were connected to the patient. Preoperative baseline systolic and diastolic BP, PR, SpO<sub>2</sub> and RR were recorded. Under strict aseptic precautions, a midline lumbar puncture was performed using a 25 G Quincke needle in sitting position. The patient was then immediately placed in supine position. The time for intrathecal injection was considered as 0 and the following parameters were observed – sensory blockade, motor blockade, duration of analgesia.

The PR, systolic and diastolic BP, SpO<sub>2</sub> and RR were recorded every 2 min for 10 min and then every 5 min throughout the intraoperative period. The above vital signs at the completion of surgery were noted.

Hypotension was defined as fall in systolic BP >30% from baseline or MAP <60 mmHg. This was managed with i.v Mephentermine 6mg in increments. Bradycardia was defined as HR < 60 / min and was managed with Inj. Atropine 0.01mg/kg i.v. Respiratory depression was defined as RR < 8/min and or SpO<sub>2</sub> < 85%. This was planned to be managed with bag and mask ventilation or intubation and IPPV if necessary. Blood loss more than the allowable loss was replaced with blood.

### Monitoring and follow up of the patients

Patient was shifted to recovery room after completion of surgery. The vital signs were recorded, every 15 min in the 1st hour after surgery and 30 min interval for next 2 hours and thereafter at hourly intervals for next 3hrs. Sensory and motor block were assessed every 15 min till recovery of pin prick sensation to L1 and Bromage score of 1 respectively. Patients were shifted to post operative ward after complete resolution of motor blockade.

Patients were monitored for 24 hours to detect the occurrence of side effects - respiratory depression, nausea, vomiting, dry mouth, urine retention and pruritis. Patients were also enquired about the occurrence of transient neurological symptoms which was described as pain / paraesthesia in the neck, buttocks, legs or pain radiating to lower extremities after initial recovery from SAB within 72 hrs.

### Assessment of sensory blockade

Following subarachnoid block, sensory block was assessed by loss of sensation to pinprick using 23 G sterile needle. The assessment was started immediately after injection and continued every 15 sec till loss of pinprick sensation at T10 level. Onset of sensory block was taken as time from intrathecal injection to loss of pinprick sensation at T10. At 20 mins interval after SAB, the dermatomal level of sensory block noted and this was considered as maximum level of sensory block.

### Assessment of Motor blockade

Motor block was assessed using the Bromage score:

Grade 1: full flexion of knees and feet possible.

Grade 2: just able to flex knees with free movement of feet.

Grade 3: unable to flex knees but with free movement of feet.

Grade 4: unable to move legs and feet.

Assessment of motor block was started immediately after the intrathecal injection. It was tested every 15 sec till Bromage Score of 4 was reached. Onset of motor block was taken as time taken to achieve Bromage score of 2 from subarachnoid block. The degree of motor block after 20 min of injection was noted and this was considered the maximum degree of motor block. Thereafter, motor block regression was noted and duration of motor block was taken as time from initiation of SAB to return of Bromage Score to 1.

### Assessment of Pain

At the end of surgery, the degree of pain was assessed using VAS scale till VAS score  $>4$  was reached. Whenever the patient complained of pain, the rescue analgesic, Inj. Diclofenac 75 mg i.m was given. Duration of effective analgesia was defined as time interval between onset of SAB and the time to reach VAS  $\geq 4$ . (Fig.1)

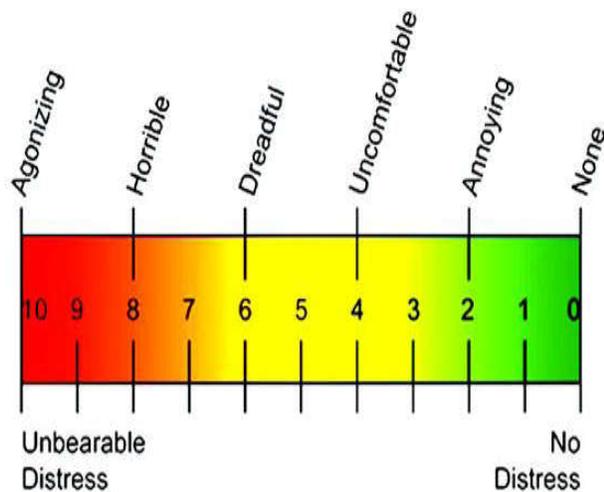


Fig 1: Visual Analogue Scale.

### Statistical analysis

All recorded data were entered using MS Excel software and analysed using SPSS 16 version software for determining the statistical significance. Analysis of Variance was used to study the significance of mean of various study parameters between the three groups.

Chi-square test with Yates correction was used to study the significant association between sex distributions among the groups. The p-value taken for significance is less than 0.05. A p-value  $< 0.001$  was considered to be highly significant.

The median was used to compute the maximum sensory and motor block and the sedation scores.

### Patient characteristics

The groups were comparable with respect to their age because there was no statistical significant difference among the groups ( $p > 0.05$ ). The demographic profile of both the groups showed no significant differences statistically (table no.01)

Both the groups were comparable in terms of the sex distribution and there was no statistical significant difference ( $p > 0.05$ ). Both the groups were comparable on the basis of duration of surgeries.

### Observations and Results

**Table 1:** Comparison of age, BMI and ASA among the two groups.

Parameters	Group D (n=30)	Group B (n=30)	P value
	Mean $\pm$ SD	Mean $\pm$ SD	
Age in years	33.87 $\pm$ 10.19	37.27 $\pm$ 10.31	0.204
BMI	23.04 $\pm$ 1.2	23.23 $\pm$ 1.25	0.553
ASA	Group D	Group B	P value
	n (%)	n (%)	
Grade 1	20 (66.7%)	20 (66.7%)	1.00
Grade 2	10 (33.3%)	10 (33.3%)	
Total	30 (100%)	30 (100%)	

### Onset of sensory block

There is a significant difference between groups with regard to onset of sensory block, with Group LD having a rapid onset compared to Group LB ( $p < 0.0001$ ). (table 02)

### Onset of motor block

There is no significant difference between groups in the onset of Motor block. (table 02)

### Time to two segment regression

There is significant difference between groups in two segments Regression, with Group LB requiring a much longer time compared to Group LD ( $p < 0.0001$ ). (table 02)

### Time to sensory regression to $L_1$

There is significant difference between the groups in mean time to sensory regression to  $L_1$ - with Group D requiring a much longer time compared to Group B ( $p < 0.0001$ ). (table no 02)

### Mean duration of analgesia

There is a significant difference between the groups in the mean duration of analgesia with Group LD having a much longer duration compared to Group LB ( $p < 0.0001$ ). (table no 02)

### Maximum level of sensory block

The median of the maximum level of sensory block reached in both the groups is T6., Therefore, there is no significant difference between the groups in this respect. (table no 02)

**Mean duration of motor block**

There is significant difference between groups in duration of motor block with group LD having longer duration compared to group LB (p<0.0001). (table no 02)

**Table 2:** Comparison of sensory, motor analgesia parameters among the two groups.

Parameter	Group LD (n=30)	Group LB (n=30)	P value
	Mean ± SD	Mean ± SD	
<b>Sensory parameters</b>			
Onset of sensory block (sec)	109.33 ± 12.98	133 ± 15.35	<0.001
Two segment regression (min)	132 ± 14.6	106.67 ± 15.77	<0.001
Time to sensory regression to L1	322 ± 40.39	259.67 ± 22.51	<0.001
<b>Motor parameters</b>			
Onset of motor block (sec)	153 ± 59.83	167.67 ± 18.46	0.2202
Duration of motor block (min)	330.5 ± 39.85	253.34 ± 22.48	<0.001
<b>Duration of analgesia</b>			
Analgesia (min)	343 ± 43.02	290.67 ± 22.88	<0.001

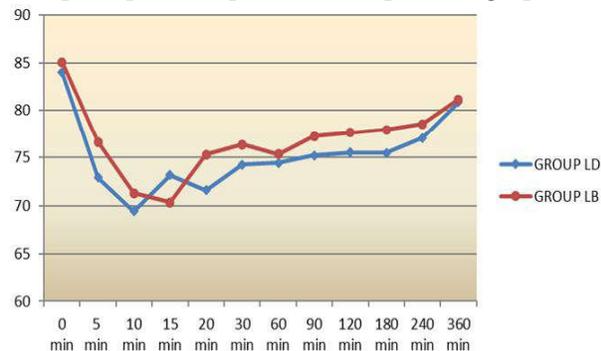
**Hemodynamic parameters**

These included heart rate, systolic blood pressure, diastolic blood pressure and respiratory rate recorded at definite time intervals of 0 and every 5 minutes for first 30 minutes and there after every 10 minutes for the next 90 minutes.

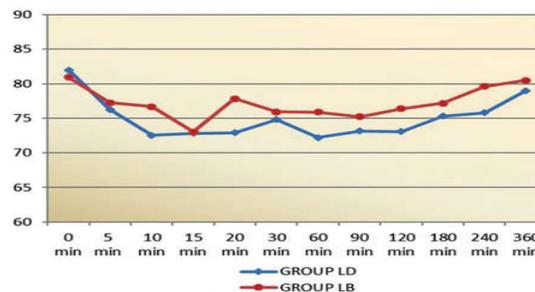
**Variation of heart rate among the groups**

There is no significant difference between both the groups with respect to intra-operative and postoperative mean heart rates with p>0.05. (Graph 1)

Both the groups have similar mean SBP, DBP and MAP values throughout the intra-operative and postoperative periods with p >0.05.(graph 2)



**Graph 1:** Variation of heart rate among the groups.



**Graph 2:** Variation of MAP by groups.

**Mean respiratory rate**

There was no statistically significant difference in the mean respiratory rate between Group D and Group B at any point of time during the study.

**Mean Oxygen saturation**

There was no statistically significant difference in the mean oxygen saturation between the two groups at any point of time during the study.

**Adverse effects**

There was no statistically significant difference in the adverse effects among the two study groups. (table no. 03). Six patients in Group LD and five patients in Group LB had Bradycardia. Three patients in group LD and two patients in group LB had hypotension. None of the patient s in Group LD had nausea, vomiting or Pruritis. In group LB one patient had Pruritis, one patient had nausea and two patients had vomiting.

**Table 3:** Comparison of adverse effects among the two groups.

Side effects	Group LD		Group LB		P value
	Frequency	Percent	Frequency	Percent	
Bradycardia	6	20.0%	5	16.7%	0.494
Hypotension	3	10.0%	2	6.7%	
Nausea	0	0.0%	1	3.3%	
Pruritis	0	0.0%	1	3.3%	
Vomiting	0	0.0%	2	6.7%	
Nil	21	70.0%	19	63.3%	
Total	30	100.0%	30	100.0%	

**Discussion**

In our study, we compared the sensorimotor effectiveness of addition of buprenorphine (60 µg) or dexmedetomidine (10 µg) to intrathecal isobaric levobupivacaine (0.5%). We chose to use this dose of Dexmedetomidine as it was found to be safe according to study by B maharani et al.<sup>14</sup> We chose dexmedetomidine 10 µg as this has been found to provide good, prolonged analgesia.<sup>11</sup>

### ***Onset of sensory block***

The mean time to onset of sensory block is 109.34 sec in Group LD and is 133 sec in group LB. Onset of sensory block upto T10 is statistically significantly faster in Dexmedetomidine group over buprenorphine group with  $p < 0.0001$ .

It correlates with the study by B maharani et al<sup>14</sup> who found that the mean time of sensory block to reach T10 was  $1.67 \pm 0.52$  min in D10 group D (10 µg dexmedetomidine) and  $2.04 \pm 0.6$  min in group B (buprenorphine).

### ***Onset of motor block***

The mean time to onset of Bromage 2 motor block is 153.5 sec in group LD and 167.67 sec in group LB. There was no statistically significant difference among the three groups ( $p = 0.2202$ ).

It correlates with the study by B maharani et al<sup>14</sup> who found that the mean time to reach Bromage 3 scale was  $3.56 \pm 1.13$  with 10 µg Dexmedetomidine,  $3.66 \pm 1.19$  min with 60 µg buprenorphine which was statistically insignificant ( $p = 0.740$ ).

### ***Mean time to two segment regression and time to sensory regression to L<sub>1</sub>***

The mean time taken for two segment regression was 132.67 min in group LD compared to 106.67 min in group LB. The time for two segment regression is significantly prolonged in group LD compared to Group LB ( $p < 0.0001$ ).

In our study, there is significant difference between the groups in terms of the time to sensory regression to L<sub>1</sub> - with Group LD requiring a much longer time (322 min) compared to Group LB (259.7 min) which is highly significant with  $p < 0.0001$ .

B maharani et al<sup>14</sup> also found that the regression time to S1 dermatome was  $377.5 \pm 48.54$  min in group D and  $304.6 \pm 73.67$  min in group N ( $p < 0.001$ ).

Hala E A Eid MD et al<sup>12</sup> also concluded that Dexmedetomidine significantly prolonged time to two segment regression, sensory regression to S<sub>1</sub>.

### ***Mean duration of analgesia (min)***

There is significant difference between groups in total duration of analgesia with Group LD having a much longer duration compared to Group LB ( $p < 0.0001$ ). Group LD has a mean duration of analgesia of 343 min and Group LB has 290.6 min. Thus, the analgesic requirement in the first 24 hours postoperatively in Group LD was significantly lesser than that in Group LB.

B maharani et al<sup>14</sup> concluded that intrathecal dexmedetomidine in doses of 10 µg significantly prolong the anaesthetic and analgesic effects of spinal hyperbaric bupivacaine compared to 60 µg buprenorphine.

Addition of 10 µg increased the duration of analgesia provided by spinal bupivacaine by about  $375.83 \pm 48.59$  min compared to  $302.57 \pm 75.74$  min with 60 µg buprenorphine ( $p < 0.001$ ).

### ***Mean duration of motor block***

The mean duration of motor block in Group LD and Group LB are 330.5 min, 253.34 min respectively ( $p < 0.0001$ ) which was statistically significant.

It correlates with the study by B maharani et al<sup>14</sup> who found that motor block regression to modified Bromage 0 were significantly prolonged in group D  $342.11 \pm 48.67$  (10 µg dexmedetomidine) than in group B  $266.98 \pm 73.47$  (60 µg buprenorphine)

Al-Mustafa MM, Abu-Halaweh SA, Aloweidi AS, Murshidi MM, Ammari BA et al<sup>11</sup> observed that the regression to Bromage 0 was  $302.9 \pm 36.7$  min in D10 (10 µg dexmedetomidine) which was similar to our study.

### ***Haemodynamic Parameters***

In our study, there is no significant difference between both the groups with respect to intraoperative and postoperative mean heart rates with  $p > 0.05$ . Both the groups have similar mean SBP, DBP and MAP values throughout the intraoperative and postoperative periods with  $p > 0.05$ .

Thus, the haemodynamic stability is maintained even in the presence of Dexmedetomidine.

It correlates with the study by B maharani et al<sup>14</sup> who found that the mean values of MBP and HR were comparable between the two groups throughout the study duration.

### ***Side effects***

In a study by F A Khan Gauhar<sup>7</sup> the incidence of nausea and vomiting was higher with intrathecal buprenorphine which correlates with the findings of our study.

Three patients who received intrathecal dexmedetomidine developed transient hypotension that was easily treated with intravenous mephentermine. Six patients in Dexmedetomidine and 5 patients in Buprenorphine group had transient bradycardia which responded

to Intravenous atropine.

## Conclusions

### *The following conclusions were drawn*

The time to two segment regression was significantly prolonged with the addition of intrathecal Dexmedetomidine to hyperbaric Bupivacaine.

The time to motor regression was significantly prolonged with the addition of Dexmedetomidine. This was a major advantage in our study on perineal and lower limb surgical procedures where immobility is important during intraoperative and post operative period.

Addition of either Dexmedetomidine or Buprenorphine along with hyperbaric Bupivacaine intrathecally does prolong duration of analgesia especially in dexmedetomidine group and reduce postoperative analgesic requirements.

There was no appreciable difference in the time to onset of either sensory or motor block.

The incidence of adverse effects like nausea, vomiting and pruritis was higher in the Buprenorphine group though it was not statistically significant.

Addition of Dexmedetomidine or Buprenorphine to intrathecal hyperbaric Bupivacaine is safe as both maintain hemodynamic stability without producing excessive sedation or respiratory depression.

Further studies to validate our findings recruiting larger patient population is considered essential.

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## Comparative Efficacy of EMLA Cream and Ethyl Chloride Spray for Reducing the Venipuncture Pain During Intravenous Cannulation

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### Abstract

**Background and Objectives:** Intravenous Cannulation is a pain full procedure. Pain associated with intravenous cannulation can be decreased by using local anaesthetics. This study was conducted to evaluate the efficacy of EMLA cream against the reduction of the venipuncture pain during IV cannulation in comparison with Ethyl chloride spray.

**Methods:** This single center, prospective randomized study with two parallel groups was conducted at Department of Anaesthesiology, Critical Care and Pain Management, S.S Institute of Medical Sciences, Davanagere. A total of 100 subjects admitted due to various illnesses were enrolled into the study. Study subjects were randomly divided into two groups viz. G1 and G2 with 50 subjects in each group. Subjects in G1 were anesthetized with topical application of EMLA cream, and in G2 with Ethyl Chloride spray.

**Results:** The results of VAS score depicted that following application of EMLA cream causes mild venepuncture pain during intravenous cannulation, whereas Ethyl chloride spray causes moderate venepuncture pain during intravenous cannulation. Furthermore, our study findings delineated that EMLA cream was safe to use without any side effects when compared to Ethyl chloride spray wherein burning sensation, itching and redness like side effects were experienced by study subjects.

**Conclusion:** EMLA cream is safe and effective in reduction of venipuncture pain during IV cannulation.

**Keywords:** EMLA cream; Ethyl chloride spray; Pain; IV cannulation; VAS; Efficacy; Safe.

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### Introduction

Approximately one-half of patients undergoing intravenous (IV) cannulation report moderate pain and anxiety before the procedure.<sup>1</sup> Furthermore, venipuncture is a routine nursing procedure which is often performed in children and has the potential to produce pain, anxiety, fear, and distress, if preventive measures are not taken.<sup>2-4</sup> Literature

reports revealed that that local anesthesia is applied to the venipuncture sites on a regular basis in children, but this is handled rather inconsistently in adults.<sup>5-9</sup> In a survey among anaesthetists' in the UK, the doctors reported that they administered a local anesthetic for venipuncture in cases where the cannulsize exceeded 18 G. However, fewer than half of surgeons or specialists in internal medicine

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followed this practice.<sup>8</sup> According to a survey of 71 hospital doctors, 35% occasionally administered a local anesthetic—mostly lidocaine—before venous cannulation.<sup>9</sup> Doctors' reasons for not doing so included the amount of time it takes (45%), a lacking need/indication (35%), and the worry that venous cannulation might be more difficult as a result of this practice (21%).

In eutectic mixture of lidocaine & prilocaine (EMLA) cream, 2.5% lidocaine & 2.5% prilocaine are mixed in equal proportion at 25°C. This leads to lowering of melting point of both solids.<sup>10</sup> After removal, its effect lasts for 30-60 minutes. After 60 minutes of cutaneous application under occlusion, the local effect of EMLA is sufficient for needle insertion and minor superficial skin surgery. Pain threshold depth is about 3 mm after 60 minutes of application, about 4 mm after 90 minutes of application, and about 5 mm after 120 minutes of application.<sup>11</sup>

Ethyl chloride spray is a refrigerant spray. It causes a transient hypoesthesia of the skin. It works by freezing and numbing the skin. The ethyl chloride spray cools the skin by rapid evaporation of the volatile liquid itself. The cooling effect decreases nerve conduction velocity of A-delta and C-fibres which decreases transmission of pain.<sup>12</sup> The duration of decreased sensation lasts between 30 and 60 seconds; hence, procedure should be done immediately after evaporation of the liquid from the skin surface. Furthermore, it can cause significant "frost" of the skin as a permanent skin change, if sprayed for longer than 10 seconds.<sup>13</sup>

With this scenario, the present study was designed to evaluate the comparative efficacy of topical application of ethyl chloride spray and EMLA cream against the reduction of the venipuncture pain during IV cannulation.

## Materials and Methods

### Study design

It is single center, prospective randomized study with two parallel groups conducted at Department of Anaesthesiology, Critical Care and Pain Management, S.S Institute of Medical Sciences, Davanagere. The study is approved by institutional ethical committee.

### Study subjects

A total of 100 subjects admitted at S. S. Institute of Medical Sciences & Research Centre, due to various illnesses were enrolled into the study. A

written informed consent was obtained from all the study subjects. Study subjects were randomly divided into two groups, viz. G1 and G2 with 50 subjects in each group by chit pull out technique. Subjects in G1 were anesthetized with topical application of EMLA cream and in G2 with Ethyl Chloride spray.

### Inclusion Criteria

- Patients willing to give informed consent form
- Patients aged between 18 and above
- Exclusion criteria
- Patients with history of hypersensitivity to either ethyl chloride spray or EMLA cream and/or other local anesthesia
- Patients with damaged, denuded, or broken skin at the designated site.

All the patients were informed about the procedure and their written consent were recorded. Complete history, clinical examination and routine investigations were also done to all the patients.

### Methodology

To subjects in Group G1 EMLA cream was applied at the dose level of 1 gm/10 cm<sup>2</sup> skin surface area under occlusive dressing. After 60 minutes, we removed the cream and cleaned the area. IV cannulation was done 60 minutes after the application of EMLA cream.

Ethyl chloride spray was applied to subjects in Group G2 in a well-ventilated room. Area of Injections which was scalped, was prepared with alcohol swab. Ethyl chloride spray was then sprayed at a distance of 3-5 inches away from the skin. To spray Ethyl Chloride, we held the bottle upright over the treatment area and valve was pressed completely allowing spray from the bottle. Duration of application of spray was 4-6 seconds or until overlying skin turned white. Then we inserted 18 Gauge IV cannula immediately after evaporation of liquid from skin within 30-60 seconds.

Any local skin changes such as erythema, pallor or oedema were noted.

### Assessment Parameters

ASA grade (ASA Physical Status Classification System) of subjects in both G1 and G2 groups were recorded. Pain intensity was assessed immediately after IV cannulation on a 10 cm horizontal Visual Analogue scale (VAS).<sup>14</sup> We used a chart card with a 10-cm horizontal line with word anchors at each

end, ranging from 0 = “no pain” to 10 = “worst pain.” If the patients had difficulty communicating with us directly, we used the same chart card with

pain scaled facial pictures to evaluate the pain severity (Figure 1). Pain score was recorded in proforma.

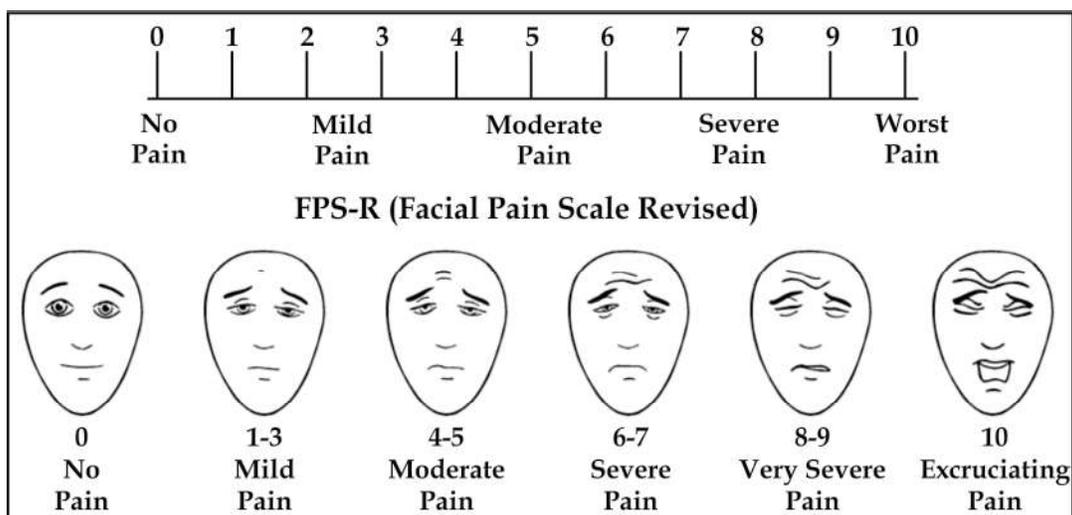


Fig. 1: Visual analog scale (VAS) score chart card.<sup>14</sup>

### Side effects

The side effects evaluation parameters viz. burning sensation, Itching, Swelling, and Redness was assessed by visual observation and scored as 1 for Yes and 0 for No. The side effects scoring was recording in the proforma.

### Statistical analysis

Categorical data were presented as frequency distributions, and numeric data were represented as mean and standard error of mean. Statistical comparison between treatment groups was done by using students t-test. P<0.05 was considered statistically significant. Statistical analysis was performed with the SPSS (Statistical Package for Social Sciences) version 16. [IBM SPASS statistics (IBM corp. Armonk, NY, USA released 2011)].

### Results

Table 1: Age wise distribution of study subjects.

Age (Years)	G1-EMLA Cream		G2-Ethyl Chloride Spray	
	Frequency	Percent	Frequency	Percent
10 - 20	6	12.00	6	12.00
21 - 30	21	42.00	13	26.00
31 - 40	9	18.00	15	30.00
41 - 50	10	20.00	9	18.00
51 - 60	4	8.00	7	14.00
<b>Total</b>	<b>50</b>	<b>100.00</b>	<b>50</b>	<b>100.00</b>

In Group I (EMLA treatment group), majority of the study subjects i.e. 42 % belonged to age group between 21-30 yrs followed by 20% belonged between 41-50 yrs, 18% belonged 31-40 yrs, 12% belonged to 10-20 yrs, and only 8% of study subjects belonged to age group of 51-60 yrs. In Group II (Ethyl chloride spray treatment group) majority of the study subjects i.e. 30% belonged to age group between 31-40 yrs. followed by 26% belonged between 21-30 yrs., 18% belonged between 41-50 yrs., 14% belonged to 51-60 yrs., and another 12% of study subjects belonged to age group of 10-20 yrs age group (Table 1).

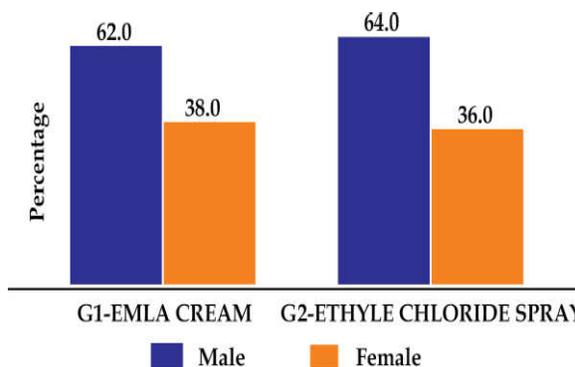


Fig. 2: Gender Wise Distribution of Study Subjects.

The majority of the study subjects i.e. 62% and 64% of study subjects in both EMLA treatment and Ethyl chloride spray treatment group were found to be males, respectively. Whereas, 38% and 36% of subjects were found to be females (Figure 2).

**Table 2:** Distribution of Study Subjects Based on Body Weight.

Weight (Kg)	G1-EMLA Cream		G2-Ethyl Chloride Spray	
	Frequency	Percent	Frequency	Percent
10 - 20	0	0.00	0	0.00
21 - 30	0	0.00	0	0.00
31 - 40	0	0.00	0	0.00
41 - 50	9	18.00	9	18.00
51 - 60	17	34.00	14	28.0
61 - 70	15	30.00	20	40.0
71 - 80	9	18.00	7	14.0
Total	50	100.00	50	100.0

34% of the study subjects body weight in EMLA cream (G1) treatment group was found to be in 51-60 Kg, Where as in Ethyl chloride (G2) treatment groups majority of the study subjects i.e. 40% body weight was found to be in 61-70 Kg. (Table 2).

**Table 3:** Comparison of Study Parameters Between Groups By Students T-Test.

Parameters	G1-EMLA Cream	G2-Ethyl Chloride Spray	p-value
<b>Physical Status</b>			
ASA Grade	1.28 ± 0.06	1.30 ± 0.06	0.821
<b>Pain Assessment</b>			
VAS Score	2.98 ± 0.09	4.18 ± 0.09	0.000
<b>Side Effects</b>			
Burning Sensation	0.00 ± 0.00	0.48 ± 0.07	0.000
Itching	0.00 ± 0.00	0.12 ± 0.05	0.013
Swelling	0.00 ± 0.00	0.00 ± 0.00	-
Redness	0.00 ± 0.00	0.14 ± 0.05	0.007

There was no statistically significant difference between ASA grade between the treatment groups. While VAS score was significantly lower (p=0.000) in EMLA cream treatment (G1) group as compared to Ethyl chloride spray treatment (G2) group. The findings of VAS score depicted that following application of EMLA cream causes mild venepuncture pain during intravenous cannulation. Whereas Ethyl chloride spray causes moderate venepuncture pain during intravenous cannulation. The mean scores of side effects viz. Burning sensation, Itching and Redness of skin during intravenous cannulation were significantly higher in G2 (Ethyl chloride spray treatment) when compared to G1 (EMLA cream treatment). These finding delineated that EMLA cream was safe to use without any side effects (Table 3).

## Discussion

Local anesthetic pre-treatment of the venipuncture site on the dorsum of the hand is indicated when using venous cannulas from a size of 18G, and without such preparations patients experience pain during IV cannulation.<sup>8</sup> Hence, in present comparative efficacy of topical application of ethyl chloride spray and EMLA cream against the reduction of the venipuncture pain during IV cannulation was evaluated.

Ethyl chloride is a fast acting and non-invasive agent. It is ask in refrigerant, abstracts heat when it evaporates from the skin after application which blocks sensory nerve conduction & produce anaesthesia.<sup>15</sup> There are several studies of ethyl chloride which yield conflicting results. On eunblinded randomised study demonstrated no significant pain relief with ethyl chloride versus no intervention in patients undergoing intravenous catheterization.<sup>1</sup> Conversely, three unblinded randomised studies demonstrated superior anesthetic efficacy of ethyl chloride versus no intervention in patients undergoing venepuncture.<sup>16-18</sup>

In our study pain assessment score (VAS) depicted that there was only mild pain observed in study subjects during IV cannulation after application of EMLA cream; Whereas, among subjects sprayed with Ethyl chloride spray there was moderate amount of pain experience by the study subjects. Furthermore, our study findings delineated that EMLA cream was safe to use without any side effects as compared to Ethyl chloride spray wherein burning sensation, itching and redness like side effects were experience by study subjects. These findings were in accordance with the previous reports published by other research investigators.<sup>19</sup> EMLA cream is an oil in water emulsion of 2.5% lignocaine and 2.5% prilocaine. The pH level of eutectic mixture is 9.4.<sup>20</sup> Effectiveness of cream may be influenced by skin integrity, race, skin thickness, location and depth of lesion, and the local vascularity.<sup>21</sup> Goodacre et.al demonstrated that EMLA has comparable efficacy as conventional infiltration in split skin grafting with less discomfort.<sup>22</sup> Thune et. al also found that EMLA cream provided adequate anaesthesia for excisional biopsies after application for 60 to 190 minutes.<sup>23</sup>

## Conclusion

In conclusion, results of this study demonstrated the efficacy of ethyl chloride and EMLA cream

as topical anesthesia. While comparison of effectiveness between Ethyl chloride and EMLA delineated that EMLA cream was safe and effective in reduction of venipuncture pain during IV cannulation.

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I, **Dinesh Kumar Kashyap**, hereby declare that the particulars given above are true to the best of my knowledge and belief.

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**(Dinesh Kumar Kashyap)**

# Efficacy of Two Different Doses of Labetalol Hydrochloride for Attenuation of Hemodynamic Response to Laryngoscopy and Endotracheal Intubation in Controlled Hypertensive Patients: Prospective Randomized Double Blind Comparative Study

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## Abstract

**Background and Aim:** The hemodynamic changes stemming from direct laryngoscopy and tracheal intubation represent sympathoadrenal response, which is more exaggerated in hypertensive patients. Present study was done with an aim to compare the efficacy of two different doses of Labetalol Hydrochloride in attenuation of hemodynamic response (Heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP)) to laryngoscopy and endotracheal intubation in controlled hypertensive patient and to document the side effects of the drug.

**Material and Method:** This is prospective randomized double blind comparative study. Sixty ASA grade II controlled hypertensive patients of either sex, comprising age group of 30-65 years, undergoing elective surgeries under general anesthesia were randomly distributed in two equal groups. Inj Labetalol Hydrochloride 0.15 mg/kg in the group L0.15 and Inj Labetalol Hydrochloride 0.30 mg/kg in the group L0.30 respectively were given intravenously 5 min prior to intubation. HR, SBP and DBP were recorded at different time intervals before and after intubation.

**Results:** There was statistically significant difference in SBP and DBP between both the group at 3,5,7,10 and 15 minute. At 5 min and 7 min post intubation, there was significant difference in HR between the group L0.15 and L0.30.

**Conclusion:** Both doses of labetalol attenuate hemodynamic response to laryngoscopy and intubation in dose dependent manner.

**Keyword:** Labetalol; Hemodynamic response; Laryngoscopy; Tracheal intubation.

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## Introduction

General anaesthesia is still one of the most common modes of anaesthesia for a variety of surgeries. It involves laryngoscopy and intubation as an integral and essential part. Laryngoscopy and endotracheal intubation cause increase in heart

rate and blood pressure as well as abnormalities of cardiac rhythm due to reflex sympathetic discharge which is caused by epipharyngeal and laryngo-pharyngeal stimulation. While the afferent limb of the reflex arc is via cranial nerves of the upper airway, the efferent limb is via sympathetic nerves.

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Centre of the reflex is the vasomotor centre situated in the medulla. The reflex is initiated when the laryngoscope presses the base of the tongue and also when it lifts the epiglottis. The endotracheal tube also triggers a reflex when it passes through the trachea. This hemodynamic response was first described by Reid and Brace in 1940.<sup>1</sup>

The hemodynamic/pressor response results in hypertension, tachycardia, and dysrhythmias, secondary to increase in circulating catecholamines. This sympatho adrenal response is usually transient, variable and unpredictable.<sup>2</sup> It reaches a peak level within one minute and ends in 5-10 minutes after intubation. The pressor response is well tolerated by overall healthy patients, i.e. ASA I and II patients.<sup>3</sup> However, it could be dangerous or even life threatening and therefore undesirable in susceptible patients (ASA III and IV); i.e. in those with systemic hypertension, coronary artery disease, intra cranial aneurysm, where circulation is already jeopardised.<sup>4</sup>

The sympatho adrenal response increases the workload of myocardium which can lead to potentially deleterious effects like ventricular failure, myocardial infarction, pulmonary oedema, ventricular arrhythmias, cerebral haemorrhage, and rupture of cerebral aneurysm. Convulsion may be precipitated in a pre-eclamptic patient.<sup>5</sup>

Various drugs and techniques have been used for attenuation of this response including lignocaine, Opioids, Barbiturates, Benzodiazepines, Calcium channel blockers, beta blocker, vasodilators etc.

In India, the prevalence of hypertension is 28%-32% in the urban population and 27.6% in the rural population. Thus, anaesthesiologists are likely to encounter more patients with this comorbid illnesses presenting for elective surgery. These patients have high incidence of cardiac arrhythmias, myocardial ischemia, acute left ventricular failure and cerebrovascular accidents following intubation. Hypertensive patients exhibit exaggerated intubation response. Hence, suppression of intubation response is always desirable. Hypertensive surges more >20% from baseline are associated with adverse outcomes and should be urgently treated with the goal of blood pressure reduction.

Labetalol Hydrochloride is a unique oral and parenteral antihypertensive drug that is alpha 1- and nonselective beta1- and beta 2-adrenergic antagonist. It reaches its peak effect at 5-15 min after intravenous(IV) injection and rapidly redistributes (5.9 min redistribution half-life). Various doses of

Labetalol Hydrochloride from 0.1 mg/kg to 1 mg/kg has been used for attenuation of stress response in previous studies.

According to the study by Amar et al., there is associated intraoperative hypotension along with attenuation, when Labetalol hydrochloride is given in doses >0.5 mg/kg.

After going into details of different studies and considering the pro and cons of different doses, we have decided to compare 0.15 mg/kg and 0.30 mg/kg for attenuation of stress response to laryngoscopy and intubation in controlled hypertensive patients.

Laryngoscopy and intubation are noxious stimuli which adversely affect the hemodynamics. Attenuation of pressor response is a very important aspect of general anaesthesia. To attenuate this response various drugs are being commonly used. In our study, we have used two different doses of labetalol hydrochloride, 0.15 mg/kg and 0.30 mg/kg, in two different groups.

Present study was done with an aim to compare the efficacy of two different doses of Labetalol Hydrochloride in attenuation of hemodynamic response [Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP)] to laryngoscopy and endotracheal intubation in controlled hypertensive patient.

## Material and Methods

The present study titled was carried out in the Department of Anaesthesiology, Government Medical College and S.S.G. Hospital, Vadodara, from October, 2018 to August, 2019. It was a prospective randomized controlled study of total 60 patients, approved by the Hospital Ethics Committee. The details of the study design and methodology are as follows:

- Study setting: Clinical setting
- Study population: Controlled hypertensive patients got admitted in S.S.G. Hospital and requiring orotracheal intubation for general anaesthesia for planned surgery.
- Study duration: From October, 2018 to August, 2019.
- Study design: Prospective Randomized Double Blind Clinical Study.
- Sampling and sample size.

232 cases should be taken (116 groups each) according to estimation taking at mean difference in pulse rate at 10 minute post-intubation by 3.12\* with standard deviation 8.35 at 95% confidence

interval and 80 % power.

(\*according to first reference of annexure 1 taking 10 minute post intubation heart rate value of group L1 is 81.60 as mean value and SD 6.3 and group L2 is 75.04 as mean value and SD 10.9).

Thus, total sample size will be 232 cases taking 116 in each group. As we could not get this much of cases during our study period, we had done total 60 cases, considering that we would get 5 cases per month.

### ***Inclusion criteria***

- Age Group: 30 – 65 years
- ASA status II
- Male / Female
- Patients posted for planned surgery under general anaesthesia requiring orotracheal intubation and having controlled hypertension.

### ***Exclusion Criteria***

- Patients who refuse to give consent.
- Pregnant and lactating women.
- Anticipated difficult airway and obesity (BMI >35).
- Patient having allergy to study drug.
- Patient with sick sinus syndrome (including sino-atrial block), second or third degree heart block and persistent bradycardia (<45-50 bpm).
- Patients is having history of taking medication for any sort of illness like verapamil, diltiazem, digitalis glycosides, clonidine, monoamineoxidase inhibitors (except MOA-B inhibitors).
- Patient with systemic diseases like cardiovascular, respiratory diseases like bronchial asthma and COPD, neurological, psychological, hepatic, untreated phaeochromocytoma, renal disease (diagnosed by clinical judgments and investigations) and on medication of above mentioned diseases.

### ***Pre-operative Preparation***

All the patients had been kept nil by mouth from 10 p.m. a day before surgery. Tablet Ranitidine (150 mg) was given orally on the previous night of operation. Antihypertensive medications were advised to continue till the date of operation. Morning dose of antihypertensive medication was also given to the patient with sips of water at 6:00

am. Intravenous access was to be secured.

Patients had been randomly allocated to a group using envelope method.

Group L0.15: Syringe contained inj. Labetalol Hydrochloride 0.15 mg/kg diluted with 0.9% saline to 10ml IV.

Group L0.30: Syringe contained inj. Labetalol Hydrochloride 0.30 mg/kg diluted with 0.9% saline to 10ml IV.

For ensuring blinding, identical 10 ml coded syringes of drugs had been prepared by one of my colleague who was not participating in study.

### ***Premedication***

Premedication was given 10 minute prior to the induction in both the study groups:

- Inj. Glycopyrrolate – 5 mcg/kg IV
- Inj. Ondansetron - 0.08mg/kg IV
- Inj. Tramadol - 1 mg/kg IV
- Inj. Midazolam – 0.02 mg/kg IV

### ***Study drug infusion***

Preoxygenation was done with 100% O<sub>2</sub> by a face mask for 3 minute. Just after preoxygenation, study drug was given according to allocated group.

- In the group L0.15 0.15 mg/kg of Labetalol Hydrochloride(diluted with 0.9% saline to 10 ml) was given 5 min prior to intubation.
- In the group L0.30 0.30 mg/kg of Labetalol Hydrochloride (diluted with 0.9% saline to 10 ml) was given 5 min prior to intubation.

### ***Induction and Tracheal Intubation***

Induction was done with inj. Thiopentone 5 mg/kg and relaxation was achieved with loading dose of inj. vecuronium 0.1 mg/kg. 3 min later the patient was intubated using a macintosh laryngoscope.

### ***Maintenance***

Anaesthesia had been maintained with controlled ventilation through closed circuit with O<sub>2</sub>:N<sub>2</sub>O (50:50) in fresh gas flow of 6L/min and sevoflurane dial concentration 2%. Inj. Vecuronium bromide had been given by top up dose of 0.02 mg/kg for muscle relaxation.

Till 15 minutes of study duration fresh gas flow and dial concentration of sevoflurane was not changed and there was no surgical stimulus. After 10 minutes fresh gas flow was reduced to 3L/min.

### Reversal and Extubation

At the end of operation, Nitrous oxide and Sevoflurane had been stopped. The respiratory efforts had been observed, the residual neuromuscular blockade had been reversed by -

- Inj. Neostigmine - 50mcg/kg IV and
- Inj. Glycopyrrolate - 10mcg/kg IV

Patient had been extubated once all the criteria for extubation were met. Patient had been shifted to recovery room.

Haemodynamic variables like HR,SBP,DBP,RPP and MAP were observed. Perioperative complications like Hypotension, hypertension, Tachycardia, Bradycardia and Arrhythmias were treated.

### 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). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

### Results

The present study was prospective randomized double blind clinical study of 60 ASA II adult patients of either sex and of the age 30-65 years,

undergoing elective general surgeries under general anaesthesia requiring orotracheal intubation.

Table 1: Demographic Data.

	Group L0.15	Group L0.15	p value
Age	50±7	53±10	0.18
Sex (male/female)	16/14	15/15	
Weight (kg)	66±8	63±5	0.08
Height (cm)	164±10	162±8	0.4

Demographic data's are comparable in both groups with non-significant results between both groups. (p>0.05). More patients were taking calcium channel blocker than the renin angiotensin inhibitor group of drugs. (Table 1)

Table 2: Mean Pre Operative Hemodynamics.

	Group L0.15	Group L0.30	p value
Heart Rate(Mean±SD)	87.23±9.3	86.2±7.6	0.64
Systolic BP(Mean±SD)	128.1±7.44	129.5±6.7	0.44
Diastolic BP(Mean±SD)	81.23±6.52	82.03±5.95	0.62
MAP(Mean±SD)	95.52±5.52	97.84±5.37	0.1
RPP(Mean±SD)	11174±1352.3	10832±998.18	0.27
SPO <sub>2</sub> (Mean±SD)	98.57±0.50	98.53±0.51	0.76

The mean pre operative pulse rate, the Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Mean arterial pressure (MAP), Rate pressure

Table 3: Changes in mean heart rate.

Time	Group L <sub>0.15</sub>		Group L <sub>0.30</sub>		Intergroup p value
	Pulse Rate	Intragroup p value	Pulse Rate	Intragroup p value	
Baseline	87.23±9.3	NA	86.2±7.6	NA	0.64 <b>p &gt; 0.05</b>
After giving premedication	85.67±9.6	0.52 <b>p &gt; 0.05</b>	85.63±7.05	0.77 <b>p &gt; 0.05</b>	0.99 <b>p &gt; 0.05</b>
Just after giving study drug	87±9.12	0.59 <b>p &gt; 0.05</b>	86.6±7.16	0.83 <b>p &gt; 0.05</b>	0.86 <b>p &gt; 0.05</b>
Just before intubation	87.33±9.26	0.88 <b>p &gt; 0.05</b>	86.48±7.7	0.88 <b>p &gt; 0.05</b>	0.7 <b>p &gt; 0.05</b>
0 minute post intubation (T0)	101.33±9.28	0.001 <b>p &lt; 0.01</b>	98.67±7.74	0.001 <b>p &lt; 0.01</b>	0.22 <b>p &gt; 0.05</b>
1 minute post intubation (T1)	101.3±9.08	0.001 <b>p &lt; 0.01</b>	98.73±7.83	0.001 <b>p &lt; 0.01</b>	0.24 <b>p &gt; 0.05</b>
3 minute post intubation (T3)	92.6±9.35	0.001 <b>p &lt; 0.01</b>	85±7.71	0.001 <b>p &lt; 0.01</b>	0.001 <b>p &lt; 0.01</b>
5 minute postintubation (T5)	85.73±9.13	0.001 <b>p &lt; 0.01</b>	72.5±7	0.001 <b>p &lt; 0.01</b>	0.001 <b>p &lt; 0.01</b>
7 minute post intubation (T7)	86±9.32	0.001 <b>p &lt; 0.01</b>	72.63±7.41	0.001 <b>p &lt; 0.01</b>	0.0001 <b>p &lt; 0.01</b>
10 minute post intubation (T10)	77.33±8.88	0.001 <b>p &lt; 0.01</b>	70.2±7.1	0.001 <b>p &lt; 0.01</b>	0.001 <b>p &lt; 0.01</b>
15 minute post intubation (T15)	77.57±8.9	0.001 <b>p &lt; 0.01</b>	70.37±6.56	0.001 <b>p &lt; 0.01</b>	0.0007 <b>p &lt; 0.01</b>

product (RPP) and the SpO<sub>2</sub> were comparable in both groups and found to be non-significant. (p>0.05) (Table 2)

We observed the baseline parameters, heart rate just after giving premedication, just after giving study drug and just before the time of intubation, the rate was comparable in both groups (p>0.05, statistically not significant).

Also, just after intubation and 1 min after intubation there was rise in heart rate, but this was under <20% range of the initial reading. They were also comparable in both groups (p>0.05, statistically not significant). There is also statistically significant difference between both the group at 3, 5, 7, 10 and 15 minute post intubation (p <0.05) (Table 3).

On intragroup comparison, in the group Group L0.15, there was a rise in pulse rate from baseline, momentarily from just after intubation till 3 minutes after intubation. Thereafter the pulse rate settled down and remained stable throughout the duration of 15 minutes. Whereas in the Group L0.30, there was a significant decrease in pulse rate, 3 minute after intubation onwards that persisted throughout the surgery.

Table 4 shows the changes in Systolic Blood Pressure starting from baseline up to 15 minutes post induction in both groups.

We observed the baseline parameters, just after giving premedication, just after giving study drug and just before the time of intubation, the SBP was comparable in both groups (p>0.05, statistically not significant). (Table 4)

**Table 4:** Changes in Systolic Blood Pressure.

Time	Group L0.15		Group L0.30		Intergroup p value
	SDP	Intragroup P value	SDP	Intragroup P value	
Baseline	128.1±7.44	NA	129.5±6.72	NA	0.45 p > 0.05
After giving premedication	128.7±7.10	0.87 p > 0.05	129.13±6.19	0.82 p > 0.05	0.8 p > 0.05
Just after giving study drug	128.03±7.32	0.97 p > 0.05	129±6.3	0.76 p > 0.05	0.58 p > 0.05
Just before intubation	128±6.93	0.94 p > 0.05	129.4±6.34	0.95 p > 0.05	0.42 p > 0.05
0 minute post intubation (T0)	141.87±8.55	0.0001 p < 0.01	139.37±7.64	0.0001 p < 0.01	0.24 p > 0.05
1 minute post intubation(T1)	137.83±8.20	0.0001 p < 0.01	134±6.56	0.001 p < 0.01	0.15 p > 0.05
3 minute post intubation(T3)	127.73±7.45	0.0001 p < 0.01	119.77±7.06	0.0001 p < 0.01	0.0001 p < 0.01
5 minute post intubation(T5)	121.07±7.44	0.0001 p < 0.01	110.77±7.32	0.0001 p < 0.01	0.0001 p < 0.01
7 minute post intubation(T7)	121.23±6.66	0.0001 p < 0.01	110.8±6.88	0.0001 p < 0.01	0.0001 p < 0.01
10 minute post intubation(T10)	108.33±4.92	0.0001 p < 0.01	104.87±4.80	0.0001 p < 0.01	0.0078 p < 0.01
15 minute post intubation(T15)	108.37±4.29	0.0001 p < 0.01	104.9±4.43	0.0001 p < 0.01	0.0032 p < 0.01

**Table 5:** Changes in Mean Arterial Blood Pressure.

Time	Group L0.15		Group L0.30		Intergroup p value
	MAP	Intragroup P value	MAP	Intragroup P value	
Baseline	95.52±5.53	NA	97.84±5.37	NA	0.10 p > 0.05
After giving premedication	95.91±5.62	0.78 p > 0.05	97.78±5.19	0.96 p > 0.05	0.13 p > 0.05
Just after giving study drug	95.72±5.48	0.88 p > 0.05	97.77±5	0.95 p > 0.05	0.13 p > 0.05

Table continued ...

<b>Just before intubation</b>	96±5.49	0.73 p > 0.05	97.56±5.32	0.83 p > 0.05	0.26 p > 0.05
<b>0 minute post intubation (T0)</b>	106.1±5.88	0.0001 p < 0.01	107±4.21	0.0001 p < 0.01	0.49 p > 0.05
<b>1 minute post intubation (T1)</b>	102.5±5.89	0.0001 p < 0.01	101.91±4.83	0.003 p < 0.01	0.67 p > 0.05
<b>3 minute post intubation (T3)</b>	102.6±4.88	0.0001 p < 0.01	98.52±3.63	0.0001 p < 0.01	0.0005 p < 0.01
<b>5 minute post intubation (T5)</b>	92.53±5.83	0.0001 p < 0.01	86.01±5.31	0.0001 p < 0.01	0.0001 p < 0.01
<b>7 minute post intubation (T7)</b>	92.64±5.72	0.0001 p < 0.01	86.03±4.78	0.0001 p < 0.01	0.0001 p < 0.01
<b>10 minute post intubation (T10)</b>	82.96±4.41	0.0001 p < 0.01	79.34±4.14	0.0001 p < 0.01	0.002 p < 0.01
<b>15 minute post intubation (T15)</b>	83.37±3.83	0.0001 p < 0.01	80.32±4.29	0.0001 p < 0.01	0.002 p < 0.01

Table 5 shows the changes in Mean Arterial Blood Pressure starting from baseline up to 15 minutes post induction in both groups. We observed the baseline parameters, just after giving

premedication, just after giving study drug and just before the time of intubation, the MAP was comparable in both groups ( $p > 0.05$ , statistically not significant). (Table 5)

Table 6: Changes in SPO<sub>2</sub>

Time	Group L0.15		Group L0.30		Intergroup P value
	SPO <sub>2</sub>	Intragroup P value	SPO <sub>2</sub>	Intragroup P value	
<b>Baseline</b>	98.56±0.50	NA	98.53±0.51	NA	0.81 p > 0.05
<b>After giving premedication</b>	98.47±0.51	0.49 p > 0.05	98.6±0.49	0.59 p > 0.05	0.31 p > 0.05
<b>Just after giving study drug</b>	98.5±0.51	0.64 p > 0.05	98.53±0.51	0.9 p > 0.05	0.82 p > 0.05
<b>Just before intubation</b>	98.53±0.51	0.81 p > 0.05	98.47±0.51	0.65 p > 0.05	0.65 p > 0.05
<b>0 minute post intubation (T0)</b>	98.57±0.50	0.93 p > 0.05	98.47±0.51	0.64 p > 0.05	0.44 p > 0.05
<b>1 minute post intubation (T1)</b>	98.5±0.51	0.64 p > 0.05	98.53±0.51	0.99 p > 0.05	0.82 p > 0.05
<b>3 minute post intubation (T3)</b>	98.53±0.51	0.81 p > 0.05	98.53±0.51	0.99 p > 0.05	0.82 p > 0.05
<b>5 minute post intubation (T5)</b>	98.43±0.51	0.31 p > 0.05	98.53±0.51	0.99 p > 0.05	0.45 p > 0.05
<b>7 minute post intubation (T7)</b>	98.57±0.51	0.93 p > 0.05	98.60±0.5	0.59 p > 0.05	0.82 p > 0.05
<b>10 minute post intubation (T10)</b>	98.63±0.49	0.58 p > 0.05	98.47±0.51	0.65 p > 0.05	0.22 p > 0.05
<b>15 minute post intubation (T15)</b>	98.53±0.51	0.82 p > 0.05	98.60±0.5	0.59 p > 0.05	0.59 p > 0.05

This table shows arterial oxygen saturation as measured by pulse oximeter. Inter group as well as intragroup comparison showed no significant change in oxygen saturation throughout the intraoperative period. (Table 6)

The only side effect observed was that of

group L0.30 (0.3 mg/kg) in form of bradycardia, intraoperatively. Three patients developed bradycardia (pulse rate < 50 beats per minute) after the study period of 10 min. Injection atropine in 0.2 mg increments (max. 0.01 mg/kg) was given. All the patients responded to atropine treatment. No any another side effect happened during study.

## Discussion

In our study, we have compared the efficacy of two different doses, 0.15 mg/kg and 0.30 mg/kg, of Labetalol Hydrochloride for attenuation of hemodynamic response to laryngoscopy and endotracheal intubation in controlled hypertensive patients. Administration of general anaesthesia incorporates laryngoscopic manipulation and endotracheal intubation as noxious stimuli capable of producing circulatory response.

Laryngoscopy and intubation of the trachea alter the respiratory and cardiovascular physiology both via reflex sympathetic responses and by the physical presence of the tube. The elevation of blood pressure is associated with norepinephrine release whereas changes in heart rate are epinephrine related. Norepinephrine levels may increase on laryngoscopy and intubation from (60-310 pg/ml) and continue to rise for 4 to 8 min, Epinephrine levels may raise 4 times from 70 to 280 pg/ml.<sup>6</sup>

This stress response does not pose a problem for the young and healthy patients; but those with cardiovascular and cerebrovascular disease and geriatric patients are at an increased risk of morbidity and mortality from the tachycardia and hypertension. The pressor response in these patients may lead to complications like left ventricular failure, myocardial infarction, pulmonary oedema, ventricular arrhythmias, cerebral haemorrhage, and rupture of cerebral aneurysm. So, These circulatory responses are exaggerated in hypertensive patients.<sup>7</sup>

According to the diagnostic criteria of the Joint National Committee on Hypertension (JNC-8), hypertension is defined if systolic blood pressure is >140 mm Hg and/or diastolic blood pressures were >90 mm Hg. Patients who are hypertensive but their hypertension is controlled by antihypertensive drugs such as calcium channel antagonists (e.g., nifedipine, nicardipine) and rennin angiotensin inhibitors (e.g., captopril) for varying periods of time are considered as controlled hypertensive patient.<sup>8</sup>

Present study was a prospective randomised controlled trial, consisting of 60, ASA II, between 30-65 years of age group, controlled hypertensive patients posted for elective surgery under general anaesthesia requiring orotracheal intubation. The patients were randomly allocated into two groups of 30 patients each using sealed envelope method i.e.

- In the group L0.15 0.15 mg/kg of Labetalol Hydrochloride (diluted with 0.9% saline to 10 ml) is given 5 min prior to intubation.

- In the group L0.30 0.30 mg/kg of Labetalol Hydrochloride (diluted with 0.9% saline to 10 ml) is given 5 min prior to intubation.

In both groups heart rate, systolic, diastolic and mean arterial blood pressure (SBP, DBP, MAP), Rate Pressure Product (RPP), pulse-oximetry (SpO<sub>2</sub>) were measured and noted at the various time intervals There was no statistically significant difference between mean ages of both the groups.

Various other authors have used another similar age groups in their study like Rajender Kumar et al, 2016<sup>9</sup>, Sangamesh B. Kunakeri, 2016<sup>10</sup>, and Hale Yarkan Uysal, 2012<sup>11</sup>. Thus our results are in consonance with their results.

The mean baseline pulse rate was 87.23±9.3 in group L0.15 and 86.2±7.6 in group L0.30. It was comparable in both the groups, p>0.05 statistically not significant. In group L0.15, there was a rise in pulse rate immediately after intubation i.e. 101.33±9.28 (16% rise), which lasted uptill 3 minutes post intubation. This momentary rise in pulse rate was within physiological limits (<20% of baseline). From 5th minute post-intubation onwards, the pulse rate settled down (85.73±9.13) and remained stable throughout the study period of 15 minutes (p<0.01, highly significant). Our results were in consonance with the study done by Rajender Kumar et al, 2016<sup>9</sup>

In both groups there was significant attenuation of systolic blood pressure during the post-intubation period. There was statistically significant (p<0.01) reduction in SBP in both groups compared to their baseline values.

However, significant difference was found between the two groups i.e. inter-group p<0.01 (highly significant). Our results were in consonance with the study done by Rajender Kumar et al, 2016.<sup>9</sup>

Significant difference found between the two groups i.e. inter-group p<0.01 (highly significant). The maximum attenuation in DBP was 70.28±6.57 as compared to a baseline value of 81.23±6.52 i.e. 17% in group L0.15 at 10 minute post intubation, while in group L0.30 it was 71.63±6.21 i.e. 16% as compared to a baseline value of 82.03±5.95 at 5<sup>th</sup> minute post-intubation.

The mean baseline mean arterial pressure (MAP) was 95.52±5.53 in group L0.15 and 97.84±5.37 in group L0.30. It was comparable in both the groups i.e. p>0.05 not significant. However, significant difference was found between the two groups. Our results were in consonance with the study done by various studies.<sup>5-8</sup>

The baseline/pre-operative RPP was 11174±1352

in group L0.15 and 10832±998 in group L0.30.

In both groups, there was decrease in the rate pressure product (RPP) during the post-intubation period. There was statistically significant ( $p < 0.01$ ) reduction in RPP in both groups compared to their baseline values. The best attenuation of RPP was observed at 10th minute post- intubation in group L0.15 was 10389±1361 while in Group L0.30 was 8017±786 at 3 minute post intubation.

The baseline SpO<sub>2</sub> was 98.56±0.50 in Group L0.15 and 98.53±0.51 in Group L0.30 as depicted in graph-10. In our study no significant difference in SpO<sub>2</sub> was found in both the groups during the intra-operative period ( $p > 0.05$ ). Our results were in consonance with the study done by various studies.<sup>12-15</sup>

The only side effect observed was that of group L0.30 (0.3 mg/kg) in form of bradycardia, intraoperatively. Three patients(10%) developed bradycardia (pulse rate <50 beats per minute) after the study period of 10 min. Injection atropine in 0.2 mg increments (max. 0.01 mg/kg) was given. All the patients responded to atropine treatment. No any other side effects was observed.

Our results were in consonance with the study done by Rajender Kumar et al, 2016<sup>9</sup> in which 7 patients have bradycardia and also they had transient premature ventricular contraction in two patients which was not seen our study.

## Conclusion

Inj. Labetalol Hydrochloride in two different doses, 0.15 mg/kg and 0.3 mg/kg, can be used for attenuation to laryngoscopy and endotracheal intubation in controlled hypertensive patients: Significant attenuation of the rise in systolic, diastolic and mean arterial blood pressure. RPP remaining stable and within physiological limit throughout the study period. There is not significant side effect found to both this doses. Labetalol Hydrochloride in both the doses 0.15 mg/kg and 0.3 mg/kg intravenous is effective in reducing the hemodynamic responses to direct laryngoscopy and tracheal intubation in dose dependent manner in controlled hypertensive patients.

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## Comparative Study of Lignocaine, Lignocaine with Dexmedetomidine and Lignocaine with Fentanyl for Biers Block in Upper Extremity Surgeries

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### Abstract

**Background:** Dexmedetomidine and Fentanyl have been used effectively along with local anaesthetics to shorten the onset, prolong the duration of the block, and to increase postoperative analgesia. We compared fentanyl and dexmedetomidine as adjuvants to lignocaine for Biers Block for upper extremity surgeries.

**Materials and Methods:** After Institutional approval and informed consent, 90 ASA 1 and 2 volunteers were taken into the study. 30 patients were randomly allocated each in Group A to receive Biers block for upper extremity with 3 mg/kg of 0.5% lignocaine; in Group B, with 3 mg/kg of 0.5 % lignocaine with 0.5 mcg/kg dexmedetomidine and Group C received Biers block of upper extremity with 3 mg/kg of 0.5% lignocaine with 1mcg/kg Fentanyl. The onset of sensory, complete motor block and tourniquet pain were observed and any symptoms after cuff deflation were recorded. Usual haemodynamic monitoring used.

**Statistical Analysis:** ANOVA (Analysis of Variance) and Chi-square tests were used for data analyses; p value of <0.05 considered significant.

**Results:** Groups A, B and C were comparable in demographic and surgical parameters. The speed of onset of sensory and motor block was higher in Group C (Fentanyl) (p <0.0001). The tourniquet pain occurred significantly later in Group B (Dexmedetomidine) (p<0.0001). There were few incidences of bradycardia in Group B.

**Conclusion:** In conclusion, present study suggested that dexmedetomidine and fentanyl will enhance the quality of anaesthesia, providing a shorter onset time of sensory and motor block, delayed first analgesia requirement.

**Keywords:** Biers block; Local Anesthetic: Lignocaine Hydrochloride;  $\alpha$ -2 Agonist: Dexmedetomidine; Fentanyl.

### Introduction

Biers block which came into clinical practice by August Bier in 1908, was forgotten for nearly half a century and it was reintroduced by Holmes in Great Britain in 1963. Since then it has become popular and numerous reports from all over have appeared affirming to its efficacy in properly selected patients. The factors to be considered while performing this block are allergic reaction to the agents used and the

anticipated length of procedure. Since the analgesia is dependent upon the continuous presence of the tourniquet, it provides satisfactory analgesia for most surgical procedures on distal parts of the extremities.<sup>1</sup>

This form of analgesia is preferably appropriate for emergencies, where patient is high risk of gastric aspiration. Moreover the feasibility and easiness of execution of this method, its effectiveness and

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its lack of any side effects have been gratifying. The equipment needed is negligible. Biers block is mainly suitable for outpatient surgeries, as it requires negligible preparation and premedication.<sup>2</sup>

Biers block is apt for distal extremity surgeries like ganglion excision, decompression of de Quervain's disease, manipulative reduction and dislocations of bones of forearm, amputations, wound debridement, tendon repair, foreign body removal, open reductions of fracture of forearm bones etc.

Currently, alpha-2 adrenergic receptor agonists<sup>3</sup> have been the focus of interest for their beneficiary effects like sedation, anxiolysis, analgesia and perioperative sympatholytic and cardiovascular alleviating effects with decreased anaesthetic requirements.

Dexmedetomidine<sup>4</sup>, a stereoisomer of medetomidine is a highly selective alpha-2 adrenergic agonist which decrease anaesthetic necessities by upto 90% and to induce analgesia in rats, and patients. It has been used successfully in combination with local anaesthetics for procedures like spinal<sup>5</sup> epidural<sup>6</sup> and brachial blocks<sup>7</sup> where it has been found to enhance/potentiate the action of local anaesthetics.

Fentanyl is a piperidine derivative that can be added to a LA during to increase the rate of success of the blockade and extend postoperative analgesia.

The present study was designed to evaluate the quality, onset of sensory, onset of motor blockade and beginning of tourniquet pain in Biers block with 0.5 mcg/kg dexmedetomidine added to 3 mg/kg of 0.5% lignocaine and 1mcg/kg Fentanyl added to 3 mg/kg of 0.5% lignocaine.

## Materials And Methods

This prospective, randomised, double-blinded study conducted in Mahadevappa Rampure medical college, Kalaburagi between January 2017 to February 2018 after obtaining clearance from Institutional Ethical Committee of the Institute and written informed consent from all patients.

The study included of 90 patients belonging to either sex and age between 18 and 60 years. All the patients fitted to ASA (American Society of Anesthesiologists) grade 1 or 2. Patients were randomly separated into three groups:

**Randomisation of the patients is allocated into defined groups according to computer generated random numbers-**

*Group A-* received Biers block for upper extremity

with 3 mg/kg of 0.5% lignocaine.

*Group B-* received Biers block of upper extremity with 3 mg/kg of 0.5% lignocaine with 0.5 mcg/kg dexmedetomidine.

*Group C-* received Biers block of upper extremity with 3 mg/kg of 0.5% lignocaine with 1 mcg/kg Fentanyl.

No sedatives and opioids were administered to the patients in the preoperative period. Standard monitoring applied to the patients to measure blood pressure, and pulse rate every 5 min for the 30 min then every 15 min till 2 h after deflation of tourniquet.

22 gauge intravenous cannula inserted in the most distal vein on the dorsum of the hand to be operated, it was used for injecting lidocaine mixture, and another 20 gauge cannula was inserted in the other hand for fluids, antibiotics, and analgesics.

The arm to be operated upon was evacuated from blood by Esmarch bandage, then double tourniquet was put on the upper arm with proximal inflated to 300 mm Hg. Complete termination of arterial blood supply and venous return in limb was confirmed by pallor of the hand absence of radial pulse, and absence of the plethysmography of pulse oximetry.

Injection of 40 ml of the lidocaine solution with the adjuvant was done over next 1 min and the time of complete injection of the solution was considered 0 time.

Sensation was examined by pin prick every 30 s in the 1st 10 min or until complete sensory loss to define the sensory onset, and every 1 min after deflation of the tourniquet to determine sensory recovery time.

Motor block was examined every 30 s in the 1st 10 min to determine the onset of motor block, then every 30 s after deflation of tourniquet to conclude motor recovery time. It was studied by the ability of the patient to move his wrist or fingers in flexion, extension, supination, or pronation.

Once patient felt discomfort, distal tourniquet was inflated with 250 mmHg or 100 mm Hg above the systolic blood pressure of the patient, and the proximal one was deflated. At the end of the operation, the anesthesiologist deflated tourniquet by repeated inflation, deflation technique in which 10 s of deflation followed by 1 min of reinflation, and this was repeated 3 consecutive times.

Time to 1<sup>st</sup> analgesic request was calculated from time of deflation of the tourniquet was recorded.

Side effects such as hypotension (20% decrease

of baseline bloodpressure), bradycardia (heart rate below 60 beat per minute), tinnitus, numbness, dizziness, hallucinations, excessive sedation and pain on injection were treated and recorded.

**Statistical Analysis**

One-Way ANOVA (Analysis of Variance) used for the comparison between the groups and Chi-square test applied for age, sex and ASA grades. P value of <0.05 considered significant.

**Results**

The present study demonstrated that patients were between the 18-60 years of age with mean age of 38.6 in Group A, 33.2 in Group B and 40.3 in Group C.(table 1)

**Table 1:** Age Distribution.

	Group A	Group B	Group C
<b>Mean</b>	38.6	33.2	40.3
<b>S.D</b>	15.3	TT9.6	14.5

P value < 0.05.

In our study there were seventeen male patients and thirteen female patients in Group A, thirteen male patients and seventeen female patients in Group B and sixteen male patients and fourteen female patients in Group C.(table 2)

**Table 2:** Sex Distribution.

	Group A	Group B	Group C
<b>Male</b>	17	13	16
<b>Female</b>	13	17	14

p value < 0.05

The present study revealed that sensory blockade occurred at mean time of 6.6 mins in Group A, 2.4 mins in Group B and 4.3 mins in Group C. (table 3)

**Table 3:** Statistical Analysis of onset of Sensory Blockade.

	Group A	Group B	Group C
<b>Mean</b>	6.6	2.4	TT 4.3
<b>S. D</b>	1.4	0.7	0.9

p value < 0.05

The present study revealed that onset of motor block occurred at mean time of 16.6 mins, 7.8 mins and 13.9 mins with standard deviation of 2.1, 1.4 and 1.9 mins in Group A, Group B and Group C respectively. (table 4)

**Table 4:** Statistical Analysis of onset of Motor Block.

	Group A	Group B	Group C
<b>Mean</b>	16.6	7.8	13.9
<b>S.D</b>	2.1	1.4	1.9

p value < 0.05

The present study revealed that onset of tourniquet pain occurred at mean time of 11.3 mins, 13.2 mins and 16.9 mins with standard deviation of 3.5, 2.1 and 2.8 mins in Group A, Group B and Group C respectively.(table 5)

**Table 5:** Statistical Analysis of onset of Tourniquet Pain.

	Group A	Group B	Group C
<b>Mean</b>	11.3	13.2	16.9
<b>S.D.</b>	3.5	2.1	2.8

p value < 0.05

The present study demonstrated that duration of surgery took a mean time of 49 mins, 45 mins and 48 mins with standard deviation of 19.5, 11.6 and 16.8 mins in Group A, Group B and Group C respectively. (table 6)

**Table 6:** Statistical Analysis of duration of Surgery.

	Group A	Group B	Group C
<b>Mean</b>	49	45	48
<b>S.D</b>	19.5	11.6	16.8

p value of 0.05

Whole 90 patients were distributed into 3 groups of 30 each. Age, sex and time duration of surgery were comparable in between groups (p >0.05). The time of onset of sensory and motor block was faster in Group B as compared to Group C (p <0.0001), while duration of onset of tourniquet pain was longer in Group C compared to Group B (p <0.0001).(table 7)

Whole 90 patients were distributed into 3 groups of 30 each. Age, sex and time duration of surgery were comparable in between groups (p >0.05). The time of onset of sensory and motor block was faster in Group B as compared to Group C (p <0.0001), while duration of onset of tourniquet pain was longer in Group C compared to Group B (p <0.0001).(table 7)

	Group A	Group B	Group C
<b>Age (Years)</b>	38.6 +/- 15.3	33.2 +/- 9.6	40.3 +/- 14.5
<b>Sex</b>			
<b>Male</b>	17	13	16
<b>Female</b>	13	17	14
<b>Onset of Sensory Block (minutes)</b>	6.6 +/- 1.4	2.4 +/- 0.7	4.3 +/- 0.9

Table continued ...

<b>Onset of motor Block (Minutes)</b>	16.6 +/- 2.1	7.8 +/- 1.4	13.9 +/- 1.9
<b>Onset of Tourniquet Pain (Minutes)</b>	11.3 +/- 3.5	13.2 +/- 2.1	16.9 +/- 2.8
<b>Duration of Surgery (Minutes)</b>	49 +/- 19.5	45 +/- 11.6	48 +/- 16.8

p value < 0.05

## Discussion

Intravenous regional anesthesia is a simple, cost-effective and safe procedure for surgery. It is a proven, time tested technique for surgeries of upper and lower extremity. It provides rapid onset of analgesia in 5–10 minutes with good muscle relaxation. Biers block is principally appropriate for out patient surgeries, as it requires very less preparation and premedication.<sup>1</sup>

Drawback of biers block is pain due to tourniquet, as tourniquet has to be kept inflated constantly throughout procedure and limited duration of the surgery can be allowed.

In view to enhance quality of block, duration of analgesia and sedation, several trials have been done with dexmedetomidine and fentanyl.

Memis et al<sup>4</sup> in 2004 performed Biers block using 0.5% lignocaine 3 mg/kg with saline in control group and 0.5% lignocaine 3 mg/kg with 0.5 mcg/kg dexmedetomidine in study group.

Grounded on this study, we used 0.5 mcg/kg dexmedetomidine with lignocaine in the present study.

The current study was performed on 90 patients undergoing various upper extremity procedures. The patients were randomly chosen to three groups:- Group (A) Group (B) and Group (C). Group A patients underwent biers block with 0.5% lignocaine alone. Group B patients underwent Biers block with combination of dexmedetomidine 0.5 mcg/kg and 0.5% lignocaine. Group C patients underwent Biers block with 1 mcg/kg Fentanyl and 0.5% lignocaine.

Ninety patients were randomly assigned for upper extremity surgeries for short procedures after adequate nil by mouth, physical status and basic investigations.

The present study demonstrated that patients were between the 18-60 years of age with mean age of 38.6 in Group A, 40.3 in Group B and 33.2 in Group C.

In our study there were seventeen male patients and thirteen female patients in Group A, thirteen male patients and seventeen female patients in Group B and sixteen male patients and fourteen female patients in Group C.

## Exsanguination

John Mabeet al<sup>2</sup> studied that while Esmarch was the most active exsanguination method, arm elevation or arterial compression also were effective.

Hence, in this study first gravitational drainage was done followed by Esmarch bandage application.

## Dose Selection

In this study Group A received 0.5% of lignocaine 3 mg/kg, Group B received 0.5% of lignocaine 3 mg/kg with dexmedetomidine 0.5 mcg/kg and Group C received 0.5% of lignocaine 3 mg/kg with fentanyl 1 mcg/kg.

Also, Dilek Memis et al<sup>4</sup> used 0.5% of lignocaine 3mg/kg diluted to 40 mL in lignocaine group and 0.5% of lignocaine 3 mg/kg with dexmedetomidine 0.5 mcg/kg diluted to 40 mL in dexmedetomidine group.

Abhishek Gupta et al<sup>3</sup> performed 40 mL 0.5% of lignocaine and either dexmedetomidine 0.5 mcg/kg in Group A or dexmedetomidine 1 mcg/kg in Group B.

Esmaoglu et al<sup>9</sup> used 3 mg/kg lignocaine diluted with saline in control group and 1 mcg/kg of dexmedetomidine +3 mg/kg lignocaine in dexmedetomidine group.

Gobeaux et al.<sup>10</sup> added 100 µg of fentanyl to adrenaized lignocaine for brachial plexus block and reported increasing levels of sensory and motor blockade.

The present study showed significant reduction of onset of sensory and motor block in Group B and Group C. Sensory and motor block recovery times were also statistically prolonged in these groups (p < 0.001).

In a study conducted by Dilek Memis et al<sup>4</sup> also found substantial reduction in onset times of sensory and motor block in Group LD as related to Group L. Sensory and motor block recovery times were also statistically extended in this group.

## Toxicity Reaction

The problems of Biers block usually are caused by the systemic toxicity of the adjuvants used.

Brown and colleagues in their twenty years' experience explained Biers block without mortality and morbidity. In one series of 1400 patients, only 8 patients had CNS stimulation and only three had frank convulsions.<sup>12</sup>

Dunbar and Mazze found zero arrhythmias and small drop in blood pressure or bradycardia on release of the tourniquet.<sup>13</sup>

Kennedy and co-workers noticed a 15% incidence of ECG changes and documented one cardiac arrest that was preceded by bradycardia.<sup>14</sup>

They explained that lower the dose and higher the injection release interval, the probability of toxic reactions were rare. In this study, there were no significant changes in heart rate or ECG.

### **Blood Levels**

Mazze and colleagues reported a blood level of 1.5 mcg/mL following 3 mg/kg of 0.5% lignocaine.<sup>15</sup>

Hargrove and colleagues found that maximum level of local anaesthetic in venous blood from other arm did not exceed 2 mcg/mL.<sup>16</sup>

In our study, we could not calculate blood levels due to lack of facilities.

### **Complications Related to the use of Tourniquet**

One study reviewed an predictable 6,30,000 tourniquet applications found an incidence of peripheral nerve damage of 1 in 80,000. The incidence was high in procedures involving the upper extremity than in those involving lower extremity. The tourniquet time was in range 20 minutes to 2-½ hours.<sup>17</sup>

DilekMemis et al<sup>4</sup> found that addition of dexmedetomidine found significant decrease in tourniquet and post-operative pain during Biers block.

In this study there were no complications related to the application of tourniquet and also it was found that adding up of dexmedetomidine and fentanyl reduce tourniquet pain during Biers block.

In recent years, alpha-2 adrenergic receptor agonists<sup>4</sup> have been the focus of interest for their beneficiary effects such as sedation, anxiolysis analgesia and perioperative sympatholytic and cardiovascular stabilizing effects with reduced anaesthetic requirements. Dexmedetomidine, centrally acting  $\alpha_2$ - adrenergic agonist exerts strong analgesic action. It increases the local anaesthetic action of lignocaine via  $\alpha_2A$

adrenoceptor. Dexmedetomidine<sup>4</sup>, a stereoisomer of medetomidine is a extremely selective alpha 2 adrenergic agonist and has been shown to decrease anaesthetic requirements by upto 90% and to induce analgesia in rats, volunteers and patients. It has been used successfully in combination with local anaesthetics for procedures like spinal<sup>5</sup>, epidural<sup>6</sup> and brachial blocks<sup>7</sup>, where it has been found to enhance/potentiate the action of local anaesthetics.

Perioperative dexmedetomidine usage decreases the necessities for opioid or non-opioid analgesics, both intra and post-operatively.<sup>19</sup> Intravenous dexmedetomidine can be used as a premedication as it decreases patient's anxiety, sympatho-adrenal responses and opioid analgesic requirements, but it did not reduce tourniquet pain.<sup>20,21</sup> Dexmedetomidine causes hypertension and bradycardia until the central sympatholytic effect dominates, resulting in moderate decrease in both mean arterial pressure and heart rate from baseline.<sup>22</sup>

In this study, dexmedetomidine produced early onset of block, whereas fentanyl when added in Biers block provided delayed onset of tourniquet pain and better postoperative analgesia.

### **Conclusion**

Present study suggested that dexmedetomidine and fentanyl will enhance the quality of anaesthesia, providing a shorter onset time of sensory and motor block, delayed first analgesia requirement.

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## A Comparative Study of Cormack Lehane Grading by Macintosh, McCoy and Video Laryngoscope in Patients with Predicted Normal Airway

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### Abstract

**Background:** The conventional Macintosh laryngoscope is used most commonly due to its familiarity and ease of use. Newer devices like video laryngoscope are also being commonly now-a-days. Hence a comparative study of the 3 commonly used laryngoscopes has been done.

**Aims & Objectives:** To compare direct laryngoscope view of the different laryngoscope blades & to find out the most suitable laryngoscope in patients with predicted normal airway.

**Methodology:** 150 ASA grade I-II patients with 50 patients in each group were taken. Their stress response, CML grading & intubation time were compared.

**Results:** Stress response was least & CML grading was best, however the time taken to intubate was maximum ( $P < .001$ ) with Video-laryngoscope as compared to McCoy & Macintosh.

**Conclusion:** Video-Laryngoscope provides better visualization of glottic opening as compared to Macintosh and McCoy with less stress response but being a newer device needs more expertise to intubate the patient.

**Keywords:** Video-laryngoscope; Macintosh laryngoscope; CML; Tracheal intubation.

### Introduction

As it is well known that the primary responsibility of the anesthesiologist is airway management. Most anesthesia mishaps happen at the time of induction, and difficulties in intubation may lead to fatal consequences.<sup>1</sup> Failure to oxygenate is the most common cause of death & severe neurological brain damage perioperatively. Conventionally intubation is done with Macintosh laryngoscope blade in predicted normal airway but when

direct Laryngoscopic view is not up to the mark, Anesthesiologist may have to use another available option such as McCoy blade which has a hinged tip that is to be operated externally to improve vision & subsequently help in correct placement of the endotracheal tube under vision.<sup>2</sup> Recent advances in the airway management have resulted in the advent of various optical & video laryngoscopes which are beneficial in airway management.<sup>3-5</sup>

**Aims:** Find out the most suitable laryngoscope

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blade in patients with predicted normal airway.

## Objective

The present study was conducted with following objectives:

1. To compare direct laryngoscopic view of the different laryngoscope blades.
2. Number of intubation attempts with each laryngoscope blades.
3. To study the utility of 3 different laryngoscope blades in routine anesthesia practices.

## Methods

Institutional ethical committee approval was obtained. Informed written consent was taken from the patients & their relatives. This prospective randomized single blinded study was conducted in a tertiary care centre of M. P. between September 2019-July 2020. 150 patients of ASA grade I or II were randomly allocated into 3 groups Macintosh (M) group, McCoy (MC) group, video-laryngoscope (V) group. Randomization was done by computer generated codes that were concealed in sequentially numbered opaque envelopes. Each group had 50 patients who were between 20-70 years of age & were scheduled for elective surgery under General Anesthesia. Following patients were excluded-

1. Who refused to give consent to be a part of the study.
2. Anticipated difficult intubation or had some pathology in upper respiratory tract and neck.
3. Pregnant patients.
4. ASA grade III and IV.

Pre-Operatively the airway of all the patients was assessed by Mallampatti Grade (figure.1), thyromental distance (TMD) and neck movements, neck girth and patients with predicted normal airway were selected.

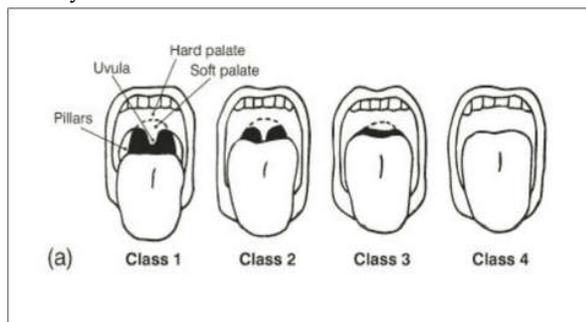


Figure 1. The Mallampatti score:

- Class 1. Complete visualization of the soft palate
- Class 2. Complete visualization of the uvula
- Class 3. Visualization of only the base of the uvula
- Class 4. Soft palate is not visible at all

Patients were blinded for the group allotted but blinding of the anesthesiologist was not possible. In the operation theatre, the patient was shifted and the standard monitors (ECG, Pulse-Oximeter, Non-invasive B. P, temperature) were attached. Baseline parameters were recorded, I.V. access taken. After pre-oxygenation for 3 minutes following drugs were given, intravenously Injection Midazolam 0.05 mg/kg, Injection Glycopyrrolate 0.01 mg/kg, Injection Fentanyl 2 mcg/kg, Induction done with injection Propofol 2 mg/kg.

After confirmation of ability to mask ventilate Injection I.V. Atracurium 0.5 mg/kg was given. Vital parameters were noted post induction. After 4 minutes of Positive Pressure Ventilation, Laryngoscopy and intubation was done. Tracheal intubation was considered a failure if it could not be accomplished in three attempts. The time taken for laryngoscopy was recorded. The Cormack Lehane grading (CML). (figure.2) of laryngeal inlet was noted.<sup>6</sup>

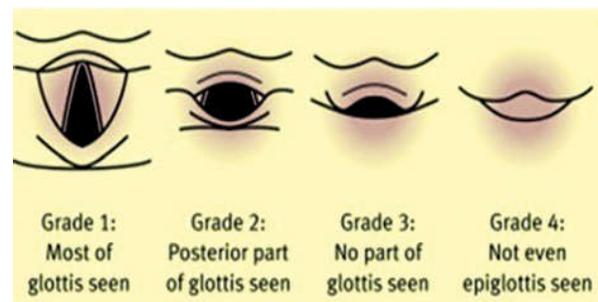


Fig. 2: Cormack Lehane grading.

In addition to clinical assessment tracheal intubation was confirmed by appearance of the capnograph wave form on the monitor.

The time to intubate - (T) was defined as the time taken from the time when the blade of the laryngoscope crosses the incisors and the anesthesiologist visually sees the tube passing through the glottis. This was divided into two parts (T1) the time from insertion of blade till the visualization of glottis and (T2) i.e. the time from visualization of glottis till the tube passes through the glottis.

The time taken for intubation was noted. Vital parameters were monitored at laryngoscopy and at 1, 3, 5 and 10 minutes post intubation. Numbers of intubation attempts were noted. Comfort of the anesthetist also Observed. A maximum number of 3 attempts were permitted with the selected laryngoscope. After failure even in 3 attempts with the assigned blade, laryngoscopy was performed using alternative blade.

After the airway was secured, anesthesia was maintained & at the end of surgery neuromuscular blockade was antagonized. After achieving adequate reversal, patients were extubated & shifted to recovery Area.

**Statistical Analysis**

Normally distributed data was compared using one -way analysis of variance (ANOVA). The non-parametric data were analyzed using Kruskal-Wallis analysis of variance. The comparisons of heart rate and blood pressure were made using repeated measures ANOVA. A pair-wise comparison of the mean values was performed by the paired t-test. A P<0.05 was assumed was statistically Significant.

**Results**

The Demographic characteristics (Table I) of the study patients including age, sex as well as preoperative examination results such as Mallampati score, neck girth measurement, and TMD (Table II) were comparable .No statistically significant difference was observed among the 3 groups, showing that the general characteristics of the 3 study groups were comparable.

The baseline HR, SPO2, SBP, DBP values were also comparable (p>0.05) in all 3 groups. The effect of laryngoscopy on HR showed a statistically Significant rise at the time of laryngoscopy and also at 1, 3, 5 minutes but settled by 10 minutes i.e. was not statistically significant (P=0.06).

**Table 1:** Basic characteristics of the patients.

Group (N=50)	Age [Mean(SD)]	Sex	
		M	F
Group M	38.64 (12.17)	25	25
Group MC	39.68 (12.50)	23	27
Group V	36.4 (11.21)	18	32

**Table 2:** Airway Assessment of patients.

Group - M			Group - MC			Group- V		
MPC	Number of patients	%	MPC	Number of patients	%	MPC	Number of patients	%
I	19	38%	I	19	38%	I	28	56%
II	22	44%	II	19	38%	II	10	20%
III	9	18%	III	12	24%	III	12	24%
Thyromental distance (cm)	Number of patients	%	Thyromental distance (cm)	Number of patients	%	Thyromental distance (cm)	Number of patients	%
6-6.5	21	42%	<6.5	29	58%	<6.5	32	64%
> 6.5	29	58%	> 6.5	21	42%	>6.5	18	36%

**Table 3:** Intubation Attempts in Each Group.

Group (n=50 each)	No. of Intubation Attempts		
	1 Attempts	2 Attempts	3Attempts
Group M	46	4	0
Group Mc	44	6	0
Group V	40	8	2

**Table 4:** Comparison of Laryngoscopy and Intubation Time.

Group	N	Mean	Std. Deviation	P Value
Time to view glottis opening (sec) (t1)	Group M	50	12.900	<0.001
	Group Mc	50	15.240	
Time to pass the tube through glottis (sec) (t2)	Group M	50	11.940	<0.001
	Group Mc	50	10.300	

Table continued ...

Time to view glottis opening (sec) (t1)	Group Mc	50	15.240	3.0140	<0.001
	Group V	50	10.260	1.2257	
Time to pass the tube through glottis (sec) (t2)	Group Mc	50	10.300	1.2330	<0.001
	Group V	50	19.860	2.9967	
Time to view glottis opening (sec) (t1)	Group M	50	12.900	1.8323	0.004
	Group V	50	10.260	1.2257	
Time to pass the tube through glottis (sec) (t2)	Group M	50	11.940	1.9630	0.001
	Group V	50	19.860	2.9967	

The rise in HR was maximum in Macintosh group followed by McCoy group & was least in video-laryngoscope group.(Figure 3)

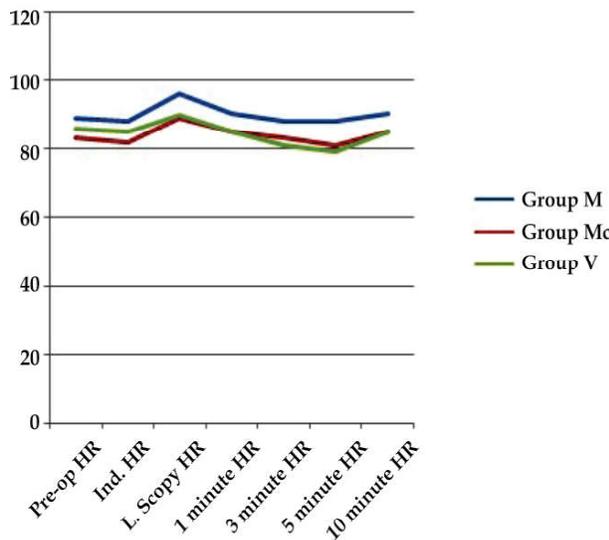


Fig. 3: Comparison of heart rate of three groups.

The SBP, DBP increased at laryngoscopy in all 3 groups but was not significant (Figure 4, 5). The pressor response was maximum in Macintosh group & was least in video-laryngoscope group.

The changes in HR, SBP, and DBP were transient & returned to baseline in 10 mins.

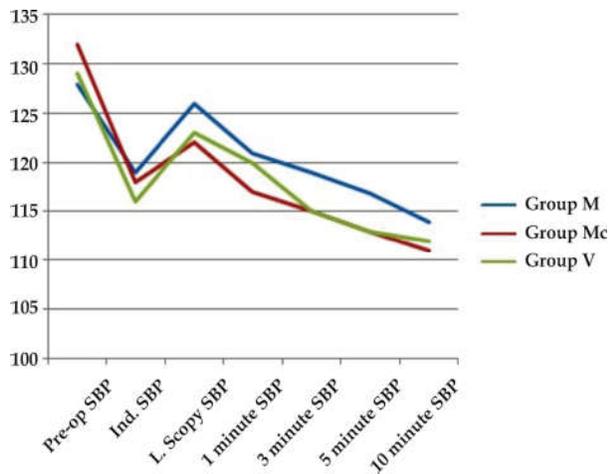


Fig. 4: Comparison of SBP of three groups..

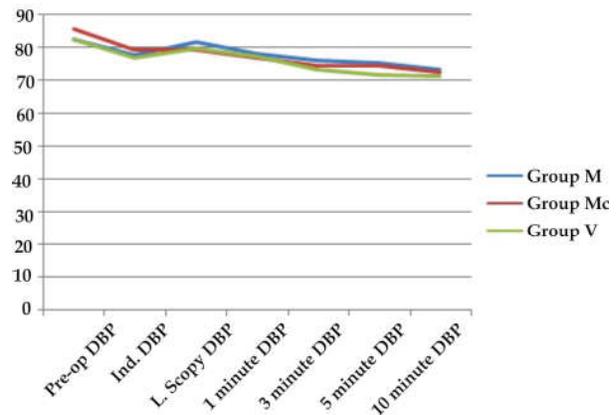


Fig. 5: Comparison of DBP of three groups.

The CML grading was noted. The difference among 3 blades was not statistically significant but grade I was seen in maximum in video-laryngoscope i.e. 60% & there was no grade III & grade IV in video-laryngoscope group.

There was no significant difference in the CML grade among all the 3 devices when compared with each other (P > 0.05) (figure 6).

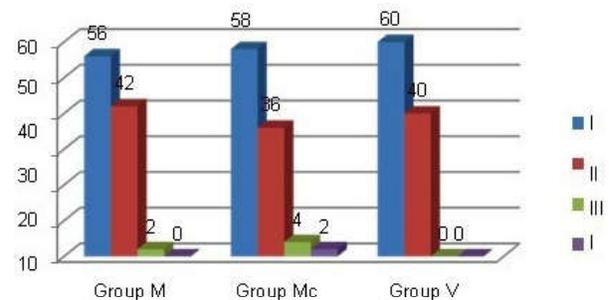


Fig. 6: Comparison of CML of three groups.

The number of advancements made by ETT toward the direction of the glottis was compared and it was found that 46 out of 50, 44 out of 50 and 40 out of 50 patients were intubated in the Ist advancement itself in the 3 group respectively. 4 patients in Macintosh group and 6 patients McCoy were intubated in II advancement while 8 patients in video-laryngoscope were intubated in II advancement and 2 were intubated in III advancement. (Table III).

The total time taken to intubate (T) was 24+2.65seconds, 25.54 + 3.64 seconds, 30.12 + 3.50 seconds, in groups Macintosh, McCoy & Video Laryngoscope respectively. Using one way anova test, there was a significant difference between the 3 groups ( $P < .001$ ). (Table IV).

## Discussion

In our study the hemodynamic response to intubation is less in McCoy when compared to Macintosh group similar results were seen with study done by McCoy EP et al.<sup>7,8</sup>

The hemodynamic response with video-laryngoscope and Macintosh laryngoscope was comparable in most of the studies<sup>9,10,11</sup> but in our study hemodynamic response was least in video-laryngoscope. Probably as glottis visualization does not need any lifting force which is needed in Macintosh rather with video-laryngoscope the glottis visualization was easiest as video-laryngoscopes incorporate a prism, which provides optical view of laryngeal inlet without having to align oral, pharyngeal and laryngeal axes hence CML is best without the need for external laryngeal manipulation as seen in study done by Dr. Atul P. et al.<sup>12</sup>

In our study Video-Laryngoscope provided best CML grading, stress response was least, however time taken to intubate was more with maximum number of second attempts.

Our results were similar to previous studies which had demonstrated that video laryngoscope improves laryngeal view when compared with Macintosh laryngoscope in patients with normal and also anticipated difficult airway.<sup>13,14</sup>

Difference between the time to view glottis opening was statistically significant among the 3 groups & was least in video-laryngoscope group however the time taken to intubate was maximum in video-laryngoscope & was statistically significant.

The number of advancements made by ETT toward the direction of the glottis was compared and it was found that 46 out of 50, 44 out of 50 and 40 out of 50 patients were intubated in the 1st advancement itself in the 3 group respectively. 4 patients in Macintosh group and 6 patients McCoy were intubated in II advancement while 8 patients in video-laryngoscope were intubated in II advancement and 2 were intubated in III advancement. These findings were similar to the study done by SUN et al.<sup>15</sup> Who also experienced more number of attempts though the CML grading

was I & II when video-laryngoscope was used. This difficulty in advancing the tube in to the glottis even after a favorable vision has been obtained was probably due to difficulty in hand-eye coordination as one has to look into the camera, while advancing the tube which may resolve with increasing experience with device.

The main limitation of our study is observer bias since it is impossible to blind the anesthesiologist to the device.

## Conclusion

Hence with our study we conclude that video-laryngoscope provides visualization of glottic opening as compared to Macintosh and McCoy with less stress response but being a newer device needs more expertise to intubate the patient.

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## A Randomized Comparative Study of Ropivacaine 0.5% in Brachialplexus Block with Adjuvant as Dexamethasone vs Fentanyl

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### Abstract

**Background and Aim:** Supraclavicular brachial plexus block is a well-known technique of giving analgesia and anaesthesia for upper limb, our study is aimed at comparing the efficacy of dexamethasone 8mg versus fentanyl 50µg in blockade characteristics and postoperative analgesia when added to 0.5% ropivacaine 30 ml in supraclavicular brachial plexus block. During the study we want to compare the sensory and motor block achieved.

**Methods:** This was a prospective randomized double blind study of 60 cases. The selection of patients was carried out randomly, depending on the lists of operations submitted by the surgical team. A written informed consent was obtained from all patients. Groups were Randomized into Ropivacaine+Fentanyl group (RF) and Ropivacaine + Dexamethasone (RD) groups.

**Results:** Duration of motor blockade was longer in RD group 793.67±75.143 compared to RF group 455.5±27.429. P value was 0.001 which is statistically significant. Duration of sensory blockade was longer in RD group 1181.67±75.59 compared to RF group 508.83. p value was 0.0001 which is statistically significant.

**Conclusion:** Role of Ultrasonography in regional block need not be emphasized, Addition of dexamethasone prolongs the duration of motor block, enhances the duration of analgesia significantly when compared with fentanyl in supraclavicular brachial plexus block and dexamethasone group has 0 VAS scores for longer period compared to fentanyl group.

**Keywords:** Supra clavicular Brachial Plexus; Ultrasound; Ropivacaine; Fentanyl; Dexamethasone.

### Introduction

Brachial plexus block is commonest procedure done in day to day practice in anaesthesia. It is performed to get anaesthesia or analgesia for upper limb for various indications. Brachial plexus block can be performed by Interscalene, supraclavicular, Infraclavicular and Axillary approaches. Though Supraclavicular block is the commonest and popular

technique it is still associated with complications like Pneumothorax. Ultrasound guided technique make this block very safe and 100% successful. Achieving block is usually done by using local anaesthetic drugs. Depending on the type of local anaesthetic used the duration of the block varies. Adding few additives to the local anaesthetic solution gives an addition advantage in onset, duration and density of the block. Considering these factors this study is

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formulated to compare the effect of Fentanyl and Dexamethasone as additives to our local anaesthetic solution Ropivacaine.

## Material and Methods

After obtaining approval from the ethical committee clearance from our institution this prospective randomized double-blind study of 60 cases was conducted. 60 patients aged between 18yrs and 60 yrs of physical status ASA grade I and ASA grade II undergoing elective upper limb surgeries were randomly divided into two groups. Each group consisting of 30 patients to receive supraclavicular brachial plexus block.

GROUP RD (N=30) - 30 ml of 0.5% ropivacaine plus 2 ml of 8mg dexamethasone

GROUP RF (N=30) - 30 ml of 0.5% ropivacaine plus 50 µg fentanyl made to 2 ml.

Informed written consent is taken from all the participants. Patients who refused regional block, with coagulation problems, local site infection were excluded from the study. An informed written consent was obtained from all the patients enrolled in the study.

## Method

### Pre-anaesthetic evaluation

During pre-operative visit patients detailed history, general physical examination and systemic examination were carried out. Basic demographic data like age, sex, height, weight was recorded.

During pre-anaesthetic check-up the visual analogue scale was explained to all patients using 10 cm scale (Fig.1). Informed consent was obtained from all the 60 patients after detailed explanation of the procedure to be performed.



Fig. 1: VAS score by visual analogue scale.

### Procedure

The basal parameters pulse rate, respiratory rate, blood pressure and spo2 were recorded before starting the case. Peripheral venous cannulation was done with 20G IV cannula in opposite arm

and infusion of ringerlactate was started. Each patient would be given 0.03 mg/kg of midazolam intravenously (IV) as a premedication 15 mins before beginning the block technique. Under strict aseptic precautions all the patients received brachial plexus block through the supraclavicular approach.

All the necessary equipment and drugs needed for administration of general anaesthesia and resuscitation will be kept ready in order to manage failure of block and any complications.

One of the anaesthesiologists not involved in the care or monitoring of the patient, prepared the local anaesthetic study solutions.

The patients and the observing anaesthesiologist as well as the physicians and nurses of the acute pain service were blinded to the study drug used.

### Position of the Patient

Patient was made to lie supine with head turned opposite to side of intended block and arm adducted & pulled down gently. A small pillow or folded sheet was placed below the shoulder to make the field more prominent.

### Technique

The supraclavicular space then was prepared using aseptic technique with povidone iodine (Betadine) solution, and the subclavian artery was identified by palpation. The linear high frequency 10-15 MHz transducer of ultrasound machine was initially placed in midline to identify trachea and later it was slid laterally till ultrasound image displayed posterior border of sternocleidomastoid. The roots of brachial plexus were identified as round hypoechoic structures emerging between origins of scalenus anterior and scalenus Medius. These structures were traced caudally till supraclavicular space and subclavian artery was identified as a pulsatile structure. The brachial plexus at this level appeared as a bunch of hypoechoic round structures lying postero-laterally in ultrasound image. The skin was anaesthetized with 1 ml of 1% lidocaine solution. The brachial plexus as approached using a nerve locator needle by in plane approach, the locator end point was distal motor response with output lower than 0.6mA. Negative aspiration of blood was confirmed and the anaesthetic was administered in 5-mL increments following aspiration.

### Assessment

Ending of injection time was recorded as 0 hour.

In the two groups the following parameters are noted.

1. Onset of sensory blockade
2. Onset of motor blockade
3. Duration of motor blockade
4. Duration of analgesia
5. VAS scores
6. Side effects

Assessment of sensory block and motor block was done at each minute after completion of drug injection in corresponding dermatomes till complete sensory and motor blockade. Motor block was assessed at 2<sup>nd</sup> hour and every 2<sup>nd</sup> hourly there after post-operatively till patient regained normal power.

To evaluate duration of analgesia and motor block duration. Patients were asked to inform the time when incisional discomfort as a sensation of pain began and also the time when full power returned to the shoulder.

Duration of analgesia was assessed using visual analogue scale (VAS). During preoperative visit patients were explained about VAS

- 0 - no pain
- 2 - mild pain
- 5 - moderate pain
- 8 - severe pain
- 10 - Unbearable pain

The maximum pain scores i.e., VAS scores at different time intervals 0,5,10,15,20,25,30,45 minutes, 1<sup>st</sup> hr, 2<sup>nd</sup> hr and thereafter every second hourly till 24 hrs in postoperative period for each patient were recorded.

Assessment of motor blockade was done by Bromage three-point score

0 - normal motor function with full flexion and extension of elbow, wrist and fingers.

1 - decrease motor strength with ability to move fingers and/or wrist only

2 - complete motor blockade with inability to move fingers.

Any hypersensitivity reaction for the drugs, evidence of pneumothorax, and other adverse events were also monitored.

In the post-operative period, when the patient complained of pain, VAS>3 at the operative site, Injection Diclofenac 75 mg slow iv infusion was given. Patients were followed up for 24 hrs for any side effects.

### Statistical Analysis

Data were expressed as mean values ± standard deviation/ standard error, percentages (%), and numbers (n). The statistical analysis was performed by a statistician using Windostat Version 9.2 in Hyderabad, Telangana. Two statistical tests were primarily used to analyze the data.

- t-tests were used to analyze differences between two groups
- Differences in VAS score over a period of time were analyzed using ANOVA (analysis of variance)

### Consideration of P values

P value: <0.05 = significant & >0.05 = Not significant.

### Observation and Results

Table 1: Demographic profile of patients.

	N	Descriptive				P value	
		Mean	Std. Deviation	Std. Error	Min. Max.		
Age	RD	30	34.53	9.705	1.772	18	0.174
	RF	30	38.33	11.615	2.121	24	
	Total	60	36.43	10.783	1.392	18	
Wt. (kg)	RD	30	64.37	9.125	1.666	41	0.560
	RF	30	62.97	9.349	1.707	49	
	Total	60	63.67	9.187	1.186	41	
Ht (cm)	RD	30	159.67	3.854	.704	154	0.325
	RF	30	158.50	5.158	.942	150	
	Total	60	159.08	4.552	.588	150	

ANOVA is applied. P value <0.05 is significant

Our study was conducted on 60 patients who were randomly allocated into group-RD and group-RF consisting of 30 patients each. Minimum age recorded in our study was 18 years and maximum age was 59 years. The mean age of patient in group-RD was 34.53 years while the mean age of patient in group-RF was 38.33 years (Table.1). The P value was 0.174 which signifies that the two groups were comparable with regards to age.

Mean weight of patients in group-RD was 64.37Kgs and mean weight of patients in group-RF was 62.97Kgs (Table.1). The P value was 0.560 which is not significant showing that the groups are comparable with regards to Weight.

Mean height of patients in group-RD was 159.67cms while mean height of patients in group-RF was 158.50 (Table. 1).The P value was 0.325

which was again insignificant showing that the two groups are comparable with regards to height.

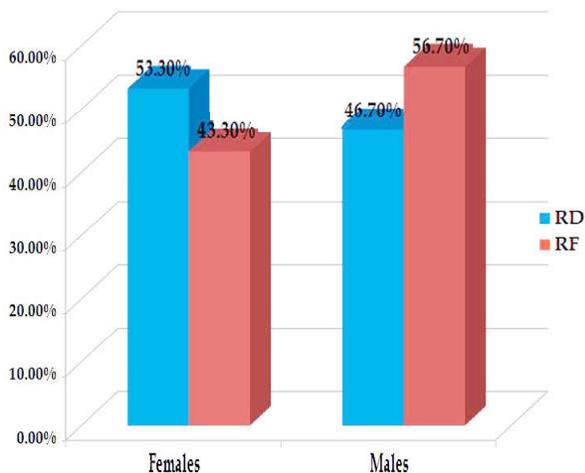
Thus, the patients in our study group were comparable with respect to Age, Weight and Height eliminating bias (if any) which can occur due to these factors.

**Table 2:** Gender Comparison in two Groups.

Group *Sex Crosstabulation				
Group		Sex		Total
		F	M	
RD	Count	16	14	30
	% within group	53.3%	46.7%	100.0%
RF	Count	13	17	30
	% within group	43.3%	56.7%	100.0%
Total	Count	29	31	60
	% within group	48.3%	51.7%	100.0%

Chisquare Value: 0.601, Df: 1, P Value: 0.606, Statistically Not Significant.

**Graph.1:** Gender Comparison in two groups.



In group-RD 53.3% were females and 46.7% were males. In group-RF, 43.3% were females and 56.7% were males (Table. 2)(Graph. 1). Difference between them was comparable in both groups thus eliminating bias if any.

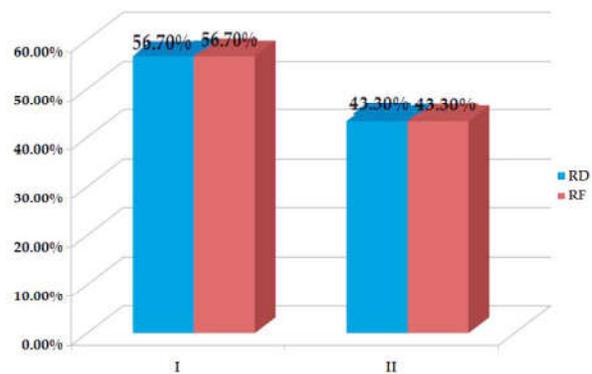
In group-RD, 56.67% patients were ASA I and the remaining 43.33% cases were ASA II. In group-RF 56.67% cases were ASA I and 43.33% cases were ASA II. There was statistically no difference between two groups (Table. 3) (Graph. 2). Thus, the patients in our study groups were comparable with respect to ASA eliminating bias if any.

**Table 3:** Comparison of ASA in two Groups.

Group *ASA Crosstabulation				
Group		ASA		Total
		I	II	
RD	Count	17	13	30
	% within group	56.7%	43.3%	100.0%
RF	Count	17	13	30
	% within group	56.7%	43.3%	100.0%
Total	Count	34	26	60
	% within group	56.7%	43.3%	100.0%

Chisquare Value: 0.001, Df: 1, P Value: 1, Statistically Not Significant

**Graph. 2:** Comparison of ASA in two Groups.

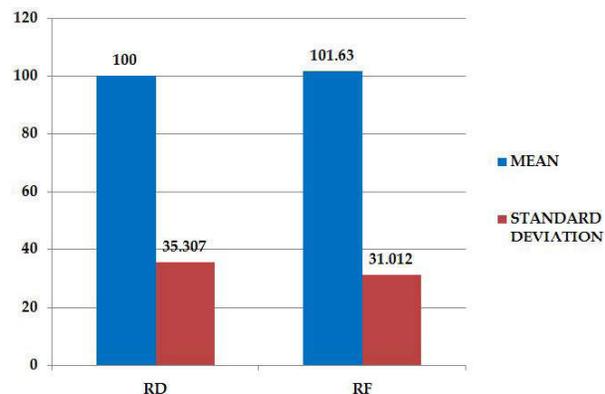


**Table 4:** Comparison of duration of surgery.

Group Statistics					
Group	N	Mean	Std. Deviation	Std. Error Mean	P Value
DOS	RD	30	100.00	35.307	0.850
	RF	30	101.63	31.012	

T- Test is applied. P value is significant if <0.05

**Graph. 3:** Comparison of duration of surgery.



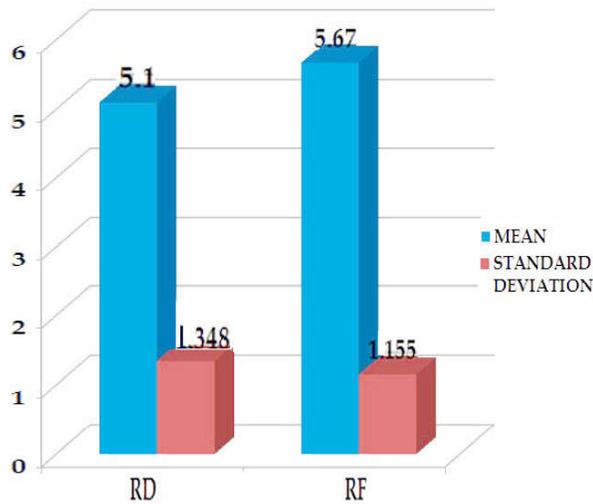
The total duration of surgery was comparable in both groups with mean duration in group-RD  $100.00 \pm 35.307$  and group-RF  $101.63 \pm 31.012$  mins. The P value was 0.850 which was insignificant (Table.4)(Graph.3).

Table 5: Comparison of onset of sensory block.

Group Statistics						
	Group	N	Mean	Std. Deviation	Std. Error Mean	P Value
SOT	RD	30	5.10	1.348	.246	0.086
	RF	30	5.67	1.155	.211	

T- Test is applied. P value is significant if  $<0.05$ .

Graph. 4: Comparison of onset of sensory block.



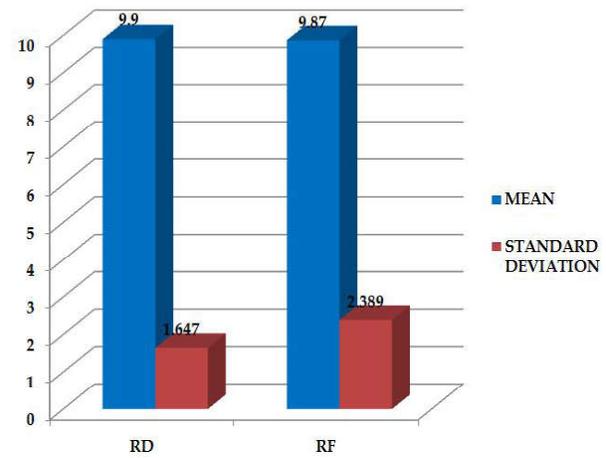
Onset time is the time from the completion of injection of study drug to first loss of pinprick sensation in any of the dermatomes C5-T1. In group-RD, it was  $5.10 \pm 1.348$  min and  $5.67 \pm 1.155$  min in group-RF (Table.5)(Graph.4). This shows that onset of sensory block was comparable in both groups with no statistical significance.

Table 6: Comparison of onset of motor block.

Group Statistics						
	Group	N	Mean	Std. Deviation	Std. Error Mean	P Value
MOT	RD	30	9.90	1.647	.301	0.950
	RF	30	9.87	2.389	.436	

T- Test is applied. P value is significant if  $<0.05$ .

Graph 5: Comparison of onset of motor block.



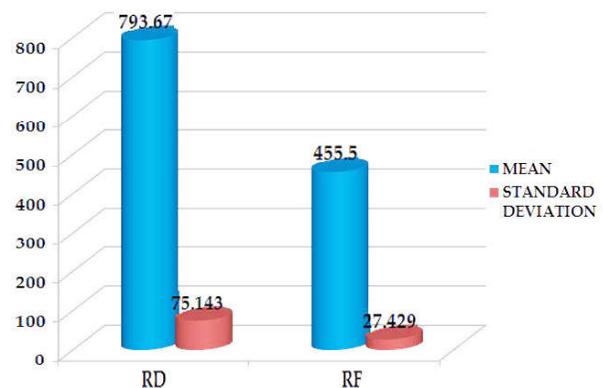
The total time required to achieve complete paralysis of the upper limb was considered as onset of motor block. In group-RD, it was  $9.9 \pm 1.647$  min and  $9.87 \pm 2.389$  min in group-RF. P value is 0.950 which is not significant (Table.6)(Graph.5). This shows that onset of motor block was comparable in both groups with no statistical significance.

Table 7: Comparison of Duration of motor block.

Group Statistics						
	Group	N	Mean	Std. Deviation	Std. Error Mean	P Value
DOMB	RD	30	793.67	75.143	13.719	0.001*
	RF	30	455.50	27.429	5.008	

T- Test is applied. P value is significant if  $<0.05$ .

Graph 6: Comparison of Duration of motor block.

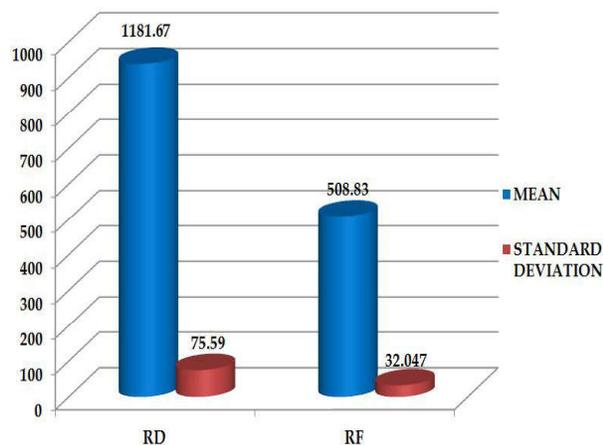


Duration of motor blockade was longer in RD group  $793.67 \pm 75.143$  compared to RF group  $455.5 \pm 27.429$ . P value was 0.001 which is statistically significant (Table.7)(Graph.6).

**Table 8:** Comparison of Duration of Sensory block.

Group Statistics						
	Group	N	Mean	Std. Deviation	Std. Error Mean	P Value
DOSB	RD	30	1181.67	75.59	13.8	0.0001*
	RF	30	508.83	32.047	5.851	

T- Test is applied. P value is significant if <0.05.

**Graph 7:** Comparison of Duration of Sensory block.

Duration of sensory blockade was longer in RD group  $1181.67 \pm 75.59$  compared to RF group  $508.83$ . p value was 0.0001 which is statistically significant (Table.8)(Graph.7).

## Discussion

### *Use of ultrasound in our study*

Ultrasound guidance for supraclavicular brachial plexus block is clinically useful for accurate nerve localization and also minimizes the number of needle attempts. Ultrasound can determine the size, depth, and exact location of the brachial plexus and its neighbouring structures and avoids vascular and pleural punctures.

In our study we used in plane approach of needle insertion with one hand holding the probe, the other advancing the block needle from the outer end of the probe in a lateral to medial direction for two main reasons. First, when positioned in the supraclavicular fossa, the probe leaves limited space on the medial side for needle manoeuvring. Second, the brachial plexus is situated lateral to the subclavian artery; thus, the lateral approach is most logical and direct.

The needle is advanced intentionally in the same plane as the ultrasound beam, i.e., along the

along axis of the probe, where the linear array of ultrasound crystals is situated. With proper needle probe alignment, movement of the needle shaft and tip (a hyper echoic line seen) can be tracked continuously during the block procedure.

When the needle does not trespass the first rib or pleura on ultrasound, the risk of pneumothorax is virtually eliminated. However, without proper alignment, the needle tip cannot be fully visualized, and penetration can be deeper than anticipated, as with the case of unrecognized pleural puncture in this study. Ultrasound imaging shows nerves as mobile structures that move away from the needle or local anaesthetic injection to the periphery, suggesting circumferential spread.

In our study, because of correct needle position and the distention of the plexus sheath which was visualised by ultrasound in all patients, relatively small volumes of local anaesthetics, less than the potentially toxic dose, were necessary to produce satisfying motor and sensory block in nearly all patients. Also the onset of sensory and motor blocks were faster in our study as compared to the studies in which this block was performed by conventional or nerve stimulator technique.

Stephan R Williams et al 1(2003) assessed the quality, safety, and execution time of supraclavicular block of the brachial plexus using ultrasonic guidance and nerve stimulation compared with a supraclavicular technique that used anatomical landmarks and nerve-stimulation. They used equal volumes (0.5ml/kg) of 0.5% bupivacaine and 2% lidocaine, with 1:200000 epinephrine. The duration of post block analgesia was (Group US: mean  $846 \pm 531$  min, median 662 min; Group NS: mean  $652 \pm 473$  min, median 511 min; P not significant). In Group US, 85% of blocks achieved surgical anaesthesia without supplementation, compared with 78% in Group NS. General anaesthesia was required in 0% and 8% of US and NS patients, respectively. They concluded that ultrasound-guided nerve stimulator-confirmed supraclavicular block is more rapidly performed and provides a more complete block than supraclavicular block using anatomic landmarks.

Vincent. W. S. Chan et al<sup>2</sup> (2003), studied Ultrasound-Guided Supraclavicular Brachial Plexus Block in 40 outpatients. The block technique aligned the needle path with the ultrasound beam. The block was successful after one attempt in 95% of the cases. They summarised that ultrasound imaging confers confidence and accuracy of needle placement for nerve localization and examines the pattern of local anaesthetic spread.

### ***Drugs selected for the study***

The three commonly used local anaesthetics are lignocaine, bupivacaine and ropivacaine. Lignocaine is short acting with no added benefit on postoperative analgesia when given in brachial plexus block. Bupivacaine is long acting with more cardiotoxic effects. Ropivacaine is similar to bupivacaine in terms of blockade characteristics but, with lesser cardio and neurotoxicity than bupivacaine. Hence ropivacaine was selected.

Casati A et al<sup>3</sup>(2000) conducted a prospective randomized double blind study to compare intra- and postoperative clinical properties of interscalene brachial plexus block performed with either 0.5% ropivacaine or 0.5% bupivacaine. This study confirmed that 0.5% ropivacaine has clinical properties similar to those of 0.5% bupivacaine, providing similar long duration of postoperative pain relief. Compared with bupivacaine, ropivacaine has the further advantage of a lower potential for central nervous system and cardiovascular toxicity.

Rosemary Hickey et al<sup>4</sup> (1991) conducted a randomized double blind study to compare the effectiveness of 0.5% Ropivacaine and 0.5% Bupivacaine for brachial plexus block. They concluded that both were similar in terms of onset of sensory and motor block, duration of sensory and motor block, incidence of analgesia, anaesthesia, paresis and paralysis and need for supplementation.

Fentanyl is commonly used potent opioid in our institution. We use fentanyl as adjuvant to spinal anaesthesia and brachial plexus block. My interest is brachial plexus blockade. This enhanced antinociception may have been mediated via activation of peripheral opioid receptors. There are also reports that Fentanyl may have local anaesthetic like action.

Tejwant Rajkhowa, et al<sup>5</sup> (2016) conducted a randomized study in 66 patients to compare the analgesic efficacy of Fentanyl used as an adjuvant to ropivacaine for supraclavicular brachial plexus block

Soman c, et al<sup>6</sup> (2015) compared the effects of fentanyl and dexmedetomidine in supraclavicular brachial plexus block achieved with ropivacaine in 90 patients.

Siamak Yaghoobi, et al<sup>7</sup> (2013) conducted a randomized study in 78 patients to compare the analgesic efficacy of dexamethasone and fentanyl added to lidocaine using axillary block.

karakaya d, et al<sup>8</sup> (2001) studied effect of fentanyl

added to bupivacaine in axillary brachial plexus block in 60 patients.

Dexamethasone is cheap and commonly available steroid with studies showing marked prolongation of postoperative analgesia. Prolongation of duration of sensory and motor blockade after perineural administration of dexamethasone may be secondary to its local action on nociceptive C fibers mediated via membrane associated glucocorticoid receptors.

Amit agarwal, et al<sup>9</sup> (2015) studied effect of dexamethasone in interscalene brachial plexus block for shoulder arthroscopic surgery in 100 patients

Gildasio S. De Oliveira Jr. et al<sup>10</sup> (2014) Nine randomized trials with 760 subjects were included. They concluded that perineural dexamethasone seems to improve analgesia duration when used as an adjunct to brachial plexus blocks.

Dr. Feroz Ahmad Dar, et al<sup>11</sup> (2013) studied effect of addition of Dexamethasone to Ropivacaine in Supraclavicular brachial plexus block in 80 patients.

### ***Concentration and doses of the drugs selected***

A faster onset of action could be achieved by increasing concentration of ropivacaine to 0.75%, but was kept to 0.5% in present study since increasing concentration failed to improve blockade characteristics and that the risk of increasing total mg dose of local anaesthetic may not be warranted.

Stephen M Klein et al<sup>12</sup> (1998) conducted a trial in 75 patients to compare 0.5% Bupivacaine and 0.5% and 0.75% Ropivacaine for interscalene brachial plexus block. They concluded that there was no clinically important difference in times of onset and recovery of interscalene block for all 3 drug concentrations when injected in equal volumes.

Various authors have used different volumes of Ropivacaine for brachial plexus block. Stephen M Klein et al<sup>12</sup>, Soman c et al<sup>6</sup>, tejwant et al<sup>5</sup> and kumud et al<sup>13</sup> used 30 ml of local anaesthetic solution for brachial plexus block.

Hence 0.5 % Ropivacaine 30 ml volume was selected for our study and only 8 milligrams of dexamethasone used as this much dose does not cause complications.

Various authors have used 50 mcg of fentanyl as adjuvant. Tejwant et al<sup>5</sup>, Ravi madhusudhan et al<sup>14</sup>, Soman C et al<sup>6</sup>.

Several authors have used 8mg dexamethasone as adjuvant. K. C. Cummings et al<sup>15</sup>, Dr. Feroz et al<sup>10</sup>, Siamik et al<sup>6</sup>, Kumud s et al<sup>13</sup>, Santosh kumar et al<sup>16</sup>.

### **Onset of sensory block**

Sensory onset time is the time from the completion of injection of study drug to first loss of pinprick sensation in any of the dermatomes C5-T1. In group-RD, it was  $5.10 \pm 1.348$  min and  $5.67 \pm 1.155$  min in group-RF. This shows that onset of sensory block was comparable in both groups with no statistical significance.

The sensory onset time of RF group in our study was  $5.67 \pm 1.155$  min well matches with study conducted by Ravi Madhusudhana<sup>14</sup> et al<sup>5</sup>  $\pm 0$  min. They compared efficacy of supraclavicular block of brachial plexus with ropivacaine, ropivacaine and tramadol, ropivacaine and fentanyl in terms of onset, quality and duration of sensory and motor block for patients undergoing surgery for the upper limb.

In study conducted by Tejwant Rajkhowa et al<sup>5</sup> where they used fentanyl as adjuvant to ropivacaine in supraclavicular block, sensory onset time in RF group was  $8.15 \pm 1.22$  min not matching with our study. onset time was less in our study. Reason could be they used nerve stimulator in their study and in our present study we used ultrasound guided nerve stimulator technique, where local anaesthetic is deposited closer to the nerve resulting in faster onset.

Leslie c et al<sup>17</sup> found that using Ultrasound in guiding the interscalene approach to the brachial plexus significantly shortened the duration of intervals in conduction of the block and onset of anaesthesia when compared with Nerve stimulator.

The sensory onset time of RD group in our study was  $5.1 \pm 1.34$  min. correlating to the study Conducted by Dr R. G. Pathak, et al<sup>18</sup> who studied the effect of Supraclavicular brachial plexus block with and without Dexamethasone in 50 patients. The mean onset of sensory block was  $5.92 \pm 2.827$  min in dexamethasone group.

Compared to other studies conducted by Amit Agarwal, et al<sup>9</sup>, Kumud S, et al<sup>13</sup> sensory onset time in our study was less, which was probably due to ultrasound guided nerve stimulator technique in our study, where local anaesthetic is deposited closer to the nerve resulting in faster onset.

In our present study by adding adjuvant, fentanyl or dexamethasone to ropivacaine there was no significant difference in sensory onset times. p value was  $>0.05$ .

### **Onset of motor block**

In our present study motor onset time of RF

group was  $9.87 \pm 2.3$  min. In study conducted by Ravi madhusudhana<sup>14</sup> et al motor onset time was  $11.5 \pm 2.41$  min. In study conducted by Tejwant Rajkhowa et al<sup>5</sup> motor onset time was  $13.2 \pm 1.64$  min. onset time was less in our study. Reason could be they used nerve stimulator in their study and in our present study we used ultrasound guided nerve stimulator technique, where local anaesthetic is deposited closer to the nerve resulting in faster onset.

Leslie c et al<sup>17</sup> found that using Ultrasound in guiding the interscalene approach to the brachial plexus significantly shortened the duration of intervals in conduction of the block and onset of anaesthesia when compared with Nerve stimulator

In our study motor onset time of RD group was  $9.9 \pm 1.64$  min matching with study by Kumud S, et al<sup>13</sup> where they studied the efficacy of dexamethasone added as an adjuvant to ropivacaine (0.5%) for brachial plexus block. Motor onset time in kumud study was 13.07 min.

In our present study by adding adjuvant, fentanyl or dexamethasone to ropivacaine there was no significant difference in sensory onset times. p value was  $>0.05$ .

### **Duration of motor block**

Motor block duration of RF group in our study was  $455.5 \pm 27.42$  min (7-8 hrs). This observation well matches with study conducted by Soman c, et al<sup>6</sup> where they compared the effects of fentanyl and dexmedetomidine in supraclavicular brachial plexus block achieved with ropivacaine. A prospective clinical trial where 90 patients were randomly allocated to either receive 30 ml ropivacaine 0.5% (Group R), 30 ml ropivacaine 0.5% with fentanyl 50 mcg (Group RF) or 30 ml ropivacaine 0.5% with dexmedetomidine 50 mcg (Group RD) in supraclavicular brachial plexus. The motor block duration in RF group was  $458.15 \pm 20.62$  min.

In study conducted by Tejwant Rajkhowa et al<sup>5</sup> duration of motor blockade of RF group was  $6.56 \pm 0.43$  hrs, comparable with our present study.

Motor block duration of RD group in our study was  $793.67 \pm 75.14$  min (12-14.5 hrs). This observation was comparable with that of Kumud S, et al<sup>13</sup> where they studied the efficacy of dexamethasone added as an adjuvant to ropivacaine (0.5%) for brachial plexus block. Total duration of motor blockade was 13.07 hrs.

There was a significant increase in duration of

motor blockade in dexamethasone group compared to fentanyl group and the difference was shown statistically significant. P value was 0.001.

### ***Duration of analgesia (duration of sensory block)***

Duration of analgesia of RFgroup in our study was  $508.83 \pm 32.047$  min (8-9 hrs). This observation well matches with study conducted by Soman c, et al<sup>6</sup> where duration of analgesia of RF group was  $569 \pm 36.04$  min.

In study conducted by Tejwant Rajkhowa et al<sup>5</sup> duration of analgesia of RFgroup was  $7.75 \pm 0.47$  min which was comparable with our present study.

Duration of analgesia of RDgroup in our study was  $1181.67 \pm 75.59$  min (18.5-21hrs)

The present study correlates well with study conducted by Amit Agarwal, et al<sup>9</sup>. They studied in 100 patients with 2 groups received 30 ml of 0.5% ropivacaine plus 2 ml normal saline and 30 ml of ropivacaine 0.5% plus 2 ml dexamethasone 8 mg. Duration of analgesia in dexamethasone group was  $1103.72 \pm 296.027$  min. Dexamethasone (8 mg) significantly prolonged the duration of analgesia.

In another study by K. C. Cummings III, et al<sup>15</sup> 218 patients were divided into 4 groups. (i)0.5% ropivacaine only (ii)0.5% bupivacaine only (iii)0.5% ropivacaine mixed with dexamethasone 8 mg (iv)0.5% bupivacaine mixed with dexamethasone 8mg. They concluded that Dexamethasone prolongs analgesia from interscalene blocks using ropivacaine or bupivacaine, with the effect being stronger with ropivacaine. Median duration of analgesia with ropivacaine and dexamethasone was 22hrs well comparable with our study.

In study conducted by Santhosh Kumar et al<sup>16</sup> Comparative evaluation of ropivacaine and ropivacaine with dexamethasone in supraclavicular brachial plexus block was done. Duration of sensory blockade was  $1179.4 \pm 108.6$  min. This correlate well with our study.

There was a significant increase in duration of sensory blockade/duration of analgesia in dexamethasone group compared to fentanyl group and the difference was shown statistically significant. P value was 0.0001.

To date there is one study conducted by Siamak Yaghoobi, et al<sup>7</sup> comparing fentanyl with dexamethasone added to lidocaine in axillary block in patients undergoing operation of forearm fracture. They concluded that addition of dexamethasone to lidocaine significantly prolonged the duration

of analgesia compared with fentanyl & lidocaine mixture or lidocaine alone.

### ***Adverse effects***

There was no incidence of haematoma, pneumothorax, accidental intravascular injection, post block nausea and vomiting, convulsions, neuralgia, neuropathies, increased rate of infections in both the groups. No patients in either group required any interventions.

The results in our study showed that dexamethasone 8 mg can be used safely as an adjuvant to Ropivacaine to prolong the duration of sensory blockade analgesia.

### **Conclusion**

Use of ultrasound for performing brachial plexus block allows accurate nerve localization, reduces complications, shortens onset time of sensory and motor blockade.

Addition of dexamethasone prolongs the duration of motor block, enhances the duration of analgesia significantly when compared with fentanyl in supraclavicular brachial plexus block.

Also, dexamethasone group has 0 vas scores for longer period compared to fentanyl group.

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## Comparison of Nerve Stimulator Guided and Ultrasound Guided Interscalene Brachial Plexus Block in Shoulder Surgery

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### Abstract

**Introduction:** This study was conducted to compare the two techniques, Nerve stimulator guided and Ultrasound guidance for Interscalene brachial plexus block in shoulder and upper arm surgeries.

**Methods:** Total 80 patients were included in our study which were randomly allotted by sealed envelope technique two groups namely US-guided (Group US) or NS-guided (group NS). The drug mixture of 0.375% bupivacaine and 0.5% lignocaine with 1:200000 adrenaline was used.

**Results:** Comparison between the Nerve Stimulator (NS) and Ultrasound guided (US) technique of interscalene brachial plexus block revealed that the number of pricks (1-77.5%, 2-20%, 3-2.5% in US group and 1-52.5%, 2-35%, 3-12.5% in NS group), block execution time (5.32(0.50) min in US and 7.10 (0.62) min in NS group), time of onset of sensory and motor block was significantly less in US group as compare to NS groups. The recovery from sensory (11.9 (1.19) hrs in US and 8.74(0.71) hrs in NS,  $p=0.0001$ ) and motor block (6.76(0.63) hrs in US and 5.35 (0.48) hrs in NS group,  $p=0.001$ ) also was significantly longer US group than in NS group. VAS scores were significantly lower in group US group than in NS group in post operative periods. The incidence blockade failure requiring general anesthesia was not significant. Block was successful in 95% of cases in US group and 85% of cases in NS group.

**Conclusion:** Effective quality of the block, execution time, onset of sensory and motor block, recovery from sensory and motor block and VAS scores were more satisfactory with ultrasound technique than the nerve stimulator technique.

**Keywords:** Interscalene block; Nerve stimulator; USG guidance.

### Introduction

Winnie in 1970 popularized the interscalene approach to the brachial plexus. Interscalene brachial plexus block is recommended in the perioperative management of patients presenting for shoulder and upper arm surgery.<sup>1</sup> Benefits of this technique include excellent intraoperative anaesthesia and muscle relaxation, better

postoperative VAS scores, and lower incidences of nausea and vomiting. Moreover, it is more cost effective compared to general anaesthesia.

The use of a peripheral nerve stimulator (PNS) had been considered the 'gold standard' for performing peripheral nerve blocks for the last two decades and has been shown to be a highly effective technique for determining adequate

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needle placement to produce regional anaesthesia/analgesia. However, with recent developments in high-frequency imaging, the use of ultrasound (US) technology has significantly increased for nerve localization.<sup>2</sup>

Ultrasonography seems to be the most suitable image modality for regional anaesthesia.<sup>3</sup> Perhaps the most significant advantage of ultrasound technology is the ability to provide anatomic examination of the area of interest in real time, allowing one to visualize neural structures (plexus and peripheral nerves) and the surrounding structures (e.g. blood vessels and pleura), navigate the needle toward the target nerves, and visualize the pattern of local anaesthetic spread, whereas, nerve stimulation guidance is useful only when a motor response is elicited. Nerve stimulator provides objective but indirect evidence of nerve location.<sup>4</sup>

We conducted the study to evaluate ultrasound-guided nerve detection in an interscalene brachial plexus block and to compare it with nerve stimulator-guided nerve detection and to compare ultrasound guided interscalene nerve block with nerve stimulator guided interscalene nerve block in terms of simplicity, safety, and efficacy.

## Materials and Methods

The study was performed at the Department of Anaesthesiology at our hospital which is a rural tertiary care hospital and medical college. After clearance from the ethical committee of the institute, study was initiated on patients meeting the study requirements from a period spanning over 2019-2020.

### Study Population & Design

A total of 80 patients aged between 18 and 60 years of either sex with ASA status I and II posted for elective upper arm and shoulder orthopedic surgeries (proximal humerus, shoulder) under interscalene brachial plexus block was randomized into two equal groups in a prospective randomized manner by sealed envelope technique. The participants were explained in details about the study and were included after written informed consent.

*The groups were as follows:*

- A) "Group US(Ultrasound group)" received interscalene brachial plexus block under USG guidance.
- B) "Group NS(Nerve stimulator)" received

interscalene brachial plexus block under peripheral nerve stimulation.

## Selection of Cases

### Inclusion criteria:

- American Society of Anaesthesiologist I and II patients.
- Patients of age 18 years to 60 years posted for upper limb surgery including shoulder and upper arm surgeries.
- Either male or female.
- Haemodynamically stable patient with HR>60/min, SBP>110mmHg.

### Exclusion criteria:

- Patients refusing to voluntarily participate in the study
- Pre-existing peripheral neuropathy of upper limb as well as any nerve injury due to trauma
- Patients with difficult airway coming under MPC grade III and above
- Patients with infection at injection site
- Patients with pneumothorax/ History of severe cardiac/ respiratory/ renal/hepatic or bleeding disorders.
- Pregnancy
- Known hypersensitivity to the study drugs.

### Anesthesia Technique

Patients received supplemental oxygen through a nasal canula (3 l/min). A wide-bore, 18G intravenous canula was inserted and fluid Ringer's lactate was started at 100 ml/hr. Patients were sedated with inj. midazolam 1mg, intravenously and inj. fentanyl 1 mcg/kg or 50 micrograms whichever is maximum intravenously to maintain moderate sedation.

The sealed envelope was opened by non-participating Anaesthesiologist and the respective equipment (either US or PNS) accordingly was made ready and the drugs were loaded maintaining sterility.

The drug that was to be used is a mixture of 0.375% bupivacaine and 0.5% lignocaine with 1:200000 adrenaline. Doses used were 15 ml of 0.5% bupivacaine and 5ml of 2% lignocaine with adrenalin, mixed up in a syringe up to 20 ml, giving final concentration of 0.375% Bupivacaine and 0.5% Xyloacine Adrenaline (or up to 2 mg/kg bodyweight of bupivacaine and 5mg/kg of

lignocaine adrenaline whichever is maximum volume made up to 20 ml with distilled water). The patients were positioned supine with the arms by the side and head turned to the opposite side by 45°. The proposed site of block was aseptically prepared with chlorhexidine 4% and draped with exposure allowed for the block site.

### ***In the ultrasound group***

Patient was placed in a supine position, with the patient's head facing away from the side to be blocked. A slight elevation of the head of the bed was done to make the patient more comfortable and allows for better drainage and less prominence of the neck veins. The patient was asked to reach for the ipsilateral knee in order to lower the shoulder and provide more space for the block performance.

Scanning usually begins just below the level of the cricoid cartilage and medial to the sternocleidomastoid muscle with the goal of identifying the carotid artery.

A 5 cm 22 G short bevel needle was then inserted in-plane toward the brachial plexus, typically in a lateral-to-medial direction, after a local anesthetic infiltration of the skin. The needle was advanced along the long axis of the transducer in the same plane as the ultrasound beam. The needle aimed in between the roots instead of directly at them in order to minimize the risk of accidental nerve injury. As the needle passes through the prevertebral fascia, a "pop" can often be appreciated. After careful aspiration to rule out intravascular needle placement, the drug was injected in increments of 5 ml, with careful aspiration after each increment. The pattern of local anesthetic spread around the target nerves was observed in real time during the injection. It is necessary to ensure that high resistance to injection is absent to decrease the risk of intrafascicular injection. Injection of several milliliters of local anesthetic often displaces the brachial plexus away from the needle. Additional advancement of the needle 1–2 mm toward the brachial plexus may be beneficial to ensure the proper spread of the local anesthetic. The needle shaft and tip was visualized in real time as the needle is advanced toward the target nerves.

### ***In the nerve stimulator group:***

The interscalene brachial plexus blockade was performed using Meier's approach and the roots of the brachial plexus was identified with the aid of a nerve stimulator (Stimuplex HNS 12, B-Braun, Germany) and a 5cm 22G insulated stimulating

needle with a stimulation frequency of 2Hz, a pulse duration of 0.15 ms, and an initial intensity of stimulating current of 1mA. Patient was placed in a supine position, with the patient's head facing away from the side to be blocked. The landmarks for low interscalene block were identified, i.e: clavicle, posterior border of the clavicular head of the sternocleidomastoid muscle and external jugular vein. The palpating hand was not be moved during the entire procedure to allow for precise redirections of the needle. Interscalene groove was identified by rolling the finger posterior to sternocleidomastoid muscle between the belly of the anterior and middle scalene muscle at the level of cricoid cartilage. Skin over the insertion site was infiltrated with local anesthetic. The stimulating needle (2-inch, 22-gauge Stimuplex insulated needle) was connected to a nerve stimulator at an initial current intensity of 1 mA was inserted between the palpating fingers and advanced at an angle almost perpendicular to the skin and in a slight caudal direction and advanced until it elicits motor responses in the distribution of the axillary, musculocutaneous or radial nerve.

The current was gradually decreased to a range of 0.4 mA, with a persistent acceptable motor response.

After careful aspiration to rule out intravascular needle placement, the drug was injected in increments of 5 ml, with careful aspiration after each increment. After the injection of the local anesthetic, the sensory and motor block was tested at a 5 min interval starting after the completion of injection of the local anesthetic as follows:

- Testing the sensory block by loss of sensation over the upper lateral aspect of the upper arm in the distribution of the C6 dermatome. The onset of sensory block was taken as the time interval between the completion of drug injection and the complete loss of pinprick sensation.
- Testing the motor block by inability to elevate the arm (deltoid sign). The onset of motor block was taken as the time interval between the completion of drug injection and the inability to elevate the arm.

Intraoperative sedation was provided with intravenous inj. fentanyl 25 micrograms every hourly with the first dose of 25 micrograms being given after half an hour of the first dose of 50 micrograms given before performing the nerve block on patient, titrated to achieve moderate sedation. Intraoperative oxygen saturation monitoring was continued. Hemodynamics monitoring standard

observed every 5 minutes and recording was done every 10 minutes in the chart.

In case of failure of block to achieve adequate sensory and motor blockade is noted, the patient received General Anesthesia with Endotracheal tube and operation was performed under general anesthesia. The same was noted in data sheet. The time given for deciding failure of block and using general anesthesia for the patient was 30 minutes after the block is performed.

At the conclusion of surgery, patients were transferred to the postanesthetic care unit. When patients had fulfilled the standard postanesthetic care unit discharge criteria, they were transferred to the unit. Patients were asked to rate their pain using a visual analogue pain scale (VAS) (0=no pain to 10=worst pain imaginable) on arrival in PACU and every 2 hourly thereafter till rescue analgesia is needed. The time for rescue analgesic was noted. The patient was monitored for recovery from nerve blockade both in terms of sensory and motor blockade.

### Definitions

**Block execution time:** In the group US, time is started after the time of initial scanning and identification of anatomical structures from insertion of 22g Stimuplex needle and ended at the removal of the needle after local anaesthetic drug has been administered.

In the group NS, the time is started after identification of anatomical landmark for interscalene block and interscalene groove palpated from insertion of 22G Stimuplex insulated stimulating needle attached to PNS machine and ended at the removal of the needle after local anaesthetic drug has been administered.

**Time of onset of sensory block:** It was assessed by pin prick and cold application every 2 min till the onset of sensory block. The time from the removal of block needle to the time when the patient first says he/she has reduced sensation when compared to the opposite limb.

**Time of onset of motor block:** The onset of motor blockade was assessed every 3 min till the onset of motor block. It is the time of removal of the block needle to the time when the patient had weakness of any of the two joints - Shoulder and elbow upon trying to perform active movements.

**Recovery from sensory and motor block:** Postoperatively, patients were supplemented with analgesics when they complained of pain or had a VAS score of more than 4, and the duration of

analgesia was recorded. The recovery from sensory block was defined as the interval between the onset of sensory block and the first dose of analgesic medication. The recovery from motor block was defined as the interval between the onset of motor block and regain of motor power of 4/5 was achieved at elbow and shoulder joints.

**Success:** We considered our block to be successful when the patient had a full block of all the sensory dermatomes and no power to move above-mentioned joints.

**Failure-Failure** was defined as the absence of full sensory block in at least one dermatome and conversion of regional anaesthesia to general anaesthesia as assessed after 30 minutes of performing block.

**Patient satisfaction criteria:** Patient satisfaction score for anesthesia and comfort at the end of surgery (after 1 hour of shifting in the post operative ICU) was noted on a numerical subjective scale of 1-5 with 1 being dissatisfied and 5 being completely satisfied.

### Statistical Analysis

A structured data entry form was utilized to record the findings at various points in the study. Excel spreadsheet (Microsoft Corp) was used for electronic data entry. All statistical analysis was done by using descriptive and inferential statistics using chisquare test and student's unpaired t test and software used in the analysis were SPSS 24.0 version and GraphPad Prism 7.0 version and  $p < 0.05$  is considered as level of significance.

The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000.

### Results

A total of 80 patients aged between 18 and 65 years of either sex with ASA status I and II posted for elective upper arm and shoulder orthopedic surgeries (proximal humerus, shoulder) under interscalene brachial plexus block was randomized into two equal groups in a prospective randomized manner by sealed envelope technique.

Mean age of the study population was 40.4 years and 70% were men. Demographic details have been explained in Table 1.

**Table 1:** Comparison of the baseline demographic characteristics

of US group and NS group.

Variables	US group (n=40)	NS group(n=40)	p value
Age in years, n(SD)	39.42(12.28)	40.60(13.57)	0.77
Gender,male n(%)	31(77.5)	29(72.5)	0.26
BMI, n(%)	29.10(3.20)	29.20(3.27)	0.14
MPS grading, grade 1, n(%)	27(67.5%)	30(75%)	0.54
Baseline Heartrate, mean(SD)	86.28(8.30)	89.08(7.92)	0.127
Systolic Blood Pressure, mean(SD)	136.45(6.32)	137.05(6)	0.664
Diastolic Blood Pressure, mean(SD)	84.38(5.27)	87.90(4.06)	0.001
Oxygen saturation, mean(SD)	98.20(0.72)	97.65(2.95)	0.257
Respiratory rate, mean(SD)	15.65(1.08)	15.43(1.11)	0.35

Vital parameters were monitored throughout the procedure (Table 2).

**Table 2:** Comparison of the vital measures at the different time points of US group and NS group.

Variables	US group (n=40)	NS group(n=40)	p value
<b>Respiratory rate, (breaths/min)</b>			
RR@10min	13.53(1.09)	13.35(0.89)	0.433
RR@30min	11.40(1.13)	12.18(1.08)	0.002
RR@60min	12.08(1.29)	12.30(1.09)	0.402
<b>Heartrate, (beats/min)</b>			
HR@10min	81.60(7.85)	85.63(7.89)	0.025
HR@30min	77.78(7.59)	79.33(5.71)	0.305
HR@60min	69.35(5.57)	71.93(8.08)	0.101
<b>Systolic Blood Pressure, (mm Hg)</b>			
SBP@10min	134.40(6.47)	135.93(6.21)	0.285
SBP@30min	116.88(6.31)	119.43(6.34)	0.075
SBP@60min	120.45(7.27)	117.80(6.65)	0.093
<b>Oxygen Saturation, (%)</b>			
Spo2@10min	98.27(0.55)	97.67(2.62)	0.161
Spo2@30min	98.45(0.84)	98.32(2.52)	0.767
Spo2@60min	98.52(0.75)	98.42(2.38)	0.801

We observed time taken for identification of anatomical structure, time to perform block, time to onset of sensory and motor block was significantly lower in Ultrasound group compared to nerve

stimulator group(Table 3)

**Table 3:** Comparison of the operative data of the studied cases of US group and NS group.

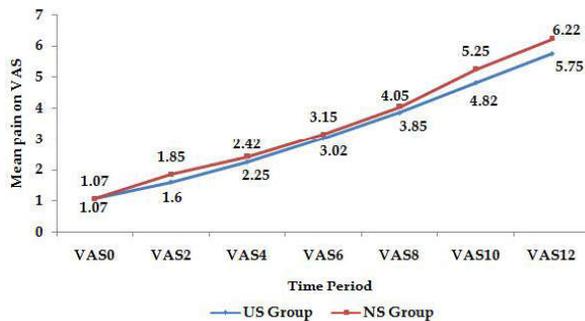
Variables	US group (n=40)	NS group (n=40)	P value
Time taken for Identification of anatomical structure and landmarks (min), mean(SD)	1.93(0.46)	2.36(0.37)	0.0001, S
Number of pricks	one in 31(77.5%) two in 8(20%) three in 1(2.5%)	one in 21(52.5%) two in 14(35%) three in 5(12.5%)	0.04, S
Time to perform block (min),mean(SD)	5.32(0.50)	7.10(0.62)	0.0001, S
Onset of sensory block (min) ,mean(SD)	6.80(1.31)	10.80(1.06)	0.0001, S
Onset of motor block (min)	7.76(0.50)	12.30(0.83)	0.0001, S
Duration of surgery(hours), mean(SD)	2.04(0.29)	2.38(0.30)	0.41, NS

During the postoperative period, we found time to recovery of patient from sensory block and motor block was significantly lower in ultrasound group compared to nerve stimulator group. Success rate of both US group and NS group were comparable (Table 4).

**Table 4:** Comparison of the postoperative data of the studied cases of US group and NS group.

Variables	US group (n=40)	NS group (n=40)	P value
Recovery from sensory block(min), mean (SD)	11.90(1.19)	8.74(0.71)	0.0001, S
Recovery from motor block(min), mean(SD)	6.76(0.63)	5.35(0.48)	0.0001, S
Conversion to GA	2(5%)	6(15%)	0.13, NS
Complication rate, n(%)	3(7.5%)	6(15%)	0.28, NS
Patient satisfaction score, mean(SD)	4.62(0.49)	3.82(0.55)	0.0001, S

We found VAS scores were lower with in ultrasound guided interscalene brachial plexus block than with nerve stimulator guided interscalene brachial plexus block. (Figure 1)



**Fig. 1:** The VAS score in group US was less than group NS, which is statistically significant at post-operative 2<sup>nd</sup> hour, 10<sup>th</sup> hour and 12<sup>th</sup> hour. (p value 0.0001).

## Discussion

Peripheral nerve blocks are cost effective anesthetic techniques used to provide good quality anesthesia and analgesia while avoiding airway instrumentation and hemodynamic consequences of general anesthesia. Patient satisfaction, a growing demand for cost effective anesthesia and a favorable postoperative recovery profile have resulted in increased popularity for regional techniques. Regional anaesthesia has many benefits including reduced morbidity and mortality as compared to general anesthesia.<sup>5,6</sup> superior postoperative analgesia,<sup>7</sup> cost-effectiveness,<sup>8</sup> and a lower rate of serious complications. Brachial plexus block is an easy and relatively safe procedure for upper limb surgeries. Various approaches like supraclavicular, interscalene, infraclavicular and axillary have been used for blocking the brachial plexus. Interscalene approach to brachial plexus block is associated with rapid onset and reliable anesthesia.<sup>9</sup>

A study done in 2008 by Kapral et al on 160 patients to compare success rate of interscalene block ultrasound guidance vs PNS in patients with trauma related shoulder and upper arm surgeries found that Surgical anesthesia was achieved in 99% of patients in the ultrasound vs 91% of patients in the nerve stimulation group (P <.01). Sensory, motor, and extent of blockade was significantly better in the ultrasound group when compared with the nerve stimulation group.<sup>10</sup>

Marhofer et al compared onset time of block and sensory block between ultrasound guidance and PNS and found that the onset time and the quality of a regional anesthesia is improved by

ultrasonographic nerve identification compared with PNS.<sup>11</sup>

A randomized controlled prospective study done by sauter et al on 80 patients found block performance time was comparable between ultrasound guidance and PNS (4.3 min vs 4.1) and Onset time for sensory block was also comparable between the two (13.7 min vs 13.9 min). The time until readiness for surgery was also comparable between both groups (18.1 min). There was no statistical difference in median discomfort related to the block procedure and median tourniquet time. There was no statistical differences in success rates between USG group vs PNS group (85% vs 95%).<sup>12</sup>

Yuan Jia-min, et al (2012) studied success rate and complications in the ultrasound guided brachial plexus blockade. They included Sixteen trials involving 1321 adults blocks performed using US guidance were more likely to be successful (risk ratio (RR) for block success 0.36, 95% CI 0.23–0.56, P <0.00001). There was decreased incidence of vascular puncture during block performance (RR 0.13, 95% CI 0.06–0.27, P <0.00001) & decreased the risk of complete hemi-diaphragmatic paresis (RR 0.09, 95% CI 0.03–0.52, P=0.0001). They concluded that Ultrasound decreases risks of complete hemi-diaphragmatic paresis or vascular puncture and improves success rate of brachial plexus nerve block compared with techniques that utilize PNS for nerve localization. Larger studies are needed to determine whether or not the use of US can decrease risk of neurologic complications.<sup>13</sup>

McNaught A et al (2011) concluded that ultrasound reduces the number of attempts, LA volume, and postoperative pain when compared with NS for interscalene block.<sup>14</sup>

A prospective randomized trial done by casati et al found lower number of needle passes in US group compared to NS group (4 vs 8) and onset of sensory block was shorter in group US than in group NS whereas no statistical differences were observed in onset of motor block and readiness to surgery. Procedure-related pain was reported lesser in US group; patient acceptance was similarly good in the two groups.<sup>15</sup>

A systematic review and meta-analysis done by Abrahams et al.<sup>16</sup> which included 13 RCTs found Ultrasound improves efficacy of peripheral nerve block compared with PNS technique for nerve localization and further larger studies are needed to determine whether Ultrasound can decrease the number of complications such as nerve injury or systemic local anaesthetic toxicity.

Similarly another meta-analysis done by Walker et al which included 18 studies concluded that in experienced hands, ultrasound provides at least as good success rates as other methods of peripheral nerve location and ultrasound may reduce complication rates and improve quality, performance time, and time to onset of blocks.<sup>17</sup> In contrast to above studies, a study done by Liu et al<sup>18</sup> on 250 patients found no difference between needle stimulator and USG guidance in terms of time to perform the procedure however there was less number of needle passes in USG guidance group. Study done by Casati et al found rapid onset of block and prolonged duration of block in Ultrasound guidance group.<sup>19</sup>

Numerous studies have been done comparing success rates between nerve stimulator and US guidance. Study done by Maher et al<sup>4</sup> found no statistically significant difference in the success rate in both groups. In agreement with this study, studies done by Schwemmer U et al<sup>20</sup>, Marhofer P et al<sup>21</sup>, Williams SR et al<sup>22</sup> also found no difference in success rates between both groups. In contrast Kapral et al<sup>10</sup> and Chan et al<sup>23</sup> found higher success rate among USG group compared to nerve stimulator group 99% vs 91% and 95% vs 85% respectively.

## Conclusion

It may be reasonable to conclude that USG guided interscalene block characteristics gave superior results when compared with PNS guided interscalene block in terms of parameters like identification of anatomical structures - landmarks, block execution times, faster onset as well as prolonged duration time of sensory and motor blocks and lower pain scores. However the success rates and conversion to General Anesthesia rates were comparable between the USG and PNS guided blocks.

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## Comparative Study of Isobaric Levobupivacaine Alone and Isobaric Levobupivacaine with Fentanyl for Spinal Anaesthesia in Lower Abdominal Surgeries

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### Abstract

**Introduction:** Levobupivacaine 0.5% and racemic bupivacaine 0.5% are equally effective in spinal anaesthesia with less systemic toxicity seen with levobupivacaine. Fentanyl has been used as an adjunct to racemic bupivacaine in spinal anaesthesia. This study was designed to study on the intrathecal use of 0.5% levobupivacaine with fentanyl in elective lower abdominal surgeries.

**Methods:** A prospective randomized controlled double blind study was conducted in 100 patients of ASA I and II physical status posted for elective lower abdominal surgeries under subarachnoid block, randomized into 2 groups with 50 patients each, received either 3 ml of 0.5% isobaric levobupivacaine (group L) or 2.8 mL of 0.5% levobupivacaine with fentanyl 10 µg in 0.2 mL (group F). Hemodynamic parameters, time for onset of sensory and motor blockade, maximum height of sensory block and total duration of sensory and motor blockade were recorded. Intraoperative or postoperative side effects were noted.

**Results:** There were no significant differences between the two groups in the haemodynamic changes, and quality of sensory and motor block. Anaesthesia was adequate and patient satisfaction was good in all cases. Side-effects were minor and infrequent with both regimes.

**Conclusions:** We conclude that, in terms of efficacy, 2.8 mL of 0.5% levobupivacaine with fentanyl 10 µg is comparable to 3 mL of 0.5% levobupivacaine alone in spinal anaesthesia for lower abdominal surgeries. Further studies may be directed to find the optimal combination of levobupivacaine and opioid for spinal anaesthesia.

**Keywords:** Levobupivacaine; Analgesics; Opioid; Fentanyl; Anesthetic techniques; Anaesthesia; Spinal.

### Introduction

Subarachnoid anaesthesia (SAB) is the most popular as well as effective technique for infraumbilical surgeries. It provides fast onset and effective sensory and motor blockade. Spinal anaesthesia is widely used, providing a fast onset and effective sensory and motor blockade. It has

many advantages like simplicity, easy to perform, rapid onset of action and good muscle relaxation. It has an added advantage of preventing complication of General Anaesthesia like poly pharmacy, pressor response from intubation, nausea, vomiting, sore throat, excessive sedation etc.

Racemic bupivacaine is one of the most common

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local anaesthetics used for spinal analgesia and levobupivacaine is its S-enantiomer. Clinical studies comparing levobupivacaine and racemic bupivacaine in epidural and spinal analgesia show that both are equally effective.<sup>1-6</sup> During epidural use, levobupivacaine and racemic bupivacaine have the same analgesic potency, however levobupivacaine is 13% less potent on a percentage weight per volume basis for motor block.<sup>7</sup> Hence, in the epidural route, levobupivacaine has greater sensory-motor dissociation in blockade than racemic bupivacaine. It is likely that similar sensory-motor dissociation is also present in the intrathecal use of levobupivacaine. Fentanyl is a lipophilic opioid which has been used as an adjunct to local anaesthetics, including racemic bupivacaine, for enhancement of analgesia without intensifying motor and sympathetic block in spinal analgesia.<sup>8,9</sup> It is possible that the addition of fentanyl to levobupivacaine may result in a mixture for spinal anaesthesia with minimal motor block and hypotension. At the time this study was designed, no study had been published on the intrathecal use of 0.5% levobupivacaine with fentanyl. We performed this clinical study to compare the clinical efficacy, motor block and haemodynamic effects of using 2.8 mL of 0.5% levobupivacaine with fentanyl 10 µg (0.2 mL) and 3 mL of 0.5% levobupivacaine alone in spinal anaesthesia for elective lower abdominal surgeries requiring sensory block to at least the tenth thoracic (T10) dermatome.

### Aims

To study and compare the clinical effects and block characteristics of isobaric levobupivacaine alone and isobaric levobupivacaine with fentanyl for spinal anaesthesia in lower abdominal surgeries.

### Objectives

The following parameters were studied and compared.

- The time for onset, level and duration of sensory blockade.
- The time for onset, degree and duration of motor blockade.
- Time for 2 segment regression of sensory block.
- The hemodynamic variations.
- Adverse effects if any.

### Methods

A Prospective randomized controlled, double blind study was conducted in hundred patients

undergoing elective lower abdominal surgeries under spinal anaesthesia at Basaveshwara General and Teaching Hospital attached to Mahadevappa Rampure Medical College, Gulbarga after getting approval by Internal Ethics Committee. The study was conducted from November 2016 to January 2018. By keeping the confidence limits at 95% and power of study at 80%, to detect a minimum of 10% difference in proportion of hypotension between the two groups, the minimum sample size required is 25 in each group. We included 50 patients in each group for better validity of results after obtaining informed and written consent. 100 patients chosen for the study were divided into 2 groups in a ratio of 1:1, Group L and Group F, of 50 each, by permuted block randomization technique in the ratio 1:1.

### Statistical Methods

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 probability test has been used to find the significance of study parameters on categorical scale between two or more groups. Statistical software: 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.

The inclusion criteria were aged between 50 and 75 yr, ASA I-III and body weight between 45 and 80kg. The exclusion criteria were known hypersensitivity to amide local analgesics, contraindication to spinal analgesia Group L received 3 mL of 0.5% levobupivacaine alone and Group F received 2.8 mL of 0.5% levobupivacaine with fentanyl 10 µg (0.2 mL). an intravenous (i.v.) infusion of 10mL/kg of Ringer lactate solution was given before initiation of the spinal anaesthesia. The anaesthesiologist who performed the intrathecal injection and assessment of the spinal block, was blinded to the group of study solution. The study solution was prepared by another anaesthesiologist who was not involved in the clinical care of the patient. Insertion of the spinal needle was undertaken in aseptic conditions using a 25-G Quincke needle at the lumbar L3-L4 interspace with midline or paramedian approach. The patient was in the left lateral position when the spinal needle was inserted. Upon completion of the intrathecal injection, the patient was immediately turned back to a supine position. All patients were given supplementary nasal oxygen of 2 L min.<sup>-1</sup> During the procedure electrocardiogram (ECG), heart rate (HR) and pulse oximetry were monitored

continuously. Non-invasive blood pressure was taken before the conduct of spinal anaesthesia, every 3 min for 15 min after the initiation of spinal anaesthesia and every 5 min thereafter. Sensory blockade was monitored using pin prick test, which was performed every 2.5 min for 15 min after the initiation of spinal anaesthesia and again at the end of the procedure. Motor blockade was assessed according to a modified Bromage Scale (0: no paralysis, able to flex hips, knees and ankles; 1: able to flex knees, unable to raise extended leg; 2: able to flex ankles, unable to flex knee; 3: unable to flex ankle, knee and hip) every 2.5 min for 15 min and at the end of the operation. The operation was started after the initiation of spinal anaesthesia if the level of sensory block had reached T10 or above. If the level of sensory block was inadequate, then general anaesthesia was given. Hypotension was defined as a decrease in the systolic blood pressure of more than 30% from the baseline or mean arterial pressure less than 65 mm Hg. This was treated with i.v. boluses of mephentermine 5 mg. Bradycardia was defined as a heart rate of less than 50 beats/min and was treated with i.v. injection of atropine 0.5 mg. The onset of adequate sensory block was defined as the achievement of a sensory block level of T10 dermatome or higher. The addition of any sedative drugs, if required, was recorded. Patient satisfaction was assessed as good, fair or poor at the end of the operation. Adequacy of anaesthesia was assessed by the attending anaesthesiologist as good, fair or poor.

**Results**

50 patients were recruited in each group. There were no significant differences between the two groups for patient characteristic data, ASA classification and type of operation (Table 1). The baseline and intraoperative haemodynamic parameters were similar in both groups. The onset time for adequate level of sensory block, the highest level of sensory block (table 2) and degree of motor block were also similar in both groups (Table 3). The efficacy of both levobupivacaine alone and levobupivacaine with fentanyl was good. Anaesthesia was adequate and patient satisfaction was good in all cases. Two patients, one in each group, required supplementary sedation with i.v. midazolam 1 mg and 2 mg, respectively. Side-effects of anaesthesia with these two regimes were minor and infrequent. Three patients (12%) in the Group L had shivering. Hypotension occurred in four patients (16%), one in Group L and three in Group F. No patient had nausea, vomiting or pruritus.

It is a clinical randomized controlled double blind study with 100 patients randomly divided into 2 groups of 50 patients each, using permuted block randomisation technique in the ratio 1:1.

Group F - receiving intrathecal levobupivacaine with fentanyl. Group L- receiving intrathecal levobupivacaine alone

They were evaluated for hemodynamic variations, onset and duration of sensory and motor blockade, side effects of the drugs if any.

**Demography**

The groups are matched with respect to age and gender.

The mean age in Group L is 38.02±11.12 years and in Group F 37.42±10.82 years.

Weight and Height in this samples in the groups were matched.

**Table 1:** Surgical procedures carried out among the two groups.

Procedure	Levobupivacaine		Levobupivacaine with fentanyl	
	No	%	No	%
Anatomical repair hernia	7	14	6	12
Open appendectomy	9	18	11	22
TURP	2	4	4	8
Post Laparotomy 2° suturing	3	6	1	2
Inguinal hernia mesh repair	15	30	12	24
Jabouley's procedure	3	6	5	10
Lumbar sympathectomy	3	6	3	6
Palmo's procedure	4	8	4	8
DJ stenting	4	8	4	8

Mean duration of surgery is statistically similar in two groups studied P = 0.091.

**Table 2:** Onset and duration of sensory blockade at L1 and T10.

Parameters	LevoLevobupivacaine group (n=50)	levobupivacaine with fentanyl Group (n=50)	P value
Onset of sensory block at L1 (min)	2.88±1.81	2.02±0.34	>0.05
Onset of sensory block at T10 (min)	5.14±3.76	3.24±1.98	>0.05

Table continued ...

Total duration of sensory block (regression to <L1)	190.04±35.19	209.02±34.74	>0.05
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**Table 3:** Onset and total duration of motor blockade.

Parameters	LevoLevobupivacaine group (n=50)	Levobupivacaine with fentanyl group (n=50)	P value
Onset of Motor block B1(min)	3.12±1.62	3.02±0.65	>0.05
Total duration of motor block (B1- B0) min	176.65±40.64	179.46±30.84	>0.05

## Discussion

This study was conducted to evaluate the hemodynamic variations, sensory and motor blocking properties of isobaric levobupivacaine 0.5% (15 mg) and isobaric levobupivacaine 0.5% (15 mg) with 10 mcg fentanyl.

Demographic data comparing age, sex, weight, height, ASA grade shows no statistically significant difference among both the groups.

This study found that 2.8 mL of 0.5% levobupivacaine with fentanyl 10 µg was an effective mixture for spinal anaesthesia in lower abdominal surgeries that required a sensory block to the T10 dermatome. The onset time, level of sensory block, degree of motor block and haemodynamic effects were similar between 3 mL of 0.5% levobupivacaine alone and 2.8 mL of 0.5% levobupivacaine with fentanyl 10 µg. Levobupivacaine has been found to be as effective as racemic bupivacaine in spinal anaesthesia.<sup>5,6</sup> The effect of adding fentanyl to bupivacaine for spinal anaesthesia has been studied. Ben-David and colleagues (1997) compared the use of 0.17% bupivacaine 3 mL with and without fentanyl 10 µg in spinal anaesthesia for arthroscopy.<sup>8</sup> The sensory blockade was significantly more intense with a lower failure rate in the group with fentanyl. Ben-David and colleagues (2000) compared the use of bupivacaine 4 mg with fentanyl 20µg and bupivacaine 10 mg in spinal anaesthesia for surgical repair of hip fracture in geriatric patients.<sup>9</sup> Both regimes were effective with less hypotension in the group with Levobupivacainefentanyl.

It was suggested that the intrathecal use of fentanyl had a synergistic effect with the low-dose bupivacaine in the achievement of a functional sensory blockade for surgical anaesthesia. The use of a low dose of bupivacaine was associated with

a less sympathetic blockade resulting in lower incidence of hypotension. Choi and colleagues (2000) found that the intrathecal use of hyperbaric bupivacaine 8 mg with 10 µg of fentanyl was as effective as hyperbaric bupivacaine 12 mg in Caesarean section.<sup>10</sup> The addition of fentanyl had the advantage of a low incidence of excessively high block. Martyr and Clark (2001) compared the use of 7.5 mg hyperbaric bupivacaine with fentanyl 20 µg and 12.5 mg hyperbaric bupivacaine alone.<sup>11</sup> Both groups were equally effective with no differences in the incidence or severity of hypotension. Korhonen and colleagues (2003) found that 3 mg of hyperbaric bupivacaine with 10µg of fentanyl was as effective as 4mg of hyperbaric bupivacaine for knee arthroscopy.<sup>12</sup> The recovery of motor function was faster in the group with fentanyl. These studies confirmed the local anaesthetic dosesparing effect of fentanyl when it was added to bupivacaine for intrathecal use. This might be associated with less hypotension during spinal anaesthesia. The use of racemic bupivacaine with fentanyl in spinal anaesthesia for urological surgery is effective. Kuusniemi and colleagues (2000) studied the effect of adding fentanyl 25 µg to bupivacaine for spinal anaesthesia.<sup>13</sup> They found that the addition of fentanyl 25 µg to 5 mg of bupivacaine resulted in effective anaesthesia with motor block of short duration. While the addition of fentanyl 25 µg to 10 mg of bupivacaine increased the intensity and duration of motor block in comparison to bupivacaine 10mg alone. The incidence of pruritus in all patients with fentanyl was 30%. Goel and colleagues (2003) studied the addition of fentanyl to bupivacaine 5mg in spinal anaesthesia.<sup>14</sup> It was concluded that the addition of fentanyl 12.5µg provided better surgical anaesthesia and improved the reliability of block than fentanyl 7.5 or 10µg. Haemodynamic stability was good in all patients. The incidence of pruritus was 33%. Kararmaz and colleagues (2003) compared the intrathecal injection of bupivacaine 4 mg with fentanyl 25 µg (Group F) and bupivacaine 7.5 mg (Group B).<sup>15</sup> The density and duration of motor block were more in Group B. Both groups had adequate sensory block for surgery. Hypotension was more significant in the Group B (25% vs. 0%). The incidence of pruritus was 75% in Group F. These studies showed that the addition of fentanyl to bupivacaine for spinal anaesthesia would augment the effect of bupivacaine. This would allow the reduction in the dose of bupivacaine used and would increase the reliability of lower dose of bupivacaine used for spinal anaesthesia. This might result in less intensity of motor block and less hypotension. However,

the use of intrathecal fentanyl was associated with significant incidence of pruritus. The addition of fentanyl to levobupivacaine has been found to have a dose-sparing effect on the requirement of levobupivacaine for epidural analgesia in labour.<sup>16</sup> Intrathecal use of levobupivacaine has been studied. Our previous study with 2.6 mL of 0.5% levobupivacaine and that of Glaser and colleagues both found that 0.5% levobupivacaine and 0.5% bupivacaine have similar clinical effects, including sensory and motor block.<sup>5,6</sup> Intrathecal injection of an opioid with levobupivacaine had been studied by Vercauteren and colleagues.<sup>17</sup> They used 2 mL of 0.125% levobupivacaine or racemic bupivacaine with sufentanil 0.75 µg mL<sup>-1</sup> and epinephrine 1:800000 as the initial intrathecal injection for combined spinal-epidural analgesia in labour. They found that the levobupivacaine produced no motor block in comparison with 34% of patients in the bupivacaine group had motor block of Bromage Score 1. Our study found that 2.3 mL of 0.5% levobupivacaine with fentanyl 15µg was as effective as 2.6 mL of 0.5% levobupivacaine alone in spinal anaesthesia. The haemodynamic effects, the characteristics of sensory and motor block were similar. Hence, the addition of fentanyl had a dose-sparing effect with levobupivacaine in spinal anaesthesia. Nevertheless, the potential advantages of less motor block and less hypotension were not unveiled in the dose used in our study. The potential side-effects of spinal fentanyl such as the pruritus, nausea and vomiting did not occur in our patients. The potency ratio of levobupivacaine to racemic bupivacaine was 0.98 for epidural analgesia in labour pain.<sup>4</sup> Their potency ratio in intrathecal use has not been determined. Our choice of comparing 2.6 mL of levobupivacaine with 2.3 mL of levobupivacaine and fentanyl 15µg was based on our previous study on the efficacy of 2.6 mL of levobupivacaine in spinal anaesthesia for urological surgery and published result in the use of fentanyl with bupivacaine.<sup>6,14</sup> Further studies can be directed to find the optimal combination of levobupivacaine and opioid with maximal haemodynamic stability and least motor block, which may be useful for spinal anaesthesia in ambulatory surgery.

## Conclusion

To conclude, our study demonstrates that 3 ml 0.5% isobaric levobupivacaine appears to be similar to 2.8 ml 0.5% levobupivacaine with 10 mcg fentanyl for spinal anaesthesia in lower abdominal surgeries, in terms of similar hemodynamic changes, side effect, characteristics of sensory and motor blockade. The addition of fentanyl has a

dose-sparing effect with 0.5% levobupivacaine in spinal anaesthesia. Both regimes are effective with minimal side-effects.

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## Comparative Evaluation of two Doses of Epidural Butorphanol with Bupivacaine for Postoperative Analgesia

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### Abstract

**Background:** Postoperative analgesia is very important to prevent subjective discomfort, early mobilization and shortened hospital stay. Opioids addition to local anesthetics improve the quality of analgesia. Present study was designed to evaluate and compare the duration and efficacy of two different doses of epidural Butorphanol for postoperative analgesia.

**Patients and Methods:** This prospective, randomized double blinded study was conducted on 75 patients in the age group of 20-60 years of either sex, with ASA class I and II scheduled for elective lower limb orthopedic surgeries under combined spinal epidural anesthesia after taking the informed consent and approval from hospital ethical committee. Group allocation, group I (n=25) received epidural 0.25 % bupivacaine, group II (n= 25) patients received 0.25% epidural Bupivacaine and 1 mg Butorphanol, group III (n= 25) patients received 0.25% epidural Bupivacaine and 2 mg Butorphanol. Postoperatively VAS, sedation score, vitals & side effects were observed. Injections were given on achieving VAS>3.

**Results:** Onset of analgesia was significantly shorter in group III as compare to group II and group I. Duration of analgesia was longest in group III  $9.95\pm 0.43$  hour which was significantly greater than group I  $3.90\pm 0.32$  hours and group II  $6.06\pm 0.26$  hours. Postoperative VAS scores at different intervals were lower in group III than group II and group I (group III < group II < group I). Sedation scores were significantly higher in butorphanol group with no major adverse effects.

**Conclusion:** Butorphanol 2 mg with 0.25% bupivacaine appears to be the optimal dose to produce a more rapid onset and longer duration of analgesia with no adverse effects.

**Keywords:** Epidural; Postoperativanalgesia; Butorphanol.

### Introduction

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.<sup>1</sup> Postoperative pain can be a major source of fear and anxiety in hospitalized patients. The most terrible period as far as pain is concerned is the first 24 hours, when the severity of pain and vital signs are fluctuating. Use of postoperative regional

analgesia not only decreases the cost of patient care through shorter intensive care units stays, but also decreases the rate of complications and increases patient satisfaction.<sup>2</sup> Combined spinal epidural aims at providing the benefits of spinal anesthesia with flexibility of an indwelling epidural catheter to extend the duration of analgesia into postoperative period.<sup>3</sup> Combination of local anesthetic with opioids result in prolonged postoperative analgesia.

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Butorphanol, a synthetic morphine derivative is a mixed agonist and antagonist non-narcotic opioid analgesic. Butorphanol and its metabolites are agonist at kappa receptors and mixed agonists antagonists at mu receptors.<sup>4</sup> Receptor specificity of butorphanol has been used to limit respiratory depression, gastrointestinal side effects and reduce risk of dependency.<sup>5</sup> Present study was conducted to compare and evaluate duration and efficacy of two different doses of epidural butorphanol and to find out the most suitable analgesic dose with minimal side effects for postoperative analgesia.

## Methods

The present prospective, randomized double blinded study was conducted on 75 patients in the age group of 20-60 years of either sex, with American society of anaesthesiologists (ASA) class I and II admitted to tertiary care hospital of north India after obtaining institutional ethical committee clearance and scheduled for elective lower limb orthopaedic surgeries of duration more than one hour under combined spinal epidural anaesthesia. After taking the informed consent patients were randomly divided into three groups of 25 each based on computer generated random numbers (figure 1). Group I patients received 10 ml of 0.25% epidural Bupivacaine. Group II patients received 9 ml of 0.25% epidural Bupivacaine and 1 ml of 1 mg Butorphanol. Group III patients received 9 ml of 0.25% epidural Bupivacaine and 1 ml of 2 mg Butorphanol. All injections were

prepared to make a final volume of 10 ml in all groups. After routine pre anesthetic checkup patients were moved to operation theatre. A sealed envelope with drug code was given to the attending anesthesiologist who was unaware of study design and study groups. Baseline vitals were recorded and monitored. Under all aseptic precautions combined spinal epidural anaesthesia was administered. Subarachnoid block was given with 2.5 ml of 0.5% heavy bupivacaine. Spinal needle was then withdrawn, epidural catheter was inserted, secured and its patency checked. Level of sensory blockade was checked by pinprick and motor blockade by Bromage's criteria (1=unable to move feet or knees, 2=able to move feet only, 3=just able to move knees, 4=full flexion of knees and feet). The operation was started when full surgical anaesthesia was attained. In the postoperative period, at visual analogue scale >3, a bolus of one of the three study drugs was injected through an epidural catheter. Patients were assessed at 5, 10, 15, 30, 60 and 90 minutes and then at 2, 3, 4, 5, 6, 8, 12 and 24 hours after epidural injection for intensity of pain, heart rate, systolic and diastolic blood pressure, respiratory rate and sedation score. Time from epidural injection to complete pain relief was recorded as onset of analgesia. Duration of analgesia was defined as time from epidural injection to time of request of rescue analgesia. Additional rescue analgesia was given with Diclofenac sodium 75 mg. Sedation score (0 - Fully awake, 1- Slightly drowsy, 2- Asleep but easily arousable, 3- Fully asleep but

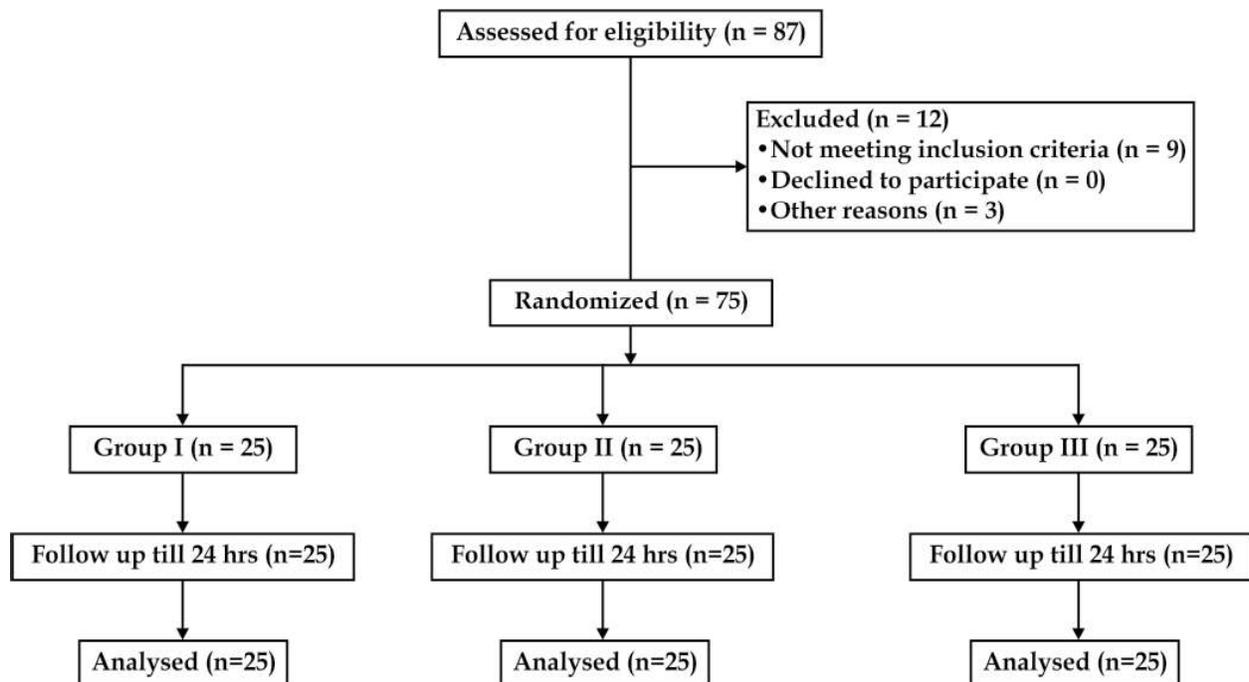


Fig. 1: Consort flow diagram.

arousable, 4- Sleeping and not arousable) was assessed. Side effects such as nausea, vomiting, pruritis, hypotension and bradycardia if any were recorded. Data was calculated in terms of mean  $\pm$  standard deviation ( $\pm$ SD). Comparison of data between groups was done by using ANOVA with Post Hoc Tukey HSD for inter group comparison of parametric data and chi square test for non-parametric data. A p value of less than 0.05 was considered significant and less than 0.001 was considered highly significant.

**Results**

Demographic variables were comparable between three groups (table 1). ASA grading, mean duration of surgery and sensory level achieved were comparable between three groups. There was no statistically significant difference between baseline vitals in three groups. Open reduction and internal fixation of femur and tibia was the most common surgery performed among all the three groups. The difference in the mean postoperative pulse rate, blood pressure at different time intervals in between groups was found to be insignificant.

**Table 1:** Demographic data of three groups.

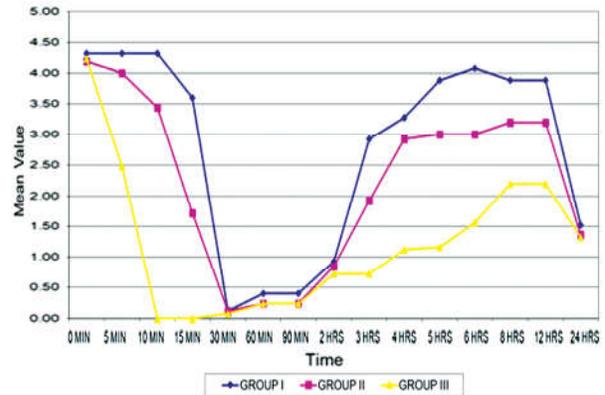
Demographic variable	Group I	Group II	Group III	P value
Age (years)	45.28 $\pm$ 7.10	43.48 $\pm$ 10.81	44.56 $\pm$ 11.36	0.813
Sex (F:M)	8:17	7:18	7:18	0.938
ASA grade (I: II)	17:8	16:9	18:7	0.832
Duration of surgery	141.40 $\pm$ 14.47	137.80 $\pm$ 20.05	143.40 $\pm$ 20.80	0.563
Sensory level achieved	T9.20 $\pm$ 1.16	T9.12 $\pm$ 1.17	T9.60 $\pm$ 1.14	0.353

**Table 2:** No. of Injections of rescue analgesia (Values are Mean  $\pm$  SD).

Group I	Group II	Group III	P value Group I VS II	P value Group I VS III	P value Group II VS III
2.72 $\pm$ 0.46	1.16 $\pm$ 0.37	1.04 $\pm$ 0.20	<0.001	<0.001	0.471

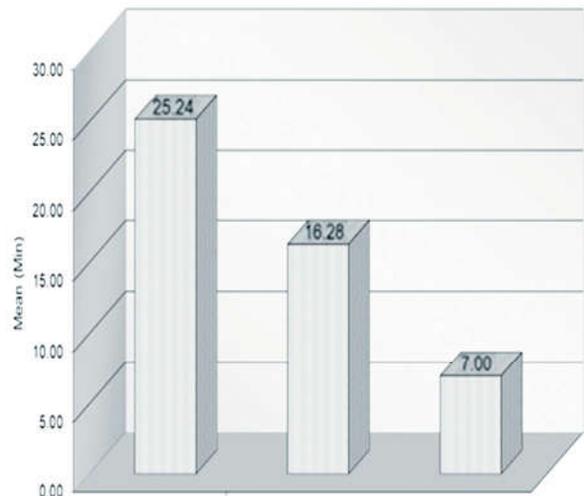
The mean oxygen saturation, respiratory rate in three groups was calculated at different intervals. The difference between the three groups was found to be insignificant statistically ( $p > 0.05$ ). The mean VAS score was calculated in three groups (figure 2). The VAS at '0' minute was found to be insignificant ( $p > 0.05$ ) between the groups, it was highly significant ( $p < 0.001$ ) at 5, 10, 15 minutes and at 3, 4, 5, 6, 8 and 12 hours ( $p < 0.001$ ). VAS at 30, 60, 90 and 2 hours was found to be insignificant statistically ( $p > 0.05$ ). This data shows that patients in group III and group II had significantly lower VAS scores.

The mean duration of onset of analgesia in group I was 25.24 $\pm$ 4.12 minutes, group II was 16.28 $\pm$ 1.51 minutes and group III was 7.00 $\pm$ 0.81 minute (figure 3). The difference in groups was found to be highly significant statistically. Thus, indicating that group III had a shorter onset of analgesia as compared to group II and group I.



**Fig. 2:** Comparison of postoperative visual analogue scale in three groups.

The mean duration of analgesia in Group I was 3.90 $\pm$ 0.32 hours, in Group II was 6.06 $\pm$ 0.26 hours and in Group III was 9.95 $\pm$ 0.43 hours (figure 4). This difference in groups was found to be highly significant statistically ( $p < 0.001$ ). Thus, indicating that group III had a longer duration of analgesia as compared to group II and group I. Mean no. of injections of rescue analgesia was 2.72 $\pm$ 0.46 in group I, 1.16 $\pm$ 0.37 in group II and 1.04 $\pm$ 0.20 in group III (table 2). The difference in group I and II, group I and III was found to be highly significant statistically ( $p < 0.001$ ). Total consumption of Diclofenac sodium injections was less in patients in group II and III as compare to group I.



**Fig. 3:** Comparison of onset of analgesia in three groups.

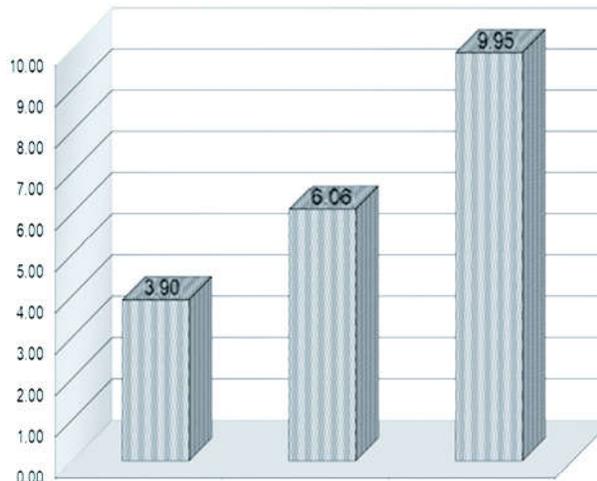


Fig. 4: Comparison of duration of analgesia in three groups.

There was no patient who was having sedation at '0' minutes thus mean difference of sedation was also found to be insignificant statistically ( $p > 0.05$ ) and at other time intervals sedation score was found to be highly significant at 5 minutes to 12 hours, except 24-hour interval where it was insignificant among three groups. Thus, indicating that group III has more incidence of sedation than group II and group I (figure 5). Nausea was seen in 4 patients of group I which was statistically significant. Vomiting was seen in 3 patients of group I which was also statistically significant as none of patient in group II and group III has episode of vomiting. None of the patient had pruritis and respiratory depression in three groups.

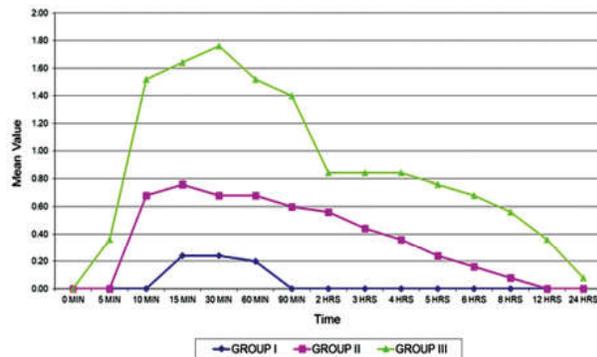


Fig. 5: Comparison of sedation scores in three groups.

## Discussion

Combined spinal epidural anesthesia finds a common place for perioperative management of orthopedic surgery. Various opioids have been used with bupivacaine for postoperative epidural analgesia like morphine<sup>6</sup>, fentanyl<sup>7</sup>, pethidine<sup>8</sup>, tramadol<sup>9</sup>, buprenorphine<sup>10</sup>, methadone<sup>11</sup> and butorphanol<sup>12</sup>. Butorphanol is a strong  $\kappa$ -receptor

agonist and a weak  $\mu$ -receptor agonist-antagonist, thus it has significant analgesic potency and narcotic antagonistic properties. The analgesic potency of butorphanol has been found to be greater than morphine and pethidine. Butorphanol unlike morphine exhibits a ceiling effect on respiratory depression.<sup>13</sup> In this study we evaluated and compared the duration and efficacy of two different doses of epidural butorphanol for postoperative analgesia in patients undergoing lower limb orthopaedic surgeries.

In our study it was observed that group I has onset of analgesia time of  $25.24 \pm 4.12$  minutes. Time of onset of analgesia decreased to  $16.28 \pm 1.51$  minutes in group II and to  $7.00 \pm 0.82$  minutes in group III, this difference in onset time was highly significant ( $p < 0.001$ ). High lipid solubility and high affinity for opioid receptors of butorphanol is the reason for rapid onset of analgesia. Our results were in accordance with study conducted by Hunt et al<sup>14</sup>, they reported that complete pain relief was present in  $21.3 \pm 5.2$  minutes when no butorphanol was added to the 0.25% bupivacaine. Time of onset decreased to  $16.5 \pm 3.6$  minutes and to  $6.9 \pm 3.6$  minutes with addition of 1 mg and 2 mg of butorphanol to 0.25% bupivacaine respectively. In our study duration of analgesia in group III was  $9.95 \pm 0.43$  hours which was significantly higher ( $p < 0.001$ ) than group II ( $6.06 \pm 0.26$  hours) and group I ( $3.90 \pm 0.32$  hours). A dose dependent reduction in rescue analgesic requirements was also noted in our study in group III and group II as compare to group I. Abboud et al<sup>15</sup> showed that addition of one or two mg of butorphanol to 0.25% bupivacaine epidurally produces significantly longer duration of labor analgesia ( $139 \pm 11$  minutes and  $141 \pm 14$  minutes, respectively) than does bupivacaine alone ( $96 \pm 6$  minutes). In a dose response study of a combination of epidural butorphanol with zero, one, two or three mg of butorphanol, Hunt et al<sup>14</sup> reported significantly greater duration of labor analgesia ( $137 \pm 18.4$  minutes) with addition of two mg of butorphanol to 0.25% bupivacaine as compared with bupivacaine alone ( $59 \pm 12.3$  minutes). Although these studies reported increased duration of analgesia with the addition of butorphanol to epidural bupivacaine than with bupivacaine alone, duration of analgesia was only about 140 minutes in the combination group. In our study duration of analgesia was  $9.95 \pm 0.43$  hours in two mg of butorphanol- bupivacaine combination group and  $6.06 \pm 0.26$  hours in one mg of butorphanol- bupivacaine combination group. Our findings are consistent with their findings but the differences in duration may be due to different study populations

as we compared postoperative analgesia after orthopedic lower limb surgeries rather than labor analgesia. In our study, mean VAS scores at the time of epidural administration were similar in all the three groups. VAS scores at 5, 10, 15 minutes and at 3, 4, 5, 6 and 8 hours were significantly ( $p < 0.001$ ) lower in butorphanol bupivacaine combination group than the bupivacaine alone group. At 30, 60, 90 minutes and two hours VAS scores were insignificant between groups. Similarly N. Bharti, P. Chari<sup>16</sup> also found median VAS scores were significantly lower in butorphanol bupivacaine combination group. Palacios et al<sup>17</sup> also found median pain scores significantly lower in butorphanol group. Sedation was significantly higher in group III ( $0.08 \pm 0.28$  to  $1.76 \pm 0.60$ ) and group II ( $0.08 \pm 0.28$  to  $0.76 \pm 0.60$ ) in our study and this was statistically highly significant ( $p < 0.001$ ) as compare to group I. Mild sedation is considered desirable as in group III and group II. Malik P et al<sup>18</sup> also found sedation scores significantly higher in butorphanol group ( $0.97 \pm 0.68$  to  $2.03 \pm 0.87$ ) at all postoperative intervals over 24 hours. There was no statistical difference in changes of respiratory rate and SpO<sub>2</sub> at different time interval between the three groups. Butorphanol has a ceiling effect on respiratory depression<sup>13</sup>, although no clinical evidence of respiratory depression with epidural butorphanol has been reported thus far, a transient depression of carbon dioxide response curve was observed by Abboud et al<sup>15</sup> after 1.5 hrs in patients receiving two to four mg of epidural butorphanol. We were unable to document any respiratory depressant effect of epidural butorphanol, also none of the patient had pruritis, nausea, vomiting and other adverse events.

## Conclusion

From the present study we conclude that both 1 mg and 2 mg of butorphanol in combination with 0.25% bupivacaine can be used for postoperative analgesia via epidural route in patients undergoing lower limb orthopedic surgeries with effective postoperative analgesia without fear of nausea/vomiting, pruritis and respiratory depression. Butorphanol 2 mg with 0.25% bupivacaine appears to be the optimal dose to produce a more rapid onset and longer duration of analgesia with no adverse effects.

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## Comparative Evaluation of Hemodynamic Changes in Different Positions in Normotensive Versus Hypertensive Patients Undergoing Percutaneous Nephrolithotomy (PCNL) Under Regional Anaesthesia

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### Abstract

**Background:** Hemodynamic changes occur with position change, are exaggerated under anesthesia and differ in magnitude between normotensive and hypertensive patients.

**Aim:** To evaluate hemodynamic changes in different positions in 2 groups of patients: Normotensive versus Hypertensive undergoing PCNL under regional anaesthesia (RA).

**Methods:** After ethical committee's approval, a comparative study was conducted at a tertiary healthcare center, included 50 consenting patients >25 years age of ASA Class 1 and 2 undergoing PCNL under RA and divided into two groups of 25 patients each, Group 1-Normotensive patients and Group 2- Hypertensive patients. Hemodynamic variables (heart rate, Systolic, Diastolic and Mean arterial pressures, Electrocardiogram) were monitored throughout surgery and were recorded at Baseline (before instituting RA), Supine to Lithotomy, Lithotomy to Supine, Supine to Prone and Prone to Supine. Hypotensive episodes (Fall in systolic blood pressure (SBP) >20% from baseline) and vasopressor requirement (If SBP <80mm Hg then Inj. Ephedrine IV 5 mg given) were recorded in both the groups.

**Results:** Statistical analysis was done using Chi-Square test and independent sample t test. Inter group comparison of hemodynamic parameters were comparable and statistically insignificant for all positions. Intra-group comparison of hemodynamic parameters showed lower readings as compared to baseline in all with respect to position change. Number of hypotensive episodes and vasopressor used did not differ significantly between two study groups.

**Conclusion:** A well-controlled hypertensive patient behaves like a normotensive patient hemodynamically with respect to position change under anesthesia. Therefore, preoperative control of hypertension is essential.

**Keywords:** PCNL; Regional anesthesia; Position change; Hypertension.

**Key Message:** Control of hypertension enables a hypertensive patient to behave like a normotensive patient hemodynamically with respect to position change under anesthesia.

### Introduction

Percutaneous Nephrolithotomy is the treatment of choice for large renal calculi and involves multiple positions, i.e. Supine to Lithotomy, Lithotomy to Supine, Supine to Prone and Prone to Supine which result in complex hemodynamic changes which are further exaggerated under anesthesia.<sup>1</sup>

These changes and responses may differ in magnitude between Normotensive and Hypertensive patients.

Hypertension is a progressive disease with multisystem involvement and perioperatively has its own challenges. Long standing hypertension and its manifestations have a direct effect on

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perioperative morbidity and mortality. Thorough preoperative assessment and optimization of blood pressure is important to reduce risk of intraoperative adverse events.

## Aims and Objectives

### Aim

To evaluate hemodynamic changes in different positions in 2 groups of patients: Normotensive (Group 1) versus Hypertensive (Group 2) undergoing PCNL under Regional Anaesthesia (RA).

### Objectives

- To monitor intra-operative hemodynamic changes (Heart rate, Systolic blood pressure, Diastolic blood pressure, Mean Arterial Pressure, ECG) in both groups with respect to change in position that is Supine to Lithotomy, Lithotomy to Supine, Supine to Prone and Prone to Supine.
- To observe and record number of hypotensive episodes, vasopressors requirement in the two groups and document any adverse intra operative event.

### Materials and Methods

After approval from institutional ethical committee a comparative study was conducted on 50 patients undergoing PCNL surgery under Regional anesthesia in Department of Anesthesiology at a tertiary care hospital. The study was conducted between years 2018 to 2020.

50 patients belonging to ASA 1 and 2 were divided into 2 Groups of 25 patients each:

- Group 1- Normotensive patients operated for PCNL.
- Group 2- Hypertensive patients operated for PCNL.

### Inclusion criteria

Patients Age greater than 25 years, of both genders belonging to ASA 1 and 2 patients were included. According to ACC/AHA 2017 HYPERTENSION GUIDELINES (13<sup>th</sup> Nov 2017) 2 normal category patients were included in Group 1 and in Hypertensive patients- elevated BP, Stage 1 and 2 patients were included in Group 2.

### Exclusion criteria

Patients with h/o Coronary Artery Disease,

Diabetes Mellitus, any other known cause of orthostatic hypotension and contraindications to Spinal Anaesthesia such as deformities of spine, coagulopathies, raised intracranial pressure, etc were excluded.

### Methodology of Study

Pre anaesthetic check-up of all the patients posted for surgery was done before the day of surgery. Appropriate pre-operative instructions were given.

On day of surgery, it was ensured that patient has taken appropriate prescribed dose of anti-hypertensive agent in the morning in Group 2 patients (standard instruction 7 am with sip of water) and patient received 500ml of Ringer's Lactate during preoperative nil per oral status.

Spinal Anaesthesia was carried out with all aseptic precautions. Bupivacaine (heavy) 0.5% with adjuvant Fentanyl doses adjusted to target sensory level of T5-T6.

During the study, Heart Rate, Blood Pressure (Systolic Blood Pressure, Diastolic Blood Pressure), Mean Arterial Pressure, ECG and Pulse oximetry were continuously monitored. These parameters were recorded in the following time intervals:

- Before instituting regional anesthesia-Baseline.
- Supine to Lithotomy- Immediate, 5 min, 10 min and 15 min intervals.
- Lithotomy to Supine- Immediate (In our study, during change in position from Lithotomy to Supine, only single reading of parameters was recorded because of immediate institution of Prone position).
- Supine to Prone- Immediate, 5 min, 10 min and 15 min intervals.
- Prone to Supine- Immediate, 5 min, 10min and 15 min intervals.

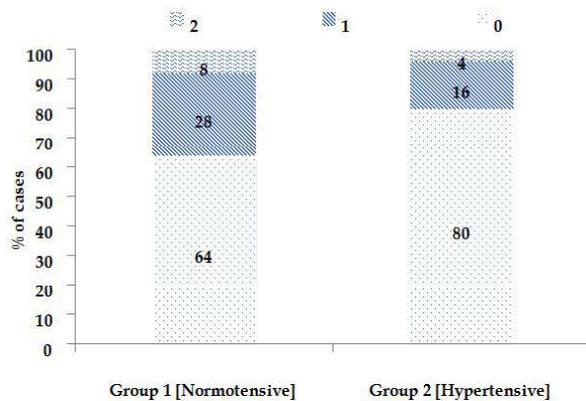
Hypotensive episodes during the procedure (defined as 20% fall in Systolic Blood Pressure from baseline) and Vasopressor requirement (when Systolic Blood Pressure <80 mmHg Inj. Ephedrine 5mg iv was given) were recorded.

### Statistical Analysis

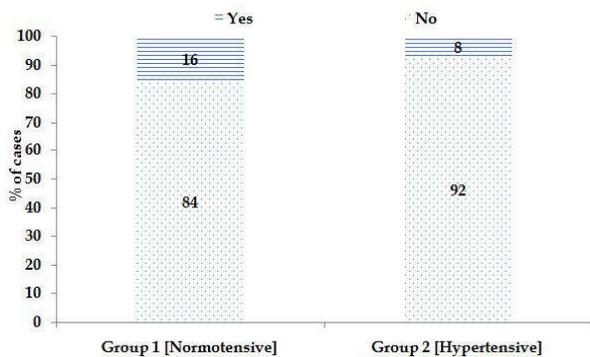
The inter-group statistical comparison of distribution of categorical variables is tested using Chi-Square test or Fisher's exact probability test if more than 20% cells have expected frequency less than 5. The inter-group statistical comparison is done using independent sample t test.

The intra- group statistical comparison of means of continuous variables is done using repeated measures analysis of variance (RMANOVA). The underlying normality assumption was tested before subjecting the study variables to t test and RMANOVA.

In the study, the p-values less than 0.05 are considered to be statistically significant. All the hypotheses were formulated using two tailed alternatives against each null hypothesis (hypothesis of no difference). The entire data is statistically analyzed using Statistical Package for Social Sciences (SPSS ver 21.0, IBM Corporation, USA) for MS Windows.



Graph 1: Hypotensive episodes in both the groups.



Graph 2: Incidence of vasopressor use in two groups.

## Results

The mean age of cases studied was higher in Group 2 patients. This may be correlated to hypertension as a co-morbidity in Group 2 patients. The sex distribution did not differ significantly between two study groups. Inter group comparison of mean heart rate, SBP, DBP and MAP between the two groups were comparable and statistically insignificant for all the position changes. Intra-group comparison of Mean heart rate, systolic

BP, diastolic BP and MAP showed lower readings as compared to baseline in all with respect to position change. Out of 25 cases studied in Group 1, 9 patients had hypotensive episodes (fall in SBP >20% from baseline), of which 7 had one and 2 had two episodes. Out of 25 cases studied in Group 2, 5 patients had hypotensive episodes, of which 4 had one episode and 1 had two episodes. The number of hypotensive episodes among the cases studied did not differ significantly between two study groups. Vasopressor (5 milligrams of Inj Ephedrine intravenous) was given when SBP fell below <80mmHg. Out of 25 cases studied in Group 1 patients 4 required vasopressor use. Out of 25 cases studied in Group 2 patients, 2 required vasopressor use. The incidence of use of vasopressor did not differ significantly between two study groups.

No patients in our study had any hypertension related or surgery related adverse events.

## Discussion

Our study involves patients undergoing Percutaneous Nephrolithotomy (PCNL) surgery under regional anesthesia. This involves lot of position changes and we have intended to study hemodynamics during these various position changes in these patients. We made two groups, that is Normotensive (Group 1) and Hypertensive (Group 2). PCNL surgery requires multiple position changes namely, Supine to Lithotomy, Lithotomy to Supine, Supine to Prone and Prone to Supine which in our study was under spinal anesthesia. Position changes in anesthetized patients are accompanied by hemodynamic changes.

Hypertension is a leading cause of global disease burden, affecting 26.4% or 1 billion of the adult population according to a study in 2000 and is responsible for 9.4 million deaths per year.<sup>3</sup>

Our study included 50 patients belonging to ASA 1 and 2, divided in two groups, Group 1 and 2 consisting of 25 normotensive and 25 hypertensive patients respectively. Both sets of patients received preloading of 500 ml of Ringers' Lactate preoperatively. PCNL involves change in position namely, Supine to Lithotomy, Lithotomy to Supine, Supine to Prone and Prone to Supine and in our study was done under regional anesthesia. We have studied hemodynamic changes following these positions which included Heart rate (HR), Systolic blood pressure (SBP), Diastolic blood pressure (DBP) and Mean arterial pressure (MAP). We have also noted hypotensive episodes (drop in SBP by 20% of baseline SBP) and vasopressor requirement (fall in SBP to less than 80 mmHg).

Table 1: Comparison of hemodynamic parameters in both the groups- inter group.

INTER GROUP	Group 1 [Normotensive] (n=25)										Group 2 [Hypertensive] (n=25)										P value	
	Heart rate		SBP		DBP		MAP		Heart rate		SBP		DBP		MAP		Heart rate	SBP	DBP	MAP		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD								
<b>Baseline</b>	84.96	12.76	133.28	15.15	81.24	9.18	97.56	10.54	90.68	19.46	147.08	14.87	89.96	11.49	108.72	12.20	0.225 <sup>NS</sup>	0.002 <sup>**</sup>	0.005 <sup>**</sup>	0.001 <sup>***</sup>		
<b>Supine to Lithotomy</b>																						
<b>Immediate</b>	83.88	14.44	125.96	14.99	75.92	9.11	92.08	10.78	91.32	19.57	134.76	15.52	80.64	12.49	98.52	13.61	0.133 <sup>NS</sup>	0.047 <sup>*</sup>	0.133 <sup>NS</sup>	0.070 <sup>NS</sup>		
<b>5 min</b>	80.36	16.25	122.68	14.80	72.76	11.32	87.44	12.60	87.96	17.54	131.08	17.54	81.64	12.01	95.88	14.13	0.119 <sup>NS</sup>	0.073 <sup>NS</sup>	0.010 <sup>**</sup>	0.031 <sup>*</sup>		
<b>10 min</b>	79.12	14.30	122.72	15.69	74.00	10.02	88.64	9.91	87.64	17.30	131.36	15.85	80.56	11.81	96.04	12.41	0.064 <sup>NS</sup>	0.059 <sup>NS</sup>	0.039 <sup>*</sup>	0.024 <sup>*</sup>		
<b>15 min</b>	80.59	14.15	120.09	14.43	72.23	12.57	86.50	12.23	87.04	16.61	128.00	13.97	79.75	12.19	95.75	11.82	0.165 <sup>NS</sup>	0.066 <sup>NS</sup>	0.045 <sup>*</sup>	0.012 <sup>*</sup>		
<b>Lithotomy to Supine</b>																						
<b>Immediate</b>	80.91	14.08	117.43	12.30	73.52	13.66	87.00	11.36	86.44	18.70	119.48	19.04	76.12	13.26	89.16	15.68	0.257 <sup>NS</sup>	0.664 <sup>NS</sup>	0.507 <sup>NS</sup>	0.590 <sup>NS</sup>		
<b>Supine to Prone</b>																						
<b>Immediate</b>	79.16	14.82	112.48	17.23	68.60	13.05	81.16	14.66	84.12	17.32	117.32	24.59	73.32	16.82	87.64	18.89	0.282 <sup>NS</sup>	0.424 <sup>NS</sup>	0.273 <sup>NS</sup>	0.182 <sup>NS</sup>		
<b>5 min</b>	78.68	15.44	117.43	15.58	71.64	10.72	86.08	13.30	83.92	16.15	118.20	20.68	72.84	16.03	86.76	17.82	0.247 <sup>NS</sup>	0.854 <sup>NS</sup>	0.757 <sup>NS</sup>	0.879 <sup>NS</sup>		
<b>10 min</b>	77.56	14.64	114.76	13.20	70.16	11.71	85.40	12.77	84.16	17.87	123.84	20.75	74.52	17.15	90.48	17.23	0.160 <sup>NS</sup>	0.071 <sup>NS</sup>	0.299 <sup>NS</sup>	0.242 <sup>NS</sup>		
<b>15 min</b>	77.60	14.06	115.56	11.98	70.68	11.20	85.52	11.11	82.96	15.62	122.60	20.95	76.64	17.70	89.60	17.60	0.208 <sup>NS</sup>	0.151 <sup>NS</sup>	0.161 <sup>NS</sup>	0.332 <sup>NS</sup>		
<b>Prone to Supine</b>																						
<b>Immediate</b>	80.32	16.78	119.68	13.88	72.04	10.73	87.00	10.84	82.32	13.04	119.68	19.87	78.16	14.72	88.04	17.00	0.640 <sup>NS</sup>	0.999 <sup>NS</sup>	0.099 <sup>NS</sup>	0.798 <sup>NS</sup>		
<b>5 min</b>	80.00	15.12	122.56	13.91	74.84	15.76	88.56	13.70	81.72	15.53	117.00	19.35	73.04	13.09	85.56	15.91	0.693 <sup>NS</sup>	0.249 <sup>NS</sup>	0.662 <sup>NS</sup>	0.478 <sup>NS</sup>		
<b>10 min</b>	80.00	16.48	119.08	14.92	74.00	13.49	89.25	13.98	79.83	16.41	119.00	20.68	75.08	16.35	87.79	16.82	0.972 <sup>NS</sup>	0.987 <sup>NS</sup>	0.803 <sup>NS</sup>	0.745 <sup>NS</sup>		
<b>15 min</b>	75.10	14.09	118.65	13.31	77.60	11.61	90.25	12.14	78.26	17.96	116.84	18.29	75.47	13.74	87.63	15.19	0.543 <sup>NS</sup>	0.725 <sup>NS</sup>	0.604 <sup>NS</sup>	0.555 <sup>NS</sup>		

Table 2: Comparison of hemodynamic parameters in both groups- intra group.

P-value (Intra-group)	Group C					Group S						
	Heart rate	SBP	DBP	MAP	Heart rate	SBP	DBP	MAP	Heart rate	SBP	DBP	MAP
Baseline vs Supine to Lithotomy	0.001 <sup>***</sup>											
Baseline vs Lithotomy to Supine	0.001 <sup>***</sup>											
Baseline vs Supine to Prone	0.001 <sup>***</sup>											
Baseline vs Prone to Supine	0.001 <sup>***</sup>											

Values are mean and SD, P-value (Inter-Group) by independent sample t test. P-value<0.05 is considered to be statistically significant. \*P-value<0.05, \*\*P-value<0.01, \*\*\*P-value<0.001, NS-Statistically Non-significant.

The mean of age of cases studied in Group 1 was  $42.20 \pm 12.53$  years and in Group 2 was  $53.92 \pm 11.47$  years and was significant higher in Group 2 ( $P$ -value $<0.05$ ). This may be correlated to hypertension as a co-morbidity in Group 2 patients. The sex distribution of cases was comparable and statistically insignificant.

The hemodynamic parameters (Mean heart rate, systolic BP, diastolic BP and MAP) between the two groups (Table 1) were comparable and statistically insignificant for all the position changes between the groups (inter-group). The hemodynamic parameters (Mean heart rate, systolic BP, diastolic BP and MAP) within the two groups (intra-group-Table 2) showed lower readings as compared to baseline in all with respect to position change. Khoshrang H, et al<sup>4</sup> found a greater degree of hemodynamic variation and lower mean blood pressure readings in prone position PCNL than in supine PCNL.

A hypotensive episode was defined as decrease in the systolic BP by more than 20% of baseline systolic BP. Though lesser number of hypotensive episodes were seen in Group 2 patients than in Group 1, The results were not statistically significant. Vasopressor (5 milligrams of Inj Ephedrine intravenous) was given when there was a fall in systolic BP to less than 80 mmHg. Though lesser vasopressor requirement was seen in Group 2 patients than in Group 1, the incidence of use of vasopressor did not differ significantly between two study groups. A similar study by Terrence L. Trentman, et al<sup>5</sup> showed an increased incidence of intraoperative hypotension and vasopressor use in hypertensive patients on treatment versus normotensive patients posted for shoulder surgery under GA.

The strength of this study was comparing the hemodynamic parameters with each change in position of PCNL surgery and comparing the magnitude of their differences in a normotensive and a controlled hypertensive patient. We also studied hypotensive episodes and vasopressor use in these two groups. There is paucity of

literature about studies involving position related hemodynamics in PCNL surgery. The limitations of this study are the small sample size and exclusion of high-risk ASA 3 and above patients.

## Conclusion

Our study concludes that controlled hypertensives behave like a normotensive patient with respect to hemodynamic parameters during various positioning changes in PCNL surgery carried out under RA and this possibly applies to all surgical patients. Therefore, control of hypertension is essential for elective procedures to maintain hemodynamic stability intraoperatively and for preventing hypertension associated complications.

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I, **Dinesh Kumar Kashyap**, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Sd/-

**(Dinesh Kumar Kashyap)**

## A Comparison of Effects of Dexmedetomidine-Ketamine versus Dexmedetomidine-Midazolam Combination in Ambulatory Transurethral Procedures

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### Abstract

**Introduction:** Minimally invasive transurethral procedures can be successfully performed on outpatient basis. The anaesthetic technique of choice for such procedures is Monitored Anaesthesia Care with a combination of local anaesthesia and sedation-analgesia. It ensures a rapid onset and early recovery with minimal cardiorespiratory adverse effects, facilitating same day discharge. Various drugs are being used in combination to achieve this goal. In this study, we have compared the effects of a combination of dexmedetomidine-ketamine and dexmedetomidine-midazolam in ambulatory transurethral procedures.

**Materials and Methods:** This prospective, randomised, comparative study was carried out on sixty patients aged 20-60 years, of either sex, ASA I/II physical status, scheduled for elective, outpatient transurethral procedures. These patients were randomly allocated into two groups - Group DK received a bolus of IV ketamine 1mg/kg and IV dexmedetomidine 1µg/kg and Group DM received a bolus of IV midazolam 0.05mg/kg and IV dexmedetomidine 1µg/kg, both were followed by a maintenance infusion of dexmedetomidine 0.2µg/kg/hr IV throughout the procedure. The heart rate, mean arterial blood pressure, analgesia using Numerical Rating Scale and sedation using the Ramsay Sedation Scale were measured intraoperatively. The recovery characteristics were assessed using the Modified Aldrete Score, time to spontaneous eye opening and length of stay in the recovery room.

**Statistical analysis:** The data was compared and analysed using the Unpaired t test and Fisher's exact test.

**Results:** Group DM showed statistically significant lower mean arterial pressure (MAP) up to 35 mins during the procedure when compared with group DK ( $P < 0.05$ ). Although the sedation scores were similar, Numerical Rating Scale scores were significantly higher in group DM than in group DK till 10 minutes of the procedure ( $P < 0.001$ ). The Modified Aldrete score was higher and time to spontaneous eye opening, length of recovery room stay was shorter ( $P < 0.001$  and  $P < 0.001$ , respectively) in group DK compared to group DM. The incidence of hypotension, bradycardia and postoperative nausea/vomiting was lower in group DK.

**Conclusion:** Although, good sedation was seen with both the combinations, the dexmedetomidine-ketamine group provided better intra operative analgesia and cardiorespiratory stability with a shorter recovery time and lower incidence of post-operative nausea/vomiting. Thus, dexmedetomidine-ketamine combination is a better, safer alternative for monitored anaesthesia care in ambulatory transurethral procedures.

**Keywords:** Dexmedetomidine; Ketamine; Midazolam; Ambulatory; Transurethral; Recovery.

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## Introduction

Transurethral procedures which are minimally invasive are being performed on outpatient basis for some time now. Advantages of ambulatory surgery are many-it is cost effective, easy to schedule, allows discharge on the same day of surgery with a possible reduction in the risk of thromboembolism and hospital acquired infections.<sup>15</sup>

The choice of the anaesthetic technique can have a significant impact on post-operative recovery and discharge. Although general anaesthesia and regional anaesthesia have been used traditionally for these procedures, greater emphasis is being laid nowadays on Monitored Anaesthesia Care (MAC) wherein a combination of local anaesthesia with sedative-analgesic drugs is usually used. The advantages of MAC are avoidance of polypharmacy, airway instrumentation, lack of significant hemodynamic effects and a rapid recovery, facilitating discharge on the same day.<sup>15</sup> Adequate analgesia, patient comfort/satisfaction and convenience of the surgeon are also of paramount importance. Commonly used drugs for sedation-analgesia in ambulatory surgeries include propofol, midazolam, ketamine, fentanyl and more recently dexmedetomidine.

Dexmedetomidine is a selective  $\alpha_2$  adrenergic receptor agonist, which provides anxiolysis, sedation and modest analgesia by inhibiting the release of endogenous catecholamines at adrenoceptors located on locus ceruleus and substantia gelatinosa of the spinal cord respectively. It provides arousable sedation mimicking natural sleep, allowing spontaneous respiration. It has a distribution half-life of 8 minutes, terminal half-life of 3.5 hrs making it suitable for ambulatory anaesthesia. It also has antiemetic and anti-sialagogue properties.<sup>4</sup> However, sympatholysis may result in adverse effects like hypotension and bradycardia. Also, amnesia with dexmedetomidine is not predictable, particularly at lower doses.<sup>14</sup>

Ketamine, a phencyclidine derivative, is a N-methyl-D-aspartate antagonist which provides excellent analgesia and amnesia. It does not suppress laryngeal reflexes and respiration, is a potent bronchodilator, with distribution half-life of 45 minutes and terminal half-life of 2-3 hours, making it one of the favoured agents for sedo-analgesia.<sup>4</sup> Ketamine has a potential role in lowering the risk of chronification of pain, modified by analgesic and anti-inflammatory effects.<sup>2</sup> However, due to its sympathomimetic effects, it increases heart rate, cardiac output and blood pressure and may also result in psychogenic adverse effects.

Midazolam is a short acting benzodiazepine with sedative-hypnotic properties and a rapid onset. It provides excellent anterograde amnesia, moderate sedation, anxiolysis and has a relatively stable hemodynamic profile. However, its metabolites have longer half-lives which may lead to prolonged sedation and psychomotor impairment/disinhibition on repeated dosage.<sup>9</sup> It also depresses ventilatory response to carbon dioxide causing respiratory depression, which may interfere with readiness for discharge.

A combination of these drugs may complement each other, lower their individual dosages, thus offsetting some of their adverse effects. This study was carried out to compare the analgesic/sedative effect and the recovery characteristics of a combination of dexmedetomidine-midazolam with dexmedetomidine-ketamine in patients undergoing outpatient transurethral procedures under monitored anaesthesia care.

## Materials and Methods

This prospective, randomised study was carried out on sixty patients, after obtaining a written informed consent, in a tertiary referral hospital. The study population consisted of patients aged 20-60 years, of either sex, belonging to ASA I/ II physical status, scheduled for elective, outpatient transurethral procedures.

Patients with ASA III/ IV physical status, age <20yrs and >60 years, with a history of drug dependence, psychological disorder, 2 or 3-degree heart block, chronic use of alpha agonist / sedatives, history of sleep apnoea / respiratory disorders, chronic renal insufficiency, liver dysfunction and procedures taking longer than one hour were excluded from the study.

A detailed history, thorough clinical examination and a written informed consent was taken a day prior to the surgery. Routine investigations including complete blood count, random blood sugar, urine analysis, electrocardiogram (ECG) was done. Special investigations were done only when indicated.

None of the patients received any premedication. On arrival at the operating room, a 20-G intravenous catheter was placed, standard monitors applied (ECG; Non-Invasive Blood Pressure; SpO<sub>2</sub>; Capnography) and baseline parameters were noted. These parameters were recorded every five mins throughout the procedure. Randomization into two groups was done using sealed envelope method.

The first group, Group DM, patients received midazolam 0.05mg/kg IV and dexmedetomidine 1µg/kg IV in 20ml normal saline over 10 min followed by a continuous infusion of dexmedetomidine 0.2 µg/kg/hr throughout the procedure. The second group, Group DK, received ketamine 1mg/kg IV and dexmedetomidine 1µg/kg IV in 20 ml normal saline over 10 min followed by a continuous infusion of dexmedetomidine 0.2µg/kg/hr throughout the procedure.

All the patients received 2-4 litres/min of O<sub>2</sub> by nasal cannula to maintain a saturation of >95%. After positioning of the patient, ten ml of 2% lignocaine jelly was topically instilled in the urethra by the surgeon prior to the procedure. Pain was assessed using the Numerical Rating Scale (NRS) with a 5 minute interval during procedure (0 = no pain, 10 = worst pain imaginable). If pain score was greater than 3 or if patient asked for additional analgesia, a rescue bolus of IV fentanyl 1mg/kg was administered. Sedation scores were assessed using Ramsey Sedation Scale (0=patient paralysed, unable to assess sedation; 1=patient anxious, agitated or restless; 2=patient cooperative, oriented and tranquil; 3=patient sedated but responds to command; 4=patient asleep but responds to glabellar tap; 5=patient asleep but responds to nail bed pressure; 6=patient asleep, no response to nail bed pressure). The goal was to maintain a score of 3. If the initial regime failed to achieve so, maintenance infusion was increased to 0.4µg/kg/hr. If the sedation score was greater than 4, the dexmedetomidine infusion was stopped immediately.

On completion of the procedure, patient was shifted to the post anaesthesia care unit and recovery was assessed using the Modified Aldrete Score (Table 1). The time taken to achieve a score of 10 was recorded. The time to spontaneous eye opening and the length of stay in the recovery room was also noted.

Table 1: Modified Aldrete Score.

Criteria	Description	Score
Consciousness	Fully awake and oriented	2
	Arousable on calling	1
	No response	0
Activity	Moves all 4 extremities voluntarily or on command	2
	Moves all 2 extremities voluntarily or on command	1
	Unable to move extremities on command	0

Circulation	Blood Pressure ±20% of pre anaesthetic level	2
	Blood Pressure ±20-50% of pre anaesthetic level	1
	Blood Pressure ±50% of pre anaesthetic level	0
Respiration	Able to breathe and cough freely	2
	Dyspnoea, Limited breathing, Tachypnoea	1
	Apnoeic or on mechanical ventilation	0
Oxygen saturation	SpO <sub>2</sub> > 92% on room air	2
	Needs supplemental O <sub>2</sub> to maintain SpO <sub>2</sub> > 90%	1
	SpO <sub>2</sub> < 90% even with O <sub>2</sub> supplementation	0
<b>Maximal Score</b>		<b>10</b>

Adverse effects like bradycardia (HR of <50/min), tachycardia (HR of >100/min), hypotension (MAP of <60mm of Hg), hypertension (MAP of >20% of baseline), desaturation (SpO<sub>2</sub> of <90%), apnoea of more than 30 seconds, bronchospasm, laryngospasm, nausea/vomiting, if any, were noted. Atropine 0.02 mg/kg IV was used to treat bradycardia and a bolus of 5ml/kg of 0.9% normal saline used in case of hypotension.

### Statistical Analysis

The data of the parameters observed was presented as Mean ± SD. Since normality assumption was followed, parametric tests were applied. The demographic profile and inter-group parameters were compared using the unpaired t-test. The data was analysed using SPSS software, version 21. Categorical intergroup data was compared using the Chi-square test/Fischer's exact test. Statistical significance was accepted when P value was less than 0.05.

### Results

This study was carried out in sixty patients undergoing elective transurethral outpatient procedures. The demographic data is as shown in Table 2. Both the groups were comparable with respect to age, sex distribution, weight, ASA status and duration of surgery (p > 0.05).

The heart rate (bpm) was recorded at five-minute intervals, as shown in Table 3, Figure 1. The baseline values were comparable. There was no statistically significant difference in the heart rate between the two groups in all the intervals, except at 30 minutes. Bradycardia was noted in 5 patients

(16%) in group DM and 2 patients (6.7%) in group DK and was treatable with IV atropine.

Table 2: Demographic Details.

	Group DM (n=30)	Group DK (n=30)	P value
Age (years)			
Mean ± SD	45.37±7.17	44.50±8.96	0.681
Weight (kgs)			
Mean ± SD	70.80±5.45	71.03±4.92	0.863
Number of Patients	17 / 13	20 / 10	>0.05
Male/ Female			
Asa Status	17 / 13	17 / 13	>0.05
I/ II			
Duration of Procedure			
Mean ± SD	49.17±5.43	47.17±5.52	0.162

#p<0.05 significant

Table 3: Comparison of Heart Rate.

HEART RATE (bpm)	Group DM		Group DK		P value
	Mean	± SD	Mean	± SD	
Baseline	80.93	7.50	81.10	6.62	0.928
After 5 mins	83.93	9.26	85.00	7.09	0.618
After 10 mins	81.50	12.10	84.47	11.32	0.330
After 15 mins	78.90	11.18	83.40	13.37	0.146
After 20 mins	77.03	8.88	81.13	10.09	0.060
After 25 mins	74.17	6.33	77.50	7.07	0.064
After 30 mins	72.27	4.68	75.43	6.31	0.031#
After 35 mins	71.03	4.15	73.90	6.47	0.05
After 40 mins	71.37	4.82	72.93	6.14	0.276
After 45 mins	68.50	3.79	69.03	4.14	0.605

# p<0.05 significant

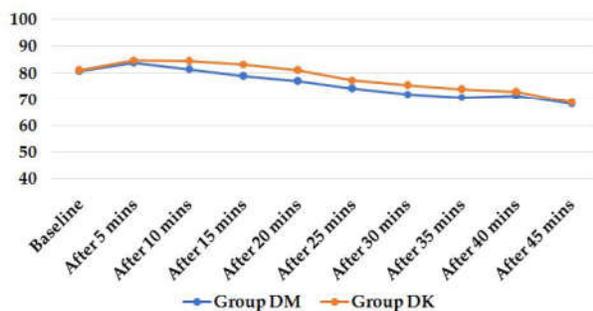


Fig. 1: Comparison of Heart Rate.

The mean arterial blood pressure (MAP) was recorded at five-minute intervals, as shown in Table

4, Figure 2. The baseline values were comparable. There was a statistically significant difference between the two groups at 5, 10, 15, 20, 30 and 35 minutes (p<0.05). The MAP in the DM group was below baseline values throughout the procedure, whereas in DK group there was an increase of about 8% after 5 minutes, with MAP returning to baseline values after 15 minutes. Hypotension was noted in 10 patients (33%) in group DM and 3 patients (10%) in group DK (p=0.057).

Table 4: Comparison of Mean Arterial Pressure.

Mean Arterial Pressure (Mm Hg)	Group DM		Group DK		P value
	Mean	± SD	Mean	± SD	
Baseline	85.97	7.86	84.73	4.40	0.456
After 5 mins	77.73	6.43	91.63	6.52	<0.001##
After 10 mins	74.83	8.33	86.80	5.00	<0.001##
After 15 mins	75.10	6.96	83.80	5.91	<0.001##
After 20 mins	72.07	8.56	78.43	7.46	0.003#
After 25 mins	72.77	8.16	76.73	8.78	0.075
After 30 mins	74.13	8.28	79.40	8.24	0.012#
After 35 mins	72.37	7.66	76.20	6.76	0.044#
After 40 mins	70.70	6.20	71.97	4.81	0.380
After 45 mins	70.07	5.68	70.83	6.14	0.617

##p<0.001 highly significant # p<0.05 significant

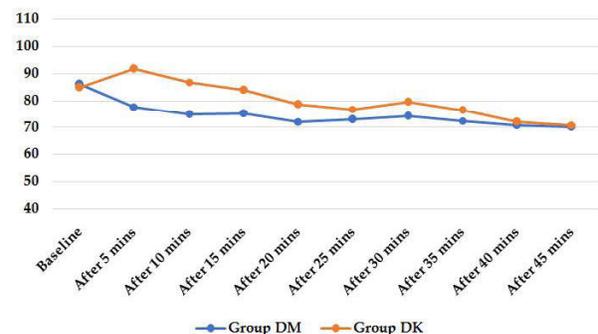


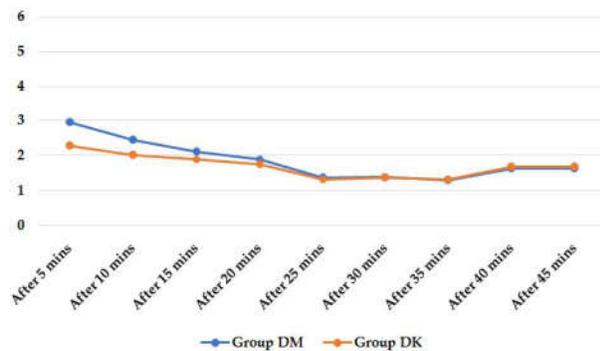
Fig. 2: Comparison of Mean Arterial Pressure.

Pain was assessed using Numerical Rating Scale at five-minute intervals during the procedure, as shown in Table 5, Figure 3. Pain score was significantly lower at 5 and 10 minutes in group DK (p<0.001). The score was comparable thereafter. The number of patients requiring rescue analgesia was nine (30%) in group DM, statistically higher in comparison to group DK where it was only one (3.3%) (p=0.012). The target sedation score of 3 (RSS) was maintained throughout the procedure in both the groups, with only one patient in group DK requiring escalation of maintenance dose of dexmedetomidine to 0.4 µg/kg/min.

**Table 5:** Comparison of Numerical Rating Scale Scores.

Numerical Rating Scale	Group DM		Group DK		P value
	Mean	± SD	Mean	± SD	
After 5 mins	2.93	0.64	2.27	0.45	<0.001##
After 10 mins	2.43	0.57	2	0.26	<0.001##
After 15 mins	2.1	0.31	1.9	0.48	0.059
After 20 mins	1.9	0.40	1.74	0.45	0.136
After 25 mins	1.37	0.49	1.33	0.48	0.791
After 30 mins	1.4	0.50	1.37	0.49	0.795
After 35 mins	1.3	0.47	1.33	0.48	0.786
After 40 mins	1.63	0.49	1.67	0.48	0.791
After 45 mins	1.63	0.49	1.67	0.48	0.791

##p<0.001 highly significant # p<0.05 significant



**Fig. 3:** Comparison of Numerical Rating Scale Scores.

The Modified Aldrete Score for recovery (Table 6, Figure 4) showed a significantly higher score in Group DK compared to group DM from 10 minutes onwards (p<0.001), with patients reaching a score of 10 faster in group DK. Time to spontaneous eye opening and the length of recovery room stay is as shown in Table 7, Figure 5. Group DK had a significantly shorter time to spontaneous eye opening of 8.23 minutes and length of stay in the recovery room of 42.33 minutes compared to group DM with time to spontaneous eye opening of 14.17 minutes and length of stay in the recovery room of 60.33 minutes (p <0.001 each).

**Table 6:** Comparison of Modified Aldrete Score.

Modified Aldrete Score	Group DM		Group DK		P value
	Mean	± SD	Mean	± SD	
After 5 mins	6.23	0.43	6.37	0.56	0.303
After 10 mins	6.37	0.49	6.70	0.65	0.029#
After 15 mins	6.67	0.55	7.47	0.57	<0.001##
After 20 mins	6.97	0.61	7.77	0.63	<0.001##
After 25 mins	7.30	0.47	8.03	0.72	<0.001##
After 30 mins	7.57	0.57	8.47	0.68	<0.001##

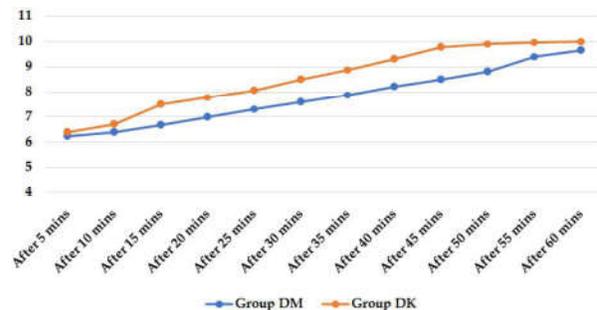
After 35 mins	7.87	0.73	8.87	0.73	<0.001##
After 40 mins	8.20	0.66	9.30	0.70	<0.001##
After 45 mins	8.47	0.90	9.77	0.43	<0.001##
After 50 mins	8.80	0.81	9.90	0.31	<0.001##
After 55 mins	9.40	0.81	9.97	0.18	<0.001##
After 60 mins	9.63	0.61	10	0	0.002##

## p<0.001 highly significant # p<0.05 significant

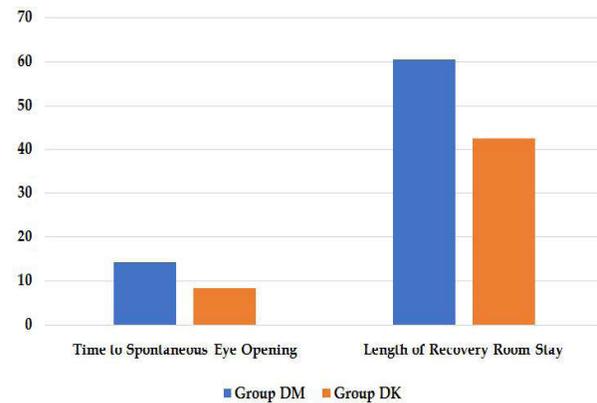
**Table 7:** Comparison of Recovery Time.

Recovery Time (in minutes)	Group DM		Group DK		P Value
	Mean	± SD	Mean	± SD	
Time to Spontaneous Eye Opening	14.17	5.59	8.23	2.05	<0.001##
Length of Recovery Room Stay	60.33	15.57	42.33	7.40	<0.001##

## p<0.001 highly significant



**Fig. 4:** Comparison of Modified Aldrete Score.



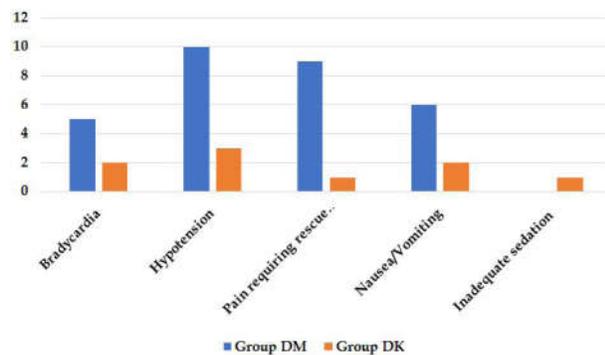
**Fig. 5:** Comparison of Recovery Time.

The complications observed are as shown in Table 8, Figure 6. Desaturation, apnoea, bronchospasm, laryngospasm and hypertension was not observed in any of the patients. Nausea/vomiting was observed in 6 patients (20%) in group DM and 2 patients (6.7%) in group DK (p=0.25).

**Table 8:** Table of Complications.

Complications	Group DM	Group DK	P Value
Bradycardia	5 (16.7%)	2 (6.7%)	0.423
Hypotension	10 (33.3%)	3(10%)	0.057
Pain requiring rescue analgesia	9 (30%)	1 (3.3%)	0.012#
Nausea/Vomiting	6 (20%)	2 (6.7%)	0.254
Inadequate sedation	0	1 (3.3%)	1.00

# p&lt;0.05 significant

**Fig. 6:** Table of Complications.

## Discussion

Minimally invasive transurethral procedures such as ureteroscopy for extraction of lower urethral stones, stent placement, cystoscopy, incision and dilation of urethral strictures can be performed successfully on outpatient basis.<sup>4</sup>

The anaesthetic technique for such ambulatory procedures dictates the need of rapid onset and recovery, devoid of any cardiorespiratory side effects, while ensuring patient comfort and surgeon satisfaction. Monitored Anaesthesia Care (MAC) with a combination of local anaesthesia and sedative-analgesic drugs (like propofol, ketamine, dexmedetomidine, midazolam, remifentanyl) can be used to achieve the same.<sup>15</sup>

Dexmedetomidine possesses many properties that are advantageous for ambulatory procedures; it has shown to provide sedation that parallels natural sleep, anxiolysis, analgesia, sympatholysis, with an anaesthetic-sparing effect and minimal respiratory depression. In addition, there is increasing evidence supporting its organ-protective effects against ischaemic and hypoxic injury.<sup>11</sup> Increasing concentrations of dexmedetomidine results in progressive increases in sedation and analgesia, decrease in heart rate, cardiac output, and memory.<sup>9</sup> Although generally effective in

non-invasive procedures as a sole agent, the use of dexmedetomidine in invasive procedures has been limited due to its distressing side effects, hemodynamic instability and prolonged recovery.<sup>10</sup> However, if other sedative-analgesic drugs were to be added, the dose-sparing effect of dexmedetomidine will enhance the already superior safety profile of it. Also, dexmedetomidine has the ability to unlock the full potential of other drugs even at lower doses.<sup>14</sup>

Sim JH et al in 2014 studied the effects of different loading doses, 0.5 and 1.0 µg/kg, of dexmedetomidine on sedation. They concluded that a higher loading dose (1.0 µg/kg) of dexmedetomidine can lead to faster sedation without any severe complications.<sup>5</sup> For maintenance, although infusion rates up to 2 µg/kg/h have been used, effective sedation is usually seen at infusion rates of 0.2-0.4 µg/kg/h. It is uncertain if a rate greater than 0.7 µg/kg/h is more efficacious and it may only increase the incidence of side-effects.<sup>14</sup> Therefore, in our study we chose a loading dose of 1 µg/kg of dexmedetomidine and the lowest recommended dose for maintenance i.e., 0.2 µg/kg/hr to avoid prolonged recovery.

Tobias Joseph D et al in 2008 evaluated a combination of ketamine (2mg/kg) and dexmedetomidine (1µg/kg) followed by a continuous infusion of dexmedetomidine 1µg/kg for sedation during cardiac catheterization in children with congenital heart disease. They suggested that it provided effective sedation without significant effects on cardiovascular or ventilatory function.<sup>13</sup> Tobias JD et al in 2012 have provided an account of reports from literature regarding the use of dexmedetomidine-ketamine combination for procedural sedation. They noted that when used together, dexmedetomidine may prevent the tachycardia, hypertension, salivation, and emergence phenomena from ketamine, whereas ketamine may prevent the bradycardia and hypotension, reported with dexmedetomidine. Also, ketamine eliminates the slow onset time of dexmedetomidine seen when it is used as a sole agent. Among the various regimens reported in literature, the most effective regimen appeared to be the use of a bolus dose of dexmedetomidine (1 µg/kg) and ketamine (1-2 mg/kg), followed by an infusion of dexmedetomidine (1-2 µg/kg/hr).<sup>1</sup>

In our study, Group DK, received bolus doses of ketamine 1mg/kg IV and dexmedetomidine 1µg/kg IV over 10 min followed by a continuous infusion of low dose dexmedetomidine 0.2µg/kg/hr throughout the procedure.

Ikeda Yet al evaluated the usefulness of

dexmedetomidine as a combination with benzodiazepines for benzodiazepines induced disinhibition during ERCP. They concluded that it yielded better sedative efficacy, lower excessive movement/disinhibition, a reduction in benzodiazepines used, and a higher procedure complete rate.<sup>8</sup> Park SW et al in 2018 examined whether an intravenous bolus of midazolam could replace the loading dose of dexmedetomidine for sedation during surgery in elderly patients who received spinal anaesthesia. The Patient State Index and Ramsay sedation score showed statistically significant deeper sedation in the combination group 10 minutes after drug administration, but no difference at the end of surgery. The heart rate was significantly higher in the combination group. They concluded that a combination of midazolam and dexmedetomidine is especially effective for patients who want faster sedation or are at high risk for bradycardia.<sup>7</sup> Yoon DK et al in 2016 studied the effects of dexmedetomidine-midazolam (MD) versus dexmedetomidine (D) alone for sedation during spinal anaesthesia. The RSS and Bispectral Index were comparable. The prevalence of bradycardia (except at 10 min), hypotension, and hypoxia did not differ statistically between the two groups. They concluded that midazolam bolus and dexmedetomidine continuous infusion may be an additional sedation method for patients who have severe bradycardia.<sup>6</sup>

In our study group DM, received a bolus of midazolam 0.05 mg/kg IV and dexmedetomidine 1 µg/kg IV over 10 min followed by continuous infusion of dexmedetomidine 0.2 µg/kg/hr throughout the procedure.

Baik, H.J. et al. in 2016 compared dexmedetomidine-ketamine versus dexmedetomidine-midazolam-fentanyl for monitored anaesthesia care during chemo port insertion. All patients received 1 µg/kg dexmedetomidine over 10 min followed by 0.2-1.0 µg/kg/h in order to maintain 3 or 4 of modified Observer's Assessment of Analgesia and Sedation score checked every 3 min. The patients in addition received a bolus of 0.5 mg/kg ketamine or 0.05 mg/kg midazolam plus 0.5 µg/kg fentanyl in group DK or DMF respectively. They concluded that both ketamine and midazolam-fentanyl co-administration with dexmedetomidine for MAC showed no significant differences in the onset time, time to spontaneous eye opening, recovery room stay, the incidences of inadequate analgesia, hypotension and bradycardia. However, the dexmedetomidine-midazolam-fentanyl combination showed a better sedation quality and

satisfaction scores despite the lower infusion rate of dexmedetomidine, and a higher incidence of BIS <60 than the dexmedetomidine-ketamine combination.<sup>3</sup>

Kose EA et al in 2012 compared the effects of combinations of dexmedetomidine-ketamine (K) and dexmedetomidine-midazolam (M) on recovery time, hemodynamic variables, respiratory variables and side effects in transurethral procedures. Group M showed significantly lower mean arterial pressure (MAP) values at 5 and 10 minutes during the procedure when compared with group K. Visual analogue scale scores were greater in group M than in group K at 5 and 10 minutes for the transurethral procedure. Sedation scores were similar between groups during the procedure. Time to eye opening and length of recovery room stay were shorter and Aldrete scores were greater in group K than group M. They concluded that both combinations provided satisfactory sedation levels, but the dexmedetomidine-ketamine combination provided better analgesia and hemodynamic stability, with a shorter recovery time, than the dexmedetomidine-midazolam combination.<sup>4</sup>

In our study, we observed that the heart rate throughout the procedure was comparable in both the groups. Bradycardia was noted in 5 patients (16%) in group DM and 2 patients (6.7%) in group DK. The mean arterial pressure was significantly lower in the DM group up to 35 mins during the procedure as compared to group DK. The increase in MAP seen in group DK was 8% only, returning to baseline values after 15 minutes. The incidence of hypotension, although statistically insignificant (p=0.057) was much greater (33%) in group DM compared to group DK (10%). No tachycardia/hypertension was seen in either of the groups. This is similar to the results of Kose EA et al and Yoon DK et al. The sympathetic stimulation and increased catecholamine levels by ketamine may be attributed to the higher mean arterial pressure in group DK. It can be said that ketamine may prevent hypotension induced by dexmedetomidine and vice versa.

The numerical rating scale score was significantly lower in group DK at 5 and 10 mins, and thereafter comparable in both the groups. However, the number of patients requiring rescue analgesia was statistically greater (30%) in group DM compared to group DK (3%). This can be attributed to the additive analgesic effects of ketamine and dexmedetomidine used in combination. Our results are comparable to that by Kose EA et al. The sedation scores of both the groups were comparable with only one patient (3%) in group DK requiring

rescue sedation. This was in contrast to the study by Baik, H. J. et al where comparable analgesia was noted between both the groups and better sedation quality and satisfaction scores was seen in the dexmedetomidine-midazolam group. In our study, we concluded that while both groups provided comparable sedation, analgesia was better with the dexmedetomidine-ketamine group.

The recovery characteristics of the groups when assessed using Modified Aldrete Score, showed a statistically higher score in group DK 15 minutes onwards. Group DK also had a statistically significant shorter time to spontaneous eye opening and length of stay in the recovery room. Thus, it can be said that the combination of dexmedetomidine-ketamine has a more favourable recovery profile, which is of paramount importance in ambulatory procedures. Our findings were similar to that of Kose EA et al.

The use of midazolam in ambulatory procedures is limited due to depression of the ventilator response to carbon dioxide leading to respiratory depression, desaturation and apnoea. However, we did not observe any desaturation/apnoea or decrease in respiratory rate in the dexmedetomidine-midazolam group. This can be explained by the use of a single bolus dose of midazolam and the effect of dexmedetomidine which by itself allows spontaneous respiration even at moderately high doses. There was no disinhibition/disorientation observed in any of these patients as well. This was similar to the observations made by Ikeda Y et al. In our study, there were no cases of bronchospasm or laryngospasm in either groups which can be explained by the anti-sialagogic properties of dexmedetomidine. Ketamine induced psychogenic effects were also not seen.

The incidence of nausea and vomiting observed was 6 (20%) cases in group DM and 2 cases (6.7%) in Group DK. A lower incidence in group DK can be attributed to the antiemetic properties of dexmedetomidine along with a lower incidence of hypotension and need for rescue analgesic in group DK. Similar results were observed by Koruk et al<sup>16</sup> on comparing sedation using dexmedetomidine and ketamine to a regimen using midazolam with ketamine during shock wave lithotripsy.

Thus, the incidence of side effects both intraoperatively and post operatively were lower in the dexmedetomidine-ketamine group.

## Conclusion

From our study, we conclude that although

good sedation levels were seen with both the combinations of dexmedetomidine-midazolam and dexmedetomidine-ketamine, the dexmedetomidine-ketamine group provided better intra operative analgesia and hemodynamic stability with a shorter recovery time and lower incidence of post-operative nausea/vomiting. This makes the dexmedetomidine-ketamine combination a better, safer alternative for monitored anaesthesia care in ambulatory transurethral procedures.

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## Efficacy of Ketamine Soaked Pharyngeal Pack for Prevention of Sore Throat Following Oro-Nasal Surgeries in Paediatrics

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### Abstract

**Background and Aim:** Post operative sore throat has reported incidence of upto 62% following general anaesthesia. The incidence in paediatric anaesthesia is variable, and the etiology is unclear. Many methods have been used to mitigate postoperative sore throat in paediatrics. The aim of the current study was to evaluate the efficacy of Ketamine soaked pharyngeal pack in preventing post operative sore throat with probable advantage of prolonged contact with mucosa, thereby producing sustained drug release at the site of action.

**Methods:** This is a prospective randomized control study in 70 ASA1 or ASA2 patients undergoing oro-nasal surgeries. Group K (n=35) received Ketamine soaked pharyngeal pack (1mg/Kg) and group N (n=35) received normal saline soaked pharyngeal pack intra operatively. We compared post-operative sore throat, dysphagia, observational pain scores and hemodynamic variables in both the groups

**Results:** Post-operative sore throat, dysphagia and observational pain score were comparatively less in group K compared to group N (p<0.05). Hemodynamic profile were comparable in both groups with no side effects.

**Conclusion:** Ketamine soaked pharyngeal pack at the dose of 1mg/kg, reduced the incidence of post-operative sore throat and dysphagia with minimal side-effects compared to normal saline soaked pharyngeal pack in paediatrics. It also reduced the requirement of post operative analgesia.

**Keywords:** Ketamine; Pharyngeal pack; Postoperative sore throat; Dysphagia and Observational pain score.

### Introduction

Adenotonsillectomy and palate surgeries are among the most commonest oro-nasal surgeries done in paediatric patients.<sup>1</sup> Added to the post-surgical pain is the post-operative sore throat which occurs in 21-65% of patients receiving general anaesthesia.<sup>2</sup> Post-intubation soreness is rated as 8<sup>th</sup> most common adverse effect in the post-operative period.<sup>3</sup> Pharyngeal packs which are commonly used in oro-nasal surgeries also contribute to increase in the incidence of post-operative sore throat.

Pharmacological and non-pharmacological intervention have been used to attenuate post-operative sore throat. Careful airway instrumentation, smaller sized ET tube, lubricating ET tube with jelly, gentle suctioning, reducing intra cuff pressure are some among non-pharmacological methods.

Pharmacological measures include nebulized ketamine<sup>2,3,12</sup>, dexamethasone<sup>9</sup>, MgSO<sub>4</sub><sup>21</sup> beclomethasone inhalation and gargling with azulene sulfonate, aspirin, benzylamine hydrochloride and licorice. Intracuff administration of alkalized lignocaine has also been used.

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The inotropic glutamate receptors N-methyl-D-aspartate (NMDA), alpha amino-3 hydroxyl-5 methyl-4 isoxazol -eprapionic acid, and the kainite receptors are found in the CNS as well as the peripheral nerves. Activation of these receptors results in nociceptive behaviours and contribute to inflammatory pain. Peripherally administered NMDA receptors antagonists are involved in anti-nociception.<sup>4</sup>

Ketamine<sup>4,5,11,13</sup> -a NMDA receptor antagonist is involved in anti-nociception and anti-inflammatory cascade by reducing nuclear factor beta(B)activity and tumour necrosis factor alpha production.<sup>4,5</sup>

No studies exists in the literature, where drug soaked pharyngeal pack have been used for the prevention of POST in the paediatric age group. Drug soaked pharyngeal pack has the probable advantage of prolonged contact with mucosa, there by producing sustained drug release at the site of action.

## Materials and Methods

After approval from the institutional ethical committee and a written informed consent, a prospective randomised control study was conducted in 70 patients, belonging to American Society of Anaesthesiologists Classes I or II, aged between 6-15 years posted for elective oro-nasal surgery. Exclusion criteria included patients refusal, allergy to study drugs, pre-op upper respiratory tract infection and psychiatric illness, anticipated difficult airway, attempts at intubation > 3 and history of head injury.

Patients were allocated into 2 groups using a computer generated randomization list to receive either pharyngeal pack soaked in Ketamine 1 mg/kg diluted in 15 ml normal saline (Group K) or Throat pack soaked in 15 ml normal saline (Group N). The length of throat pack was standardized to 40-60 cm (based on a pilot study)and was prepared by OT technician.

All patients were evaluated preoperatively on the previous day of surgery. On the day of surgery, an intravenous line was secured. On arrival in the operating room, monitors like automated non-invasive blood pressure (NIBP), pulse oximetry, an electrocardiogram was attached to the patient in operation theatre and base line parameters like heart rate (HR), systolic blood pressure(SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) were noted. Pre-medication done with Inj Glycopyrrolate 0.01 mg/kg iv, Inj Midazolam 0.1mg/kg iv and Inj Fentanyl 2 mcg/

kg iv. Induction was performed with Propofol 2 mg/kg iv and Inj Vecuronium 0.1mg/kg iv. Mask ventilation with oxygen performed for 3 min along with isoflurane. Laryngoscopy and intubation was done by an experienced anaesthesiologist using appropriate sized cuffed endotracheal tube and was fixed after confirming bilateral equal air entry by auscultation and end tidal capnography.

Throat pack soaked in Ketamine (1mg/kg) in 15 ml normal saline (Group k) or plain Normal saline (15 ml) (Group N) was used to pack the space around the tube under vision using Magill's forceps. Cuff pressure was measured and was maintained between 15-25 cm H20. Anaesthesia was maintained with oxygen 50% and air 50% and isoflurane 1-2% and Inj Vecuronium 0.02 mg/kg iv for maintenance of muscle paralysis. Isoflurane was turned off at the last suture. All patients received Inj Paracetamol 2mg/kg intravenously for analgesia. Rescue analgesia Inj Fentanyl 0.5 mcg/kg was used. At the end of the surgery, reversal done with Inj Glycopyrrolate 0.01 mg/kg iv and Neostigmine 0.05 mg/kg iv. Throat pack was removed and extubation performed after gentle oropharyngeal suctioning under vision using Yankaver tip. Attempts at intubation, size of ET tube, cuff pressure of tube and hemodynamic parameters were monitored and recorded .

Patient was followed up at 0 hr, 2<sup>nd</sup> hr, 6<sup>th</sup> hr, 12<sup>th</sup> hr and 24<sup>th</sup> hr in the postoperative period. The patient, Anaesthesiologist intubating and following up the patient were blinded to the procedure. Post-operative pain was assessed using observational pain score (OPS). If the score was >4, rescue analgesia in the form of injection fentanyl 0.5µg/kg was administered. The time at which the First rescue analgesia was given was noted and the total consumption of rescue analgesia in first 24 hours was recorded.

Severity of sore throat was graded and recorded as none, mild, moderate and severe (fig 13). Post-operative dysphagia were noted as present/absent, while post-operative pain was assessed using observational pain score (fig 14).

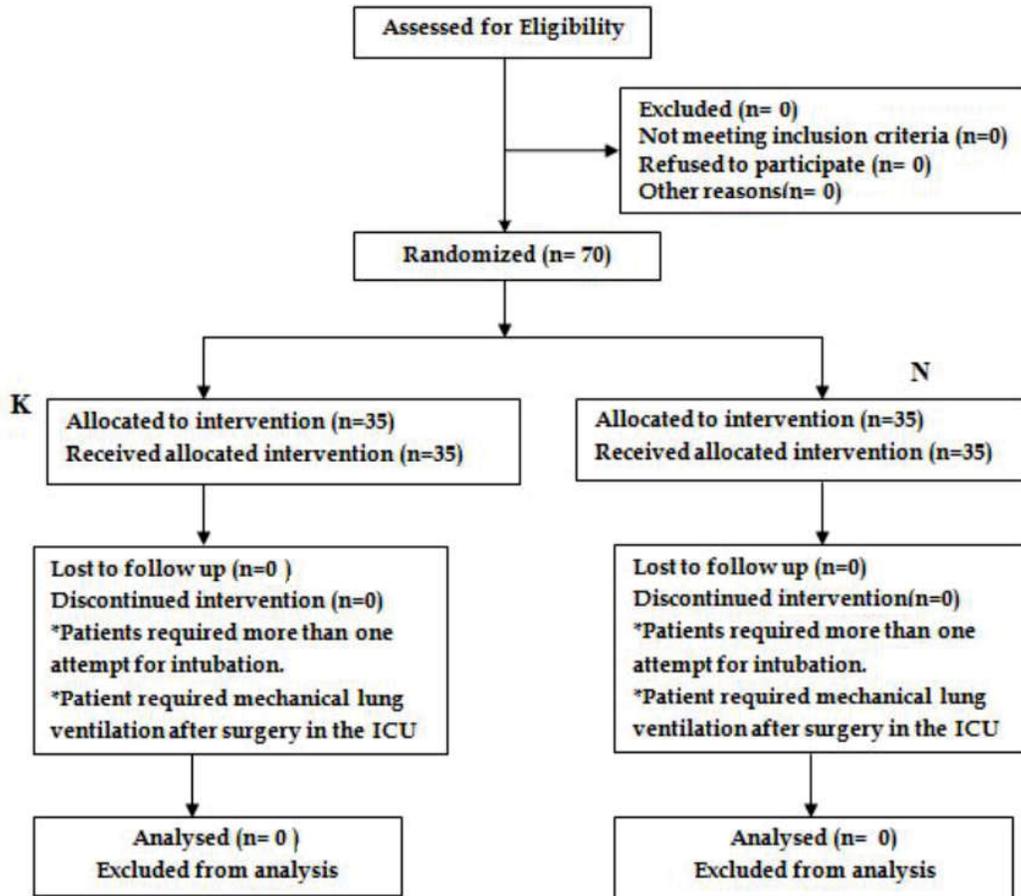
Increased oral secretions and post-operative disorientation were the side effects noted .

## Statistical Analysis

Statistical analysis was done using the computer statistical software system, SPSS version 18.0 (SPSS Inc., Chicago, IL, USA). Numerical data were analysed using Student's ttest. Categorical data were analysed by Chisquare test or fisher's exact

test as appropriate. Results were expressed as mean  $\pm$  standard deviation, number or percentage (%).

Results were considered statistically significant if  $P < 0.05$ .



**Study Design**

**Table 1:** Grading Severity of Post Operative Sore Throat 9.

Grade	Severity
1	Mild-No sore throat at any time since the operation
2	Minimal-patient answered in the affirmative when asked about sore throat
3	Moderate-patient complained of sore throat on his/her own
4	Severe-patient is in obvious distress.

**Dysphagia**

0	Absent
1	Present

**Table 2:** Pain Scoring Table <sup>11,12</sup>

Observational pain scores (OPS)

<b>Crying</b>	
None	0
Consolable	1
Inconsolable	2
<b>Movement</b>	
None	0
Restless	1
Thrashing	2
<b>Agitation</b>	
Asleep or calm	0
Mild	1
Hysterical	2
<b>Swallowing secretions</b>	
Normal	0
Uncomfortable	1
Unable	2
<b>Complaints of pain</b>	
Asleep or none	0
Cannot localize	1
Localize	2

## Results

The mean age in Group K was  $9.49 \pm 2.38$  and in Group N was  $9.97 \pm 2.66$ .

The mean gender (M:F) in Group K was 18:17 and in Group N was 23:12.

The mean body weight in Group K was  $32.40 \pm 5.22$  and in Group N was  $30.17 \pm 6.46$ .

The mean BMI in Group K was  $17.91 \pm 1.89$  and in Group N was  $15.82 \pm 2.59$ .

The mean duration of surgery in Group K was  $125.68 \pm 31.89$  and in Group N  $127.42 \pm 31.39$ .

The demographic data of the patients and duration of surgery were comparable in both the groups. The attempts at intubation, ET tube size and Cuff pressure distribution were comparable in both the groups.

The total dose of consumption of rescue analgesia was lower in Group K than in Group N ( $23.86 \pm 23.89$  V/s  $60 \pm 21.07$ ,  $p < 0.05$ ). In Group K, 45% of patients required first dose of analgesia at 720 min while 40% in Group N required at 360 min, ( $p < 0.05$ )(Fig 4).

Group K experienced lower post operative sore throat (Fig 1) and observational pain scores (Fig 3) than Group N ( $p < 0.05$ ). The percentage of post operative dysphagia (Fig 2) was lower in Group K than Group N.

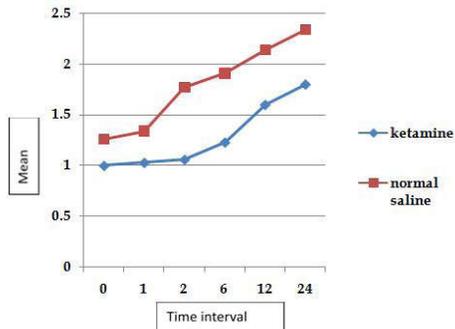


Fig. 1: Mean post op sore throat score was low in ketamine group compared to saline group.

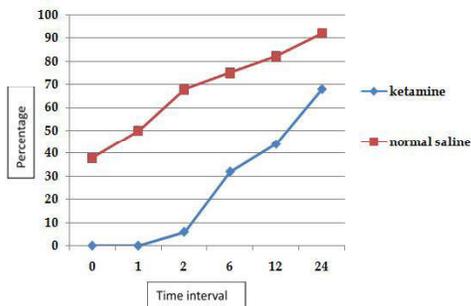


Fig. 2: Percentage of post op dysphagia was low in ketamine group compared to saline group.

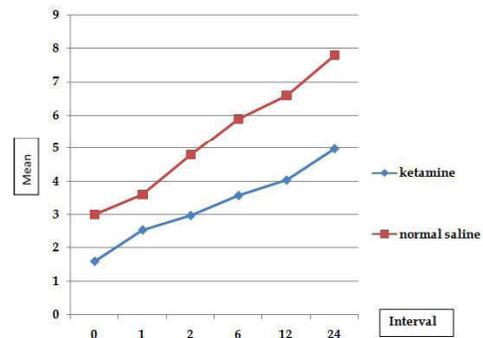


Fig. 3: Mean post op observational pain score was low in ketamine group compared to saline group.

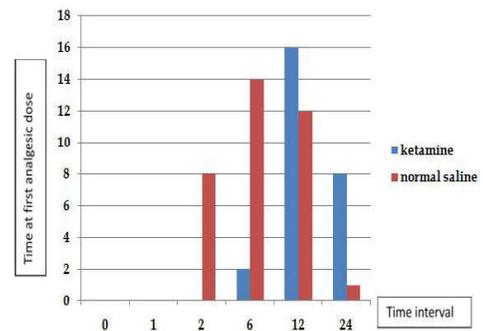


Fig. 4: 45% of patients in ketamine group required analgesia at 720 min while 40% in ns required at 360 min.

there were no significant changes in haemodynamic parameters in both the groups and no significant side effects were noted.

## Discussion

Our study shows that Ketamine soaked pharyngeal pack was efficacious in preventing post operative sore throat in paediatrics with no side effects.

Postoperative sore throat is common complaint in the post operative period.<sup>7,13,14</sup> Tracheal intubation is a foremost cause of trauma to the airway mucosa, resulting in postoperative sore throat (Post) with reported incidence of 21–65%.<sup>15</sup> It can lead to dissatisfaction and discomfort after surgery and can delay a patient's return to normal routine activities. Many factors can contribute to postoperative sore throat and the incidence has been found to vary with the method of airway management, female gender<sup>16</sup>oro-nasal surgeries, inappropriate sized endotracheal tube<sup>17</sup> and cuff pressures.<sup>18</sup>

The placement of a protective pharyngeal pack (throat pack) following tracheal intubation is common during ear, nose and throat (ENT) and oral surgery. It is commonly believed that pharyngeal packing not only helps in absorbing most of the blood from the surgical field and provides physical barrier to the leakage of blood into the aero digestive

passages. The trauma of placing a pharyngeal pack is associated with postoperative sore throat, injury to the pharyngeal plexus and swelling of the tongue.<sup>18,19</sup>

Myles et al reported that women were almost 1.5 times more likely to develop sore throat in post operative period. In our study, distribution among gender were comparable in both the groups.<sup>16</sup>

Ahmed et al in his study concluded that the method used for airway management has the strongest influence on the incidence of sore throat. Out of 312 patients interviewed, 81(26%) patients suffered with sore throat postoperatively. Of them 28% of patients with endotracheal intubation (ETT) and 3.5% of patients with laryngeal mask airway had a sore throat.<sup>20</sup> The method of airway management in our study was using endotracheal tube for intubations, which were comparable in both the groups.

Jaensson et al in his study stated that use of smaller sized ET tube alleviated sore throat.<sup>17</sup> In our study, ET tube size distribution among both the groups were comparable.

Karbasforushan A et al divided 140 patients into two groups, where one group was managed with pharyngeal pack and the other without pharyngeal pack. They concluded that pharyngeal pack increases severity of sore throat when leaving recovery room and discharging hospital.<sup>21</sup> Our study used pharyngeal pack as mode of drug delivery to the site of action.

Erhan ÖL et al preferred ketamine in post tonsillectomy for analgesia in sub anaesthetic doses as it has both central and peripheral action unlike local anaesthetics, and it lacks side effects of opioids being nausea, vomiting, respiratory depression, constipation and sedation.<sup>22</sup> In our study, we used ketamine at the dose of 1mg/kg. Systemic absorption of ketamine were not measured, yet the haemodynamics in ketamine group were comparable in Group K and Group N, suggesting potent topical ketamine effect.

Canbay et al, did study using topical 20mg ketamine and 20mg morphine over tonsillar fossae in children aged between 3 -15yr old post operatively in tonsillectomy patients and found topical administration have longer effective analgesia time.<sup>23</sup>

Mostafa et al in his study, compared 3 groups 6-16 yr old, 36 in each group. They were nebulized preoperatively with magnesium sulphate 40mg/kg (Group M), ketamine 1mg/kg (Group K) and dexamethasone 0.16mg (Group D). It was found that

nebulization Ketamine in the dose of 1mg/kg was effective in paediatric in preventing postoperative sore throat.<sup>6</sup>

The limitation of the current study was that excessive soft tissue handling during surgery and experience of the surgeon which would have contributed to postoperative soreness were not assessed in the study.

**Conflict of Interest:** Nil

## Conclusion

Pharyngeal pack soaked with Inj Ketamine of 1mg/kg was efficacious in preventing postoperative sore throat following oro-nasal surgeries in paediatrics. It also reduced the requirement of postoperative analgesia with minimal hemodynamic instability.

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# Bolus Ringer's Acetate Is Effective In Preventing Hypotension Following Lower Limb Tourniquet Release

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## Abstract

**Background:** Haemodynamic instability is a common entity following tourniquet release exacerbated by old age and comorbidities.

**Aim:** To evaluate efficacy of bolus Ringer's acetate in preventing hypotension following tourniquet release.

**Methods:** After ethical committee's approval, a comparative study was conducted in tertiary care hospital. Study was conducted on 80 consenting patients, control (n=40) and study (n=40) group between 20-80 years of age belonging to American Society of Anaesthesiologist (ASA) Grade I-II undergoing lower limb surgeries. Patients were divided into two equal groups, Group C patients did not receive bolus of Ringer's acetate and Group S were given additional bolus of 200 ml of Ringer's acetate prior to tourniquet release. Haemodynamic variables (heart rate (HR), Systolic, Diastolic and Mean arterial pressures, Electrocardiogram (ECG)) were monitored before and after release of tourniquet at frequent intervals. Hypotensive episodes (Fall in systolic blood pressure (SBP) >20% from baseline) and vasopressor requirement (If SBP <80mmHg then Inj. Ephedrine IV 5 mg) were noted.

**Results:** Statistical analysis was done using Chi-Square test and independent sample t test. Intergroup comparison of haemodynamic variables before and after release of tourniquet is comparable and is not statistically significant. Intragroup comparison of haemodynamic variables in Group C was lower when compared to Group S after release of tourniquet and this finding is statistically significant. The incidence of hypotension and vasopressor requirement was significantly higher in Group C compared to Group S (Pvalue<0.029).

**Conclusion:** Preloading with Ringer's acetate prior to tourniquet release in Group S may possibly be responsible for reduction in incidence of hypotension and vasopressor requirement.

**Keywords:** Ringer's acetate; Hypotension; Tourniquet.

## Introduction

Tourniquet is used in surgical settings to occlude arterial blood flow to produce a relatively bloodless operative field, to improve visualisation of anatomical structures and to minimize blood loss. Tourniquet release can lead to significant haemodynamic changes which are exaggerated in elderly and patients with poor cardiac reserve<sup>1</sup>.

Bolus of Ringer's acetate was used to reduce the haemodynamic changes after tourniquet release as it is a better buffering solution when compared to lactate. Accumulated lactate is released into the circulation following tourniquet release which further burdens the liver making Ringer's acetate fluid of choice for the study.<sup>2,3</sup>

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## Aims and Objectives

### Aim

To Evaluate efficacy of bolus Ringer's acetate in preventing hypotension, following lower limb tourniquet release.

### Objectives

1. To monitor, assess and compare changes in the following parameters before and after release of tourniquet in two groups (study and control) i.e, Heart Rate(HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Blood Pressure (MAP) and Electrocardiogram (ECG) .
2. To find out number of hypotensive episodes and vasopressor requirement in both the groups.

## Materials and Methods

After approval from institutional ethical committee a randomized comparative study was conducted on 80 patients between years 2018 to 2020. Patients belonging to ASA grade I & II, aged 20-80 years undergoing lower limb surgeries requiring tourniquet application under spinal anaesthesia with a minimum tourniquet application time of 60 mins were included in the study. Patients having contraindication to tourniquet use like peripheralvascular disease were excluded from the study.

## Methodology of Study

Pre anaesthesia check up was performed prior to surgery and appropriate investigations were advised. All patients were kept nil orally for a minimum period of 6 hours. The procedure of spinal anaesthesia was explained to the patients and written informed consent was obtained. The participants were randomly allocated to one of the two groups, Group C (control)and Group-S (study). Patients in both the groups were given the NBM deficit fluid & maintenance fluid. The Group-C (control) did not receive any bolus Ringer's acetate prior to tourniquet release. The Group-S (study) received 250 ml bolus of Ringer's acetate over a period of 10 mins prior to tourniquet release. Standard monitoring was done throughout the procedure but readings were recorded at following times for study: Baseline, Prior to tourniquet release and after tourniquet release at intervals of 1min, 5min and subsequently every 5 minutes up to 30 min. Hypotensive episode was defined

as fall in systolic blood pressure (SBP) >20% from baseline and the number was noted. Vasopressor requirement was defined as SBP <80mmHg then Inj. ephedrine IV 5mg was given & number of doses required were noted.

## Statistical Analysis

The inter-group statistical comparison of distribution of categorical variables is tested using Chi-Square test. The inter-group statistical comparison of means of continuous variables is done using independent sample t test

In the study, the p-values less than 0.05 are considered to be statistically significant. The entire data is statistically analysed using Statistical Package for Social Sciences (SPSS ver 21.0, IBM Corporation, USA) for MS Windows.

## Results

The mean  $\pm$  SD of age of the patients studied in Group C and Group S was  $39.72 \pm 10.35$  years and  $34.42 \pm 11.22$  years respectively. Gender distribution was comparable in both the groups. Inter group (between 2 groups) distribution of haemodynamic variables in Group C and Group S before and after release of tourniquet was not statistically significant. Intra group(within a group) distribution of haemodynamic variables in Group C and Group S immediately after tourniquet release(ART) and 5 minutes ART showed lower readings when compared to baseline and this finding was statistically significant. The incidence of hypotensive episodes and vasopressor requirement was higher in Group C with 8 in 40 patients compared to 1 in Group S with a P value(0.029). ECG showed transient changes in 3 patients. One patient in Group C had unifocal Ventricular Premature Complexes (VPCs) immediately after deflation of tourniquet, but was haemodynamically stable. VPCs subsided spontaneously without any pharmacological intervention. One patient developed bradycardia and hypotension after release of tourniquet which resolved after administration of inj. Glycopyrrolate 0.2 mg and inj. Ephedrine 5 mg. One patient in group S had T inversions after deflation of tourniquet associated with hypotension, patient was administered inj. Ephedrine 5 mg for hypotension. T inversions resolved after normalization of blood pressure.

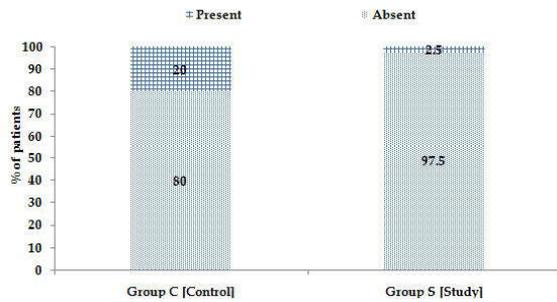
Table 1: Comparison of haemodynamic parameters in both the groups.

Groups	Group C[Control] (n=40)						Group S[Study] (n=40)						P-value								
	Heart rate			MAP			Heart rate			MAP			Heart rate	SBP	DBP	MAP					
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD									
0	Baseline	86.82	12.20	133.00	14.27	81.50	9.94	97.68	11.11	84.73	9.25	131.15	10.96	79.60	8.43	97.18	9.99	0.388 <sup>NS</sup>	0.518 <sup>NS</sup>	0.359 <sup>NS</sup>	0.833 <sup>NS</sup>
1	Prior to release of tourniquet	85.47	13.34	129.05	13.44	78.30	10.12	94.80	10.02	82.70	8.45	126.63	12.17	76.22	8.53	92.83	9.31	0.270 <sup>NS</sup>	0.400 <sup>NS</sup>	0.325 <sup>NS</sup>	0.364 <sup>NS</sup>
2	Immediately ART	82.68	12.39	117.63	14.37	70.95	9.64	85.48	10.47	80.62	9.10	117.55	12.17	71.65	8.34	87.48	9.64	0.402 <sup>NS</sup>	0.980 <sup>NS</sup>	0.729 <sup>NS</sup>	0.377 <sup>NS</sup>
3	5-min ART	79.97	14.10	112.55	13.44	68.55	10.14	82.12	10.53	80.10	8.88	115.80	13.40	70.05	10.08	86.00	11.09	0.962 <sup>NS</sup>	0.282 <sup>NS</sup>	0.509 <sup>NS</sup>	0.113 <sup>NS</sup>
4	10-min ART	80.30	12.29	113.10	15.86	69.68	10.79	82.00	12.21	78.02	10.40	114.93	12.77	69.75	9.65	85.30	10.20	0.374 <sup>NS</sup>	0.572 <sup>NS</sup>	0.974 <sup>NS</sup>	0.193 <sup>NS</sup>
5	15-min ART	80.73	13.32	113.25	17.92	70.33	10.68	83.28	12.74	77.52	10.59	114.80	13.45	69.43	9.44	84.68	10.26	0.238 <sup>NS</sup>	0.663 <sup>NS</sup>	0.691 <sup>NS</sup>	0.590 <sup>NS</sup>
6	20-min ART	79.97	13.78	112.65	16.51	70.00	10.89	82.32	12.34	76.05	10.26	115.80	14.56	70.08	9.47	85.30	10.69	0.153 <sup>NS</sup>	0.368 <sup>NS</sup>	0.974 <sup>NS</sup>	0.253 <sup>NS</sup>
7	25-min ART	80.23	13.53	113.37	15.59	71.02	10.29	83.58	11.92	75.40	9.19	116.53	14.30	70.58	9.69	85.82	12.05	0.066 <sup>NS</sup>	0.349 <sup>NS</sup>	0.841 <sup>NS</sup>	0.404 <sup>NS</sup>
8	30-min ART	80.38	12.87	113.82	14.38	71.78	10.04	83.45	11.23	76.13	9.41	117.90	13.84	72.37	10.33	87.05	12.43	0.096 <sup>NS</sup>	0.200 <sup>NS</sup>	0.793 <sup>NS</sup>	0.178 <sup>NS</sup>

Table 2: Intragroup comparison of haemodynamic parameters in both the groups.

P-value (Intra-group)	Group C						Group S					
	Heart rate	SBP	DBP	MAP	Heart rate	SBP	DBP	MAP	Heart rate	SBP	DBP	MAP
Baseline vs Immediately ART	0.011*	0.001***	0.001***	0.001***	0.002**	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
Baseline vs Immediately 5-min ART	0.001***	0.001***	0.001***	0.001***	0.007**	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***

Values are mean and SD, P-value (inter-Group) by independent sample t test. P-value<0.05 is considered to be statistically significant.  
\*P-value<0.05, \*\*P-value<0.01, \*\*\*P-value<0.001, NS-Statistically Non-significant.



**Graph 1:** Incidence of hypotensive episodes in two groups.

**Table 3:** Requirement of vasopressor in two groups.

Vasopressor requirement	Group C [Control] (n=40)		Group S [study] (n=40)		P-value
	n	%	n	%	
No	32	80.0	39	97.5	0.029*
Yes	8	20.0	1	2.5	
Total	40	100.0	40	100.0	

Values are n (% of cases), P-value by Chi-Square test (Fisher's exact probability test). P-value<0.05 is considered to be statistically significant. \*P-value<0.05.

## Discussion

Tourniquets are preferred by surgeons in peripheral limb surgeries because of their ability to limit blood flow to the limb and thereby improving the visibility of structures in the operative field and also preventing blood loss. Tourniquet use has been associated with complications varying from localized skin injuries to life threatening events such as pulmonary embolism and cardiac arrest. Most common immediate complication is hypotension/haemodynamic instability. The incidence of hypotension after the release of tourniquet depends on various factors such as old age and comorbidities of the patient. Different methods have been used to prevent this complication like use of intravenous fluids, vasopressors, and limb elevation.

Our study included 80 ASA I&II patients who were randomly allocated to two groups, Group C(control) and Group S(study)(n=40). All patients received deficit and maintenance fluid and Group S patients additionally received 200ml of Ringer's acetate 10 minutes before release of tourniquet. Blood pressure was monitored, and hypotensive episodes were watched for in both the groups. Significant hypotensive episodes (SBP<80mmHg) were treated with intravenous Ephedrine.

Gender distribution was comparable in both the groups while mean age was 34.42 +/- 11.22 in study group and 39.72 +/- 10.35 in control group.

Inter group comparison of haemodynamic

parameters were not significant as shown in table-1. A similar study done by Ali S. Ziaee et al did not find any significant relation between tourniquet duration, pressure, and age of the patient with the heart rate after deflation of the tourniquet.

Intra group comparison of haemodynamic parameters immediately and 5 minutes after tourniquet release were lower than baseline values and these findings were statistically significant as shown in table-2. Similar studies done by Ali S. Ziaee et al found that increase in tourniquet application time was associated with decrease in systolic blood pressure and Kyung Song et al found a significant decrease in MAP, CO and SV after deflation of tourniquet.

The fall in SBP, DBP and MAP can be attributed to vasodilatation and reactive hyperaemia of the tourniquet limb after the release of tourniquet. In few patients the fall in blood pressure is >20% of baseline requiring intravenous ephedrine.

Graph-1 and table-3 shows that Incidence of hypotension was more in Group C patients (8) who did not receive additional bolus of Ringer's acetate compared to Group S(1) patient. The decrease in incidence of hypotension in Group S can be attributed to preload of Ringer's acetate. Hypotension was associated with bradycardia in one patient similar to J. Jacobson et al findings where there was increased incidence of bradycardia in patients who developed hypotension. They concluded that the findings could be explained by central hypovolemia developing in conjunction with reactive hyperaemia in the leg following the release of tourniquet.

Adverse effects in our study were seen in 3 patients. Two in control group and one in study group. They were transient and did not require any major pharmacological intervention.

Many studies comparing acetate with normal saline/ Ringer's lactate with respect to changes in acid base homeostasis, electrolytes and haemodynamics in surgical and critical care setting have been done. There is clear evidence regarding beneficial effects of acetate-based crystalloids over lactate based crystalloids. Katsunori. et al showed benefits of using Ringer's acetate over Ringer's lactate as resuscitation fluid in patients with burns.

Strength of this study is Ringer's acetate was given as preloading specifically prior to tourniquet release and such studies are limited in number. To reduce haemodynamic consequences after tourniquet release, we have used Ringer's acetate to commonly used Ringer's lactate solution

considering its better profile. The limitations of this study were relatively small sample size and non-inclusion of high risk patients.

### Conclusion

Preloading with Ringer's acetate prior to tourniquet release is effective as it reduces incidence of hypotensive episodes and vasopressor requirement in Group S when compared to Group C.

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## Role of Acromioaxillo-suprasternal Notch Index (AASI) as a New Predictor of Difficult Visualization of Larynx in Comparison with Modified Mallampati Test

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### Abstract

**Background:** Pre-operative airway assessment should be able to predict potential difficult airway, allowing management plan to be developed ahead of time. Hence this study was aimed to compare Acromio-Axillo-Suprasternal Notch Index (AASI), a new simple bedside test with Modified Mallampati Test (MMP) in predicting difficult visualization of larynx.

**Materials and Methods:** After ethical committee clearance and informed written consent, 320 patients of ASA I and II posted for elective surgery under general anaesthesia were included in this study. AASI and MMP were noted during preanaesthetic airway assessment. After induction of anaesthesia, a blinded and experienced anaesthetist did laryngoscopy, intubated the patient and noted Cormack-Lehane (CL) grading of laryngeal view. The data observed was analysed using Receiver operating characteristic curve (ROC) analysis to compare AASI and MMP. A P value less than 0.05 was considered statistically significant.

**Results:** Incidence of Difficult Visualization of Larynx (DVL) in our study was 8.4%. AASI had better Sensitivity (88.89% v/s 22.22%), Specificity (98.63% v/s 95.22%), Positive predictive value (85.71% v/s 26.32%), Negative predictive value (98.97% v/s 93%) and Diagnostic accuracy (97.81% v/s 89.03%) in comparison with MMP respectively (P < 0.001) when cut off reference value of 0.56 AASI was taken.

**Conclusion:** AASI is a better predictor of difficult laryngoscopy with a higher sensitivity and positive predictive value in comparison with MMP. Hence AASI can be used as a simple bedside test to predict difficult airway during pre-anaesthetic airway assessment.

**Keywords:** Acromioaxillo-suprasternal notch index (AASI); Modified Mallampati test (MMP); Cormack-Lehane (CL) grade; Difficult visualization of larynx (DVL); Airway assessment.

### Introduction

Maintenance of a patent airway and successful intubation is the primary responsibility of an anaesthesiologist<sup>1</sup> and poses challenges to conduct a safe anaesthesia. Nearly 50-75% of cardiac arrests in patients undergoing general anaesthesia are because of difficult intubation that causes

inadequate oxygenation or ventilation, out of which 55-93% of them can cause death.<sup>2,3</sup> Hence one-third of anaesthesia related deaths have been related to inability to maintain a patent airway.<sup>4</sup>

Incidence of difficult laryngoscopy or intubation has been reported to be in the range of 0.1- 20.2%.<sup>5-</sup>  
<sup>12</sup> This wide variation is due to different patient

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demographic characters and tests used to assess airway. The purpose of the preoperative airway assessment should therefore be able to predict potential problems which might be encountered in the operating room, allowing a management plan to be developed ahead of time.<sup>12</sup>

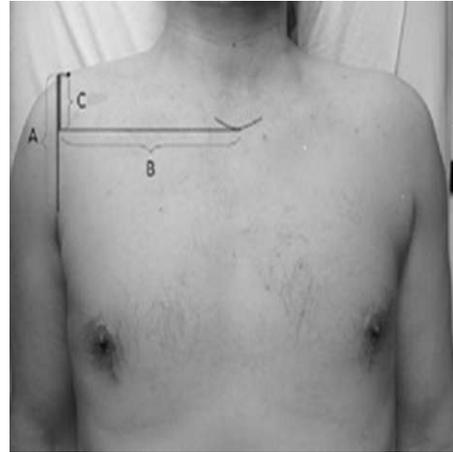
Several preoperative airway assessment tests such as Inter-Incisor Gap(IIG), Modified Mallampati Test(MMP), Head and Neck Movements(HNM), Horizontal Length of Mandible(HLM), Sternomental Distance(SMD), Thyromental Distance(TMD), Upper Lip Bite Test(ULBT) etc have been used to predict difficult intubations, but sensitivity and positive predictive value of these individual tests are low (33%-71%) with higher false positive results.<sup>12</sup>

Acromio-Axillo-Suprasternal Notch Index [AASI] a new and simple bedside test introduced by Md Kamranmanesh<sup>13</sup> is claimed to have higher sensitivity, specificity and predictive values than Modified Mallampati Test (MMP). Hence this study was designed to evaluate the validity of the new test AASI in prediction of difficult visualization of larynx in our population and compare it with routinely used MMP.

## Materials and Methods

After ethical committee clearance and informed written consent, 320 consecutive patients of ASA I and II aged between 18 to 55 years scheduled for elective surgery under general anaesthesia were included in this prospective double blind observational study in the hospitals attached to Bangalore Medical College and Research Institute. Patients not giving consent, history of burns/trauma involving head and neck, airway surgeries, tumor/mass in the neck or airway, restricted mobility at neck and mandible, edentulous, patients requiring awake or rapid sequence intubation, pregnant females, obese patients(BMI >35), ASA III and IV patients were excluded from this study.

During routine pre anaesthetic check up, AASI and MMP were assessed. AASI was calculated with the patients lying in a supine position and their upper extremities resting on the sides of the body, based on the following measurements. (1) Using a ruler, a vertical line is drawn from the top of the acromion process to the superior border of the axilla at the pectoralis major muscle(line A); (2) A second line is drawn perpendicular to line A from the suprasternal notch (line B); (3) The portion of line A that lies above the point where line B intersects it is line C<sup>13</sup>. AASI was calculated by dividing the length of line C by that of line A(AASI=C/A).



**Fig. 1:** Method for measuring the AASI. A represents the vertical distance between the superior aspect of the acromion process and superior border of axillary area, B the perpendicular line from suprasternal notch to line A, and C the portion of line A that lies above the cross-section between lines A and B. AASI is defined as C divided by A (AASI =  $\frac{C}{A}$ ). AASI =  $\frac{1}{4}$  acromioaxillo-suprasternal notch index.<sup>13</sup>

MMP score was assessed with the patients in sat up position with a fully protruded tongue without saying "ah" and graded as follows, class I= soft palate, fauces, uvula and tonsillar pillars were visible, class II= soft palate, fauces and uvula were visible, class III = soft palate and base of uvula were visible, and class IV = soft palate not visible<sup>11</sup>.

After shifting the patient to operation theatre on the day of surgery, an intravenous (IV) line was secured and Ringer lactate was kept on flow. Standard monitors like pulse oximeter (SpO<sub>2</sub>), Non-Invasive Blood Pressure (NIBP) and Electrocardiogram (ECG) were connected and baseline parameters were recorded.

All patients were premedicated with Glycopyrolate 0.2mg, midazolam 1 mg and fentanyl 2 mcg/kg iv. After pre-oxygenation with 100% oxygen for 3 min patients were induced with propofol 2 mg/kg and paralysed with vecuronium bromide 0.1 mg/kg iv.

After ventilating for 3 minutes with 1% sevoflurane in oxygen and with patient's head in the sniffing position, direct laryngoscopy was performed by a blinded and experienced anaesthesiologist with Macintosh blade size 3 and Cormack Lehane grade(CL grade) was noted as follows : Grade 1 - visualization of the entire glottis aperture, Grade 2 - visualization of only the posterior aspects of the glottic aperture, Grade 3 - visualization of the tip of the epiglottis, Grade 4 -visualization of no more than the soft palate<sup>14</sup>. CL grades 1 and 2 were considered as "Easy visualization of larynx"(EVL) and grade 3 and 4 as

“Difficult visualization of larynx”(DVL). If where the first intubation attempt was failed/difficult, intubation was reattempted with Macintosh blade size 4 with external laryngeal manipulation and they were excluded from the study.

After endotracheal intubation further anaesthetic management was continued as per institutional standard practice. Vital parameters were observed throughout the procedure at regular intervals.

Based on the sensitivity of 78.9% in the previous study done by Kamranmanesh et al<sup>13</sup>, keeping the power at 80% and alpha error of 5% a sample size of 320 was calculated using the suitable formula. Hence 320 patients were included in the study.

Statistical evaluation of data was done by SPSS software version.<sup>16</sup> Chi-square test or Fischer’s exact test was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. ANOVA (Analysis of Variance) was used as test of significance for quantitative data. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were calculated. Data observed was analyzed using Receiver operative characteristic (ROC) curves and Area under the Curve (AUC) was used to assess whether the score was clinically useful. A P value of <0.05 was considered statistically significant.

**Results**

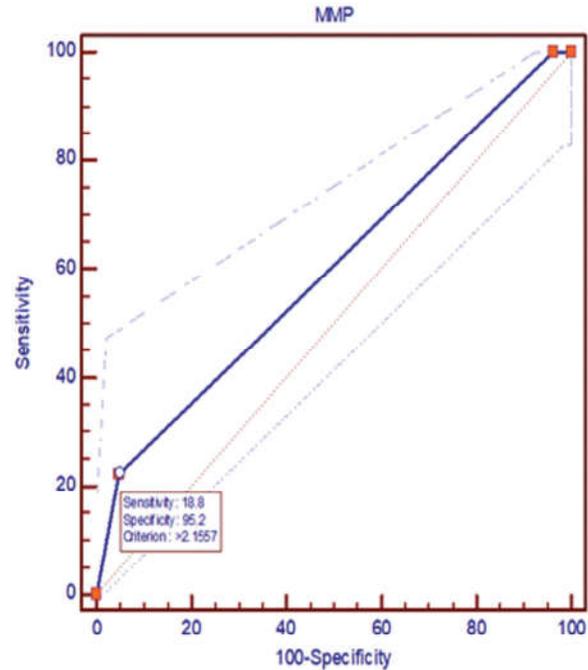
Our study involved 320 patients with equal gender distribution and none of the patients were excluded. There were 271 (84.69%) ASA I and 49(15.31%) ASA II patients.

Table 1 shows the demographic characteristics of the study population including gender, age, height, weight and BMI which didn’t bear any statistical significant impact on occurrence of Easy/Difficult Visualization of Larynx.

**Table 1:** Patients characteristics.

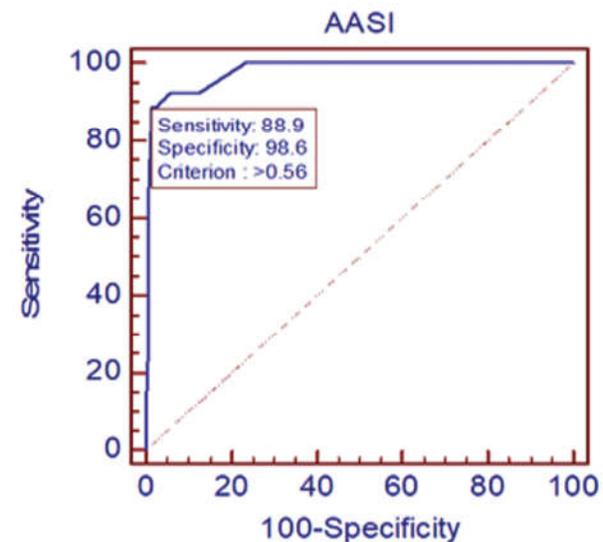
Variables	EVL	DVL	P value
Gender			
Male (160)	142	18	0.07
Female (160)	151	9	
Age (yrs)	36.74±9.89	38.48±11.79	0.39
Height (cm)	160.7±7.1	161.2±8.6	0.72
Weight (kg)	69.7±12.8	74.3±18.3	0.31
BMI (kgm <sup>-2</sup> )	25.71±2.73	26.37±3.20	0.23

The Area under the Curve of ROC curve was calculated for both AASI and MMP and found that AASI had higher AUC of 0.98 when compared to 0.60 of MMP.



**Fig. 2:** ROC Curve showing Validity of MMP in predicting difficult intubation (Based on CL grading).

The observed cumulative frequencies of AASI at different cut-off points are given in the table 2. In our study when ROC curve was applied, a cut-off point of ≥0.56 had the best trade-off between false and true positives.



**Fig. 3:** ROC Curve showing Validity of AASI in predicting difficult intubation (Based on CL grading).

**Table 2:** Criterion values and coordinates of the ROC curve.

Criterion	Sensitivity	95% CI	Specificity	95% CI	+PV	-PV
≥0.33	100.00	87.2 - 100.0	0.00	0.0 - 1.3	8.4	
>0.49	100.00	87.2 - 100.0	76.79	71.5 - 81.5	28.4	100.0
>0.5	92.59	75.7 - 99.1	87.37	83.0 - 91.0	40.3	99.2
>0.53	92.59	75.7 - 99.1	94.20	90.9 - 96.6	59.5	99.3
>0.54	88.89	70.8 - 97.6	97.61	95.1 - 99.0	77.4	99.0
>0.56	88.89	70.8 - 97.6	98.63	96.5 - 99.6	85.7	99.0
>0.57	66.67	46.0 - 83.5	99.32	97.6 - 99.9	90.0	97.0
>0.61	25.93	11.1 - 46.3	99.32	97.6 - 99.9	77.8	93.6
>0.62	22.22	8.6 - 42.3	99.66	98.1 - 100.0	85.7	93.3
>0.63	18.52	6.3 - 38.1	99.66	98.1 - 100.0	83.3	93.0
>0.66	14.81	4.2 - 33.7	100.00	98.7 - 100.0	100.0	92.7
>0.75	0.00	0.0 - 12.8	100.00	98.7 - 100.0		91.6

The distribution of AASI, MMP and CL grading among the study subjects is shown in the table 3. The incidence of DVL was 8.4% in our study population.

**Table 3:** The distribution of EVL and DVL for each parameter.

Variables	EVL(%)	DVL(%)
AASI	292(91.2)	28(8.8)
MMP Grade	300(93.8)	20(6.2)
CL Grade	293(91.6)	27(8.4%)

The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), diagnostic accuracy and area under the curve (AUC) of AASI and MMP of our study are shown in the table 4.

## Discussion

Failed mask ventilation or intubation being one of the main cause for morbidity or mortality in anaesthesia, management of unanticipated difficult airway is still a challenging task for the anaesthesiologist. Cochrane data base of systemic reviews on detection of difficult airways has concluded that bedside airway examination screening tests are expected to have high sensitivities and positive predictive values.<sup>15</sup> There

**Table 4:** Predictive values of the AASI and MMP score to predict the occurrence of DVL(CL grading III/IV).

Test	Sensitivity % (95% CI)	Specificity%	PPV	NPV	Accuracy	AUC
AASI (≥0.56)	88.89% (71.94-96.15)	98.63% (96.54-99.47)	85.71% (68.51-94.3)	98.97% (97.02-99.65)	97.81% (95.55-98.94)	0.98 (0.95-0.99)
MMP	22.22% (8.6-42.3)	95.22% (92.14-97.4)	30% (11.9-54.3)	93% (89.54-95.6)	89.06% (85.17-92.03)	0.60 (0.54-0.65)

**Table 5:** Shows the test characteristics of AASI and MMP done by different authors in comparison with our study.

Test	Author	Sensitivity(%)	Specificity(%)	PPV(%)	NPV(%)
AASI	Our study(≥0.56)	88.89	98.63	85.7	99
	Kamranmanesh et al <sup>13</sup> (>0.49)	78.9	89.4	33.3	98.4
	Safavi et al <sup>19</sup> (≥0.6)	66.67	98.44	56	99
	Rajkhowa et al <sup>18</sup> (≥0.5)	81.25	96.7	48.15	99.27
	Rupesh Sunkam et al <sup>23</sup> (≥0.49)	61.1	93.2	55	94.6
MMP	Our study	22.22	95.22	30	93
	Kamranmanesh et al <sup>13</sup>	52.4	85.7	21.6	96
	Safavi et al <sup>19</sup>	47.62	79.49	6.5	98
	Rajkhowa et al <sup>18</sup>	25	91.98	10.53	97.01
	Rupesh Sunkam et al <sup>23</sup>	77.8	62.1	21.9	95.4
	Ittichaikulthol et al <sup>24</sup>	41.7	95.5	23.1	98
	Ruchi Garg et al <sup>20</sup>	16.3	97	63.6	78
	Shoba Philip et al <sup>25</sup>	65	65.7	58.3	94.1

is no single test with adequate sensitivity and a low false positive rate.<sup>16</sup>

We came across a new index based on surface anatomy called Acromio-Axillo-Suprasternal Notch Index while searching for a simple bedside test for predicting difficult airway defined by Md Kamranmanesh et al<sup>13</sup> in 2014. According to authors difficult visualization of larynx (DVL) was observed in individuals whose neck was deeply situated in the chest with a sloping clavicle. The authors hypothesized that the portion of the arm chest junction above the level of suprasternal notch might be used as an indicator to predict DVL. Using the AASI index they evaluated predictive validity of this index with a cut off of 0.49 in comparison with routinely used MMP for assessing DVL.

Cephalometric studies suggest that there are definite differences of anatomy between Asian and western population that influences airway characteristics.<sup>17</sup> Not many studies have been done to assess AASI as a predictor of DVL in our population. Hence we designed this study to evaluate the predictive validity of AASI, to know the best cut-off of AASI which depicts DVL in our population by using ROC curve and calculating AUC and to compare the same with routinely used MMP as sensitivity of MMP was less in the previous studies done.<sup>18,19,20</sup>

Variability in the incidence of difficult visualization of larynx may be due to difference in anthropometric features, degree of muscle relaxation, intubation protocol, head position, type and size of blade and external laryngeal manipulation.<sup>21,22</sup> Our findings showed no statistical difference in age, sex, weight, height and BMI of the study population.

Considering a cut-off of  $\geq 0.56$  for AASI our study showed that AASI has a sensitivity of 88.89% v/s 22.22% , specificity of 98.63% v/s 95.22%, PPV of 85.7% v/s 30% and NPV of 99% v/s 93% when compared to MMP respectively with  $P < 0.01$  which was statistically very significant. In our study Area under the Curve of ROC curve was higher for AASI with 0.98 when compared to MMP with 0.6 which was also significant statistically. Diagnostic accuracy of AASI and MMP was 97.81% and 89.06% respectively.

T. Rajkhowa et al<sup>18</sup> and M. Safavi et al<sup>19</sup> in 2016-17 conducted similar studies comparing AASI and MMP in 440 patients and 728 patients respectively and concluded that AASI  $\geq 0.5$  and  $\geq 0.6$  as a good predictor of difficult airway respectively. Based on the best possible trade-off between the cumulative

rates of false and true positives (Table 2) our study also suggest a cut-off of  $\geq 0.56$  for AASI.

The incidence of DVL in our population was 8.4%. Our study revealed that sensitivity, specificity and predictive values of AASI were superior to those of MMP and it was significant statistically. In a meta-analysis done recently, sensitivity of MMP ranged from 0.12 to 1.00 and specificity ranged from 44% to 98% and overall accuracy ranged from poor to good.<sup>26</sup>

Cattano et al in a study of 1956 patients found that MMP test alone is insufficient for predicting difficult intubation.<sup>27</sup> Therefore a diagnostic test should be having low false negative rate with maximum sensitivity and a reasonable specificity. Hence AASI better suits as a preoperative predictive test for DVL when compared to MMP. However it should be kept in mind that no single test can reliably predict DVL, so we should use several combinations of tests wherever possible.

Limitations of our study was inter-observer variation while grading DVL and is influenced by technique used, head position, height of operating table etc. AASI has a limitation to apply in obstetric patients as the airway dimensions changes with the progression of pregnancy. Errors can occur while measuring AASI. AASI works well in presumed normal upper airway, neck mobility and normal upper trunk anatomy and not otherwise.

According to Cochrane data analysis, Upper Lip Bite Test (ULBT) has highest sensitivity of 67% as an individual predictor.<sup>15</sup> Hence further studies are suggested to compare AASI with ULBT and other tests.

In conclusion our study suggest that AASI can be used as a routine preoperative bedside test to predict DVL as it has higher sensitivity, specificity, accuracy and predictive values when compared to routinely used MMP test.

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## Comparative Assessment of Bupivacaine and Ropivacaine in Upper Limb Surgeries

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### Abstract

**Overview:** The advent of modern methodologies led to the development of better analgesic and operative techniques. The block technique has been effectively employed since a long time. The present study was formulated to ascertain if any specific drug among the selected ones have a better efficacy in upper limb surgeries.

**Methodology:** The present study employed a pool of 60 subjects who were randomly divided in two groups. The subjects were evaluated for operative and post operative parameters after administration of Ropivacaine and Bupivacaine respectively.

**Results:** The study showed a shorter time for induction and regression of both motor and sensory block in Ropivacaine subjects, while Bupivacaine had a longer duration of action.

**Conclusion:** Ropivacaine proved more efficacious as compared to Bupivacaine.

**Keywords:** Axillary block; Brachial plexus; Bupivacaine; Forearm; Ropivacaine.

### Introduction

The block technique at level of brachial plexus has been used effectively since its widespread acceptance almost a decade back. It has been shown to have an effective level of analgesia at the intra-operative and post-operative stages, providing a surgically efficient scenario for both the anesthetist as well as the surgeon.<sup>1</sup> The drug bupivacaine offers the advantage of a longer duration of nerve block as well as a more appreciative sensory to motor nerve block ratio as compared to older formulations.<sup>2</sup>

The primary mechanism through which bupivacaine acts is by eliciting its depolarizing

prevention action through bindings at the intracellular sections of the Sodium channels and thereby blocking sodium ions transport inside the cellular matrix. This leads to a disruption in nerve impulse conduction and causes the analgesia. The metabolism of bupivacaine occurs through the glucuronic acid cycle in the liver. Despite this some level of accumulative toxicity was noted in bupivacaine use especially in the cardiac and nervous system tissues.<sup>3,4</sup>

Similar to bupivacaine is a similar amide anesthetic formulation called as Ropivacaine. This is a long acting local anesthetic having a record of lower adverse events as compared to the older

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bupivacaine.<sup>5</sup> The advantage of ropivacaine also lies in its lower lipophilic nature, which leads to a decreased infiltration along the myelin coated motor fibres. This in turn will cause a reduction in the strength of motor block, while providing a equal or marginally superior sensory block. The postulated cause for this selective motor fibre exclusion is thought to be due to the stereoselective nature of ropivacaine to target specific pain transmitting fibres.<sup>6</sup>

There have been a few studies on the comparative activity of both ropivacaine and bupivacaine in obstetric as well as laparoscopic cases. The studies have reported that the number of adverse effects on the nervous systems and cardiac activity is lower with ropivacaine as compared to bupivacaine.<sup>7</sup>

## Methodology

The present study is a prospective randomized study conducted in the department of anesthesia at Pacific Institute of Medical sciences, Udaipur, Rajasthan over a period of 1 year from January to December 2020. The study included subjects who fulfilled the inclusion criteria and consented for participation. Institutional ethical clearance was obtained prior to commencement of the study.

### Inclusion Criteria

- Adult patient above 18 years and below 60 years.
- ASA grades as 1 or 2.
- Elective Surgery cases under brachial plexus block.
- No contraindications for use of anesthetics.

All patients were counselled regarding the study and its objectives. They were made to sign written informed consent forms as well as participant information sheets detailing that their identity and personal details will not be shared. The patients were also apprised of the option to opt out of the study at any stage without compromising their treatment. The total patient sample size was 60 subjects.

The patients were randomly divided into two groups using computerized randomization table.

- a. Group B (n=30): Patients proposed to undergo upper limb surgery under brachial plexus block using 30 ml of 0.5% bupivacaine.
- b. Group R (n=30): Patients proposed to undergo upper limb surgery under brachial plexus block using 30 ml of 0.5% ropivacaine.

All the patients were asked to remain nil orally

6-8 h prior to surgery.

On the day of surgery patients were admitted to the monitored preoperative holding area and were premedicated with 2 mg of Midazolam intravenously. The operative arm was positioned to expose the axilla. The axilla was prepared using aseptic technique and then axillary artery was identified by palpation.

The skin was anaesthetized with 1ml of 1% lidocaine solution. A 11/4 inch 22 G needle was inserted through the area of anesthetized skin into and through the axillary artery until it is noted that no blood could be aspirated through the needle. This negative aspiration indicated that needle was positioned beyond the posterior wall of the artery and in the brachial plexus sheath, 1ml of test solution was injected to rule out possible intravascular placement of the needle. All subjects were observed for possible intravascular placement of the needle for approx. 1 min following the injection of test solution and then the remaining 30ml of the solution was administered in 5 ml increments following aspiration. The needle was removed and firm digital pressure with gauze piece was held at the site for 5 min to assist in proximal spread of the anaesthetic solution.

Sensory and motor block were evaluated preoperatively to determine a baseline and every 5 min for 30 min or until onset of blockade was noted and thereafter every 60 min

Sensory block was assessed by the pinprick method (22G hypodermic needle). Assessment of sensory block was done in the dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve till complete sensory blockade was achieved. Sensory onset was considered when there was a dull sensation to pinprick along the distribution of any of the above-mentioned nerves. Complete sensory block was considered when there was complete loss of sensation to pinprick.<sup>8</sup>

Sensory block was graded as:

Grade 0: Sharp pin felt

Grade 1: Analgesia, dull sensation felt

Grade 2: Anaesthesia, no sensation felt.

A modified Bromage Scale for the upper extremity was used to assess motor function. This scale consists of the following four scores:<sup>9</sup>

- 0 - able to raise the extended arm to 90° for a full 2 sec
- 1 - able to flex the elbow and move the fingers but unable to raise the extended arm.

- 2 - unable to flex the elbow but able to move the fingers
- 3 - unable to move the arm, elbow or fingers

Onset of motor blockade was considered when there was Grade 1 motor blockade. Peak motor block was considered when there was Grade 3 motor blockade.

Block was considered to have failed when sensory anaesthesia was not achieved within 30 min. General anaesthesia was given subsequently to these patients who were then excluded from the study.

Haemodynamic parameters and vitals (Blood pressure, Heart rate, Respiratory rate and Oxygen saturation) were also monitored during the procedure.

Duration of analgesia was assessed by using a 10 point Visual Analogue Scale (VAS)

Duration of sensory block was determined by noting the time when there was return of dull sensation to pin prick and duration of motor blockade was determined by noting the time the patients could first move their fingers.

Side effects such as bradycardia, hypotension, headache and convulsions were looked for.

**Observations**

The present study was undertaken with an aim to compare the efficacy of Bupivacaine and Ropivacaine for brachial plexus block among patients undergoing upper limb surgery. The demographic details revealed a higher percentage of men in both the sample sub groups. The mean age of the participants was 38.69 ± 14.66 years. There were no discernible statistically significant differences in the weight and age of the participants

The operative assessment revealed that Group R had an earlier onset of sensory block as compared to the Group B. The Group R had a onset of sensory block at 5 mins while Group B had initiation of sensory block at 10 mins. At 10 mins, Group R had achieved a Grade 2 sensory block, while it was still at Grade 1 in Group B. This displayed a statistically significant difference between the two drugs. The regression of sensory block also showed a similar pattern. In the assessment at 7 and 8 hrs, the block had regressed to Grade 0 in Group R, while group B had a mixed block of Grade 1 and 2 in the same duration. Total removal of sensory block in Group B was noted at 9 hours post initiation. (Table 01)

**Table 1:** Average durations of Sensory Block.

	Time to Onset (mins)	Duration of Block	P value
<b>Group B</b>	13.56 ± 4.16	446 ± 62.6	<0.05
<b>Group R</b>	6.77 ± 1.86	410 ± 31.67	<0.05

In terms of motor block, it was seen that Group R had an onset of motor block at 5 min interval, while Group B had a initiation at 15 mins duration. Till 15 minutes, the mean grade of motor blockade was at 0 in Group B, while in group R mean motor block grade was at 3 in the same time frame. The regressions of motor block showed that Group R was faster in regression. At 6 hours, the mean level of motor block was grade 2 in group R, while group B showed a mean grade of 3. Complete regression was seen in Group R at 7 hrs, while in Group B it took 8 hrs.

**Table 2:** Average durations of Motor Block.

	Time to Onset (mins)	Duration of Block	P value
<b>Group B</b>	21.56 ± 6.23	410± 41.44	<0.05
<b>Group R</b>	5.67 ± 1.22	382± 29.33	<0.05

In terms of analgesia requirements for post operative care as well as corelations with visual analog scales obtained from patients, it was noted that there were no significant differences in pain levels among the two subgroups.

Similarly an non significant elevation in hemodynamic parameters was noted between the two subgroups.

None of the subjects exhibited any adverse reactions or side effects in the operative or post operative period.

**Discussion**

Inspite of different approaches available, the practice of using a axillary block is a commonly and standardized technique for various orthopaedic and surgical procedures of the upper limbs.<sup>10</sup> Studies have displayed the effectiveness of using regional anaesthesia as a modality that offers better outcome in the operative and post operative stage to both the patient and the surgeon. The added bonus of a reduced stress of general anaesthesia and its complications has been the reason for wide acceptability of this technique.<sup>11,12</sup>

Among the agents used for regional anaesthesia, bupivacaine has been widely recommended due to a longer duration of activity and good sensory as well as motor block. The major disadvantage though has been the incidence of its toxicity related

complications. These complications are more often seen when the dosage is higher as in the case of post-operative infusions for analgesia.<sup>2</sup>

In the present study we observed that the onset of sensory block was faster and earlier in subjects who were administered Ropivacaine as compared to Bupivacaine. This onset difference was statistically significant denoting that the quality of sensory block as well as onset was better when the newer drug is used. This is in agreement with studies by authors such as Bertini et al, Mc Glade et al, Klein et al and Kaur A et al.<sup>1,7,12-13</sup>

In the present study, the peak sensory block was achieved in both sub groups at 25 min duration but the onset was faster in the sub group subjected to ropivacaine. There have been reports of studies detailing a lower or equivalent efficiency of ropivacaine. Mageswaran and Choy et al reported a mean onset time for sensory block to be 13.5±2.9 min in ropivacaine group as compared to 11.1±2.6 min in levobupivacaine group using infraclavicular approach among a mixed sample population in elective as well as emergency orthopaedic surgery patients.<sup>14</sup>

The present study is in concurrence with findings on motor block as reported by Klein et al and Mc Glade et al. The authors reported that shorter duration of block in Ropivacaine administered cases as compared to Bupivacaine. This indicates that thought the mean duration of analgesia is longer in Bupivacaine, The time of onset is shorter in shorter in ropivacaine.<sup>7,12</sup>

In present study, no difference in VAS scores between two groups was observed at any post-operative time interval. Similarly, no significant difference between two groups was observed for mean duration of analgesic effect. This is in concurrence with studies by Thornton et al., and Mageswaran and Choy et al.<sup>14,15</sup>

Both the groups had good hemodynamic control throughout the study duration and did not show a significant difference at any time interval. No adverse effects of the two drugs on hemodynamic has been reported at the dosages used in present study and our results are also in accordance with the findings reported.

## Conclusion

We conclude that in accordance with various above mentioned studies, ropivacaine has proved a faster onset in both sensory and motor block in upper limb surgeries as compared with bupivacaine. This gives an advantage to ropivacaine in terms of

a superior quality of analgesia and can be a viable and safer alternative to bupivacaine.

The study is limited by a small sample size and would be better applied to a wider population base if a larger long term study is conducted.

**Conflict of Interest:** Nil

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## Dilated Cardiomyopathy: Effect of Trendelenberg Position on Intraoperative Hemodynamics: Case Reports

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### Abstract

Preoperative cardiomyopathy is a significant anaesthetic challenge. We present the anaesthetic management of two cases of dilated cardiomyopathy both with global LV hypokinesia and EF <35% Intervention. A low trendelenberg position (10°) was used in both cases which might have helped in maintaining preload and hence hemodynamic stability. Minimum fluid was administered in the intraoperative phase in both cases.

**Conclusion:** Maintaining a low trendelenberg position during anaesthesia with careful monitoring may be beneficial for hemodynamic stability in dilated cardiomyopathy patients.

**Keywords:** Dilated Cardiomyopathy; Anesthetic management; Trendelenberg position.

### Introduction

Cardiomyopathies are structural and functional disorders of the cardiac muscle. Preoperative cardiomyopathy presents a significant challenge to the anaesthetist. We present the anaesthetic management of two patients diagnosed with preoperative dilated cardiomyopathy posted for elective surgeries at our institution.

### Case Report 1

46 years old male patient who was a known diabetic, hypertensive, NAFLD and also a diagnosed case of idiopathic dilated cardiomyopathy since 1 year was posted for bilateral Radiofrequency Ablation surgery for chronic venous insufficiency of the lower limbs. He was on olmesartan, hydrochlorothiazide with oral hypoglycemics with

a reasonably fair effort tolerance (NYHA class 2) and compensated chronic heart failure with ECHO showing global LV hypokinesia with moderate LV systolic failure of EF=33%. ECG showed normal sinus rhythm and other blood routine investigations in normal limits. The proposed surgery was of 2-3 hr duration and the patient was taken up for surgery under informed high risk of perioperative decompensation and arrhythmias. Olmesartan was held on the day of surgery. Apart from the standard monitors, an invasive blood pressure monitor was attached prior to anaesthesia. A subarachnoid block with total of 10mg of 0.5% heavy bupivacaine with 20µg of fentanyl was administered in lateral decubitus position and patient was kept in 10° of trendelenberg position thereafter. A T10-T11 final block level was achieved. Intraoperative fluid administration was kept at

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a minimal 500ml Ringers lactate only. Procedure lasted 2.5 hrs during which the patient had stable vital parameters with an uneventful postoperative period.

### Case Report 2

A 41 year old obese female patient (wt=77kg) with a known history of systemic hypertension, dyslipidemia, hypothyroidism and an idiopathic dilated cardiomyopathy with an EF=34% was planned for a total abdominal hysterectomy along with amicrodochectomy left breast. The patient had a poor effort tolerance with METS < 4, NYHA class 3 symptoms and was on Thyroxin, Digoxin Spirinolactone, Telmisartan, Metoprolol, Frusemide, and Atorvastatin. Preoperative evaluation revealed a HR = 96/min with frequent ventricular ectopics but with no pulmonary oedema. Her blood reports revealed a TSH of 6.3 but with normal free T3/T4 levels, Hb of 10.4, normal electrolytes and renal functions. Patient was informed about the high risk of cardiovascular events and was taken up for surgery under GA with lumbar epidural block. As in the prior case an IBP monitor was placed along with standard ASA monitors prior to induction of anaesthesia. Preoperative lumbar epidural catheter was placed at L2-3 level with omission of a test dose in sitting position. GA was then induced with i/v Etomidate 20mg, Vecuronium 7mg following a premedication of Midazolam 1.5 mg, Glycopyrolate 0.2mg, Fentanyl 150µg, i/v lignocaine 100mg. Laryngoscopy and intubation were uneventful with no significant changes (>20%) in HR and BP. Anaesthesia was maintained with isoflurane in N20/O2 mixture along with propofol infusion and i/v Morphine 4.5mg and intermittent vecuronium boluses. Patient was kept in 10° trendelenberg position and epidural boluses of 8ml and 6ml of 0.125% Bupivacaine was administered at the start and 2 hrs intraoperative period. Only 1000ml of RL was administered during the whole 4 hr procedure with adequately maintained intraoperative vitals and urine output. Recurrent Ventricular ectopics continued throughout the surgery and postoperative phase. Post operatively anaesthesia was reversed after neuromuscular block reversal using Neostigmine 3.5 mg with glycopyrolate 0.7mg and patient was extubated uneventfully in awake state. Postoperatively epidural analgesia was maintained with 0.125% bupivacaine infusion at 5ml/hr with intermittent morphine epidural boluses. Apart from a brief period of postoperative ileus, cardiovascular status was uncomplicated.

### Discussion

Cardiomyopathies are now classified into many more subtypes apart from the conventional distinction into 3 types of dilated, hypertrophic and restrictive based on gross pathology.<sup>1</sup> Yet the prevalence statistics show hypertrophic cardiomyopathy (HCM) and dilated cardiomyopathy (DCM) to be the more common ones (about 1 in 500 people) and more likely to be encountered in anaesthetic practice.<sup>2</sup> DCM is characterized primarily by a systolic dysfunction with no to minimal symptoms in the early stages followed by systolic failure symptoms of fatigue and dyspnoea further complicated with peripheral oedema, ascites, nocturnal dyspnea and arrhythmias in later stages. Embolic phenomena and sudden death may also occur in later stages.<sup>3</sup> Symptomatically our first patient was probably in early stage of the disease (stage B heart failure) while the second patient was significantly advanced pathophysiologically (stage C heart failure) with c/o intermittent pedal oedema and PND and effort intolerance.

Perioperative period is a particularly risky scenario for these patients with high risk of cardiogenic shock, acute pulmonary oedema, significant arrhythmias, sudden cardiac death and DVT. The anaesthetic goals in such patients relate to the pathophysiological changes in these patients.<sup>3</sup>

1. Avoid hypovolemia and decreased preload – These patients have dilated cardiac chambers with reduced ionotopy, and are very much dependent on the preload to produce the stretch of cardiac muscle to produce the ejection.
2. Avoid any increase in afterload – The failing heart has decreased ability to pump against increased systemic afterload.
3. Avoid drugs causing direct myocardial depression.
4. Avoid tachycardia and increased cardiac muscle O<sub>2</sub> demand.
5. Avoid volume overload – very prone for heart failure.
6. Avoid sudden hypotension by careful titration of anaesthetic agents.<sup>3</sup>

For our first patient we chose spinal anaesthesia with a low dose heavy bupivacaine to avoid hypotension associated with higher block levels. Fentanyl as an adjuvant provides better quality and prolongation of the spinal block when added with heavy bupivacaine.<sup>4</sup> Olmesartan was omitted on the day of surgery as ARB and ACEI drugs can

precipitate spinal hypotension as has been reported even in recent meta-analytic studies.<sup>5</sup> Preloading and co-loading with i/v crystalloids is generally used to counter spinal hypotension. In our case in view of deranged heart function, we used an auto loading technique by giving a 10° trendelenberg position during the block administration, which caused autotransfusion of pooled blood towards the heart maintaining its preload. As expected we did not encounter any hypotension after the block administration needing vasopressor administration. In view of the low drug dose used, fear of higher migration of drug with higher level of block also did not come to pass. Only 500ml of crystalloid was used during the procedure showing the benefit of auto transfusion.

Our second case was much more challenging as the patient was symptomatically in advanced stage of the disease complicated with presence of obesity, subclinical hypothyroidism, systemic hypertension, and planned for a more prolonged surgery. Invasive BP monitor was attached prior to the anaesthesia induction in anticipation of cardiovascular events, though central venous line was omitted as the significant blood loss, and fluid shifts were not expected. An epidural catheter was placed preoperatively but a test dose was omitted as both lignocaine 2% and adrenaline used in standard test dose could have been risky in view of the cardiac condition. Fentanyl at 2µg/kg and i/v lignocaine 1.5 mg/kg was administered in the premedication to blunt the intubation stress. Cardio-stable drugs like Etomidate and Vecuronium were used for anaesthesia induction. All inhalational drugs are cardiac depressants when used alone hence a combination of low concentration of isoflurane along with propofol infusion was used for maintenance anaesthesia. Again in this case, presence of a 10° trendelenberg position helped us to maintain adequate preload throughout the procedure even during epidural administration with no need for vasopressor use. It also might have helped us to minimize external fluid administration in spite of a 300-400 ml blood loss. Total fluid administered was kept at 1000ml with no intra or

postoperative fluid overload.

Past studies have shown that trendelenberg positioning after spinal anaesthesia prevents decrease in cardiac output.<sup>6</sup> Our findings were consistent with those results and may be investigated further as a clinical hypothesis especially in cardiac compromised patients where fluid loading might be risky.

## Conclusion

Perioperative dilated cardiomyopathy can present to the anaesthetist for routine surgeries with a similar incidence as seen in the general population and a good understanding of the pathophysiology can prevent potential anticipated complications. Low trendelenberg position along with dose limitation may be good technique to maintain preload in these patients especially during neuraxial block without causing undue high sympathetic blockade.

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## Rebound Intracranial hypertension: A Complication of Epidural Blood Patch as Treatment for Intracranial Hypotension

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### Abstract

Rebound intracranial hypertension is a known complication of epidural blood patch. An elderly male presented with nausea, vomiting and poor GCS. The MRI brain showed subdural haematoma with sagging of brain matter suggestive of intracranial hypotension secondary to CSF leak resulting from multiple recent sessions of intrathecal chemotherapy. The patient underwent a lumbar epidural blood patch followed by burr hole procedure under general anaesthesia. The patient had a brief period of complete improvement and subsequently reintubated as his GCS deteriorated. The MRI brain shows mild dilatation of ventricles. The diagnostic lumbar puncture showed a high opening pressure confirming the diagnosis of Intracranial Hypertension. The patient completely resolved symptomatically with oral acetazolamide.

**Conclusion:** Anaesthesiologists must be aware about this condition and efforts at adequate monitoring to detect Intra Cranial Hypertension after an Epidural Blood Patch.

**Keywords:** Epidural blood patch; Rebound intracranial hypertension; Intracranial hypotension.

### Introduction

Epidural blood patch (EBP) is the treatment of choice in cases of post dural puncture headache (PDPH).<sup>1</sup>

Rebound intracranial hypertension (RIH) is a complication of epidural blood patch (EBP) for treatment of intracranial hypotension. It is characterized by headache, vomiting and blurring of vision.<sup>2</sup>

The symptoms of intracranial hypotension due to persistent CSF leak & Rebound intracranial hypertension secondary to the epidural blood patch bear some similarity. It is therefore vital that

these two diametrically opposite clinical conditions with different management strategies are identified early.

We report a case where epidural blood patch administered for treating Refractory Intracranial hypotension with Sub Dural Hematoma caused Rebound Intracranial Hypertension.

### Case History

A 64-year-old male patient was admitted with slurring of speech, drowsiness, upper motor weakness and Glasgow Coma Scale.8

He was a case of Non-Hodgkin's lymphoma

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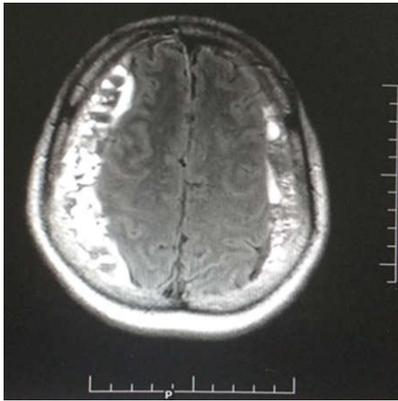
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and showed excellent remission after receiving six sessions of intrathecal chemotherapy with the last dose given four months prior to the admission. A month before presenting complaint, he had orthostatic hypotension. Intracranial hypotension was suspected due to post dural puncture. The MRI brain shows bilateral smooth dural enhancement, engorged venous sinuses, subdural collection and mild sagging of brainstem was suggestive of intracranial hypotension. He responded well to conservative management.

Following admission to our hospital, the repeat MRI brain showed bilateral subdural haematoma (SDH) with sagging of brain matter. (Figure 1) In view of the borderline GCS the plan was to perform epidural blood patch first followed by the burr hole procedure under general anaesthesia.



**Fig. 1:** MRI scan showing massive bilateral subdural hematoma.

Epidural blood patch done in prone position, at L3- L4 spine level, under C arm guidance with 20 ml autologous blood and omnipaq dye 5 ml mixture use to confirm the spread of EBP under C arm. (Figure 2)



**Fig. 2:** Epidural blood patch under C ARM.

After epidural blood patch the Neurosurgeon conducted the Burr hole procedure to drain bilateral SDH. Patient improved neurologically

and was extubated after 36 hours of the procedure. However, on day 3, the patient's GCS deteriorated to 7/15 necessitating reintubation.

MRI Brain with contrast showed resolution of the bilateral subdural hematoma, some expansion of the ventricular system and no meningeal enhancement.

The Neurologist suspected intracranial hypertension secondary to epidural blood patch and suggested a diagnostic lumbar puncture.

On day 4, lumbar puncture was done at L3-4 interspace with 22 g spinal needle in lateral decubitus. The opening pressure was 25 cm of water. A diagnosis of Rebound Intracranial Hypertension was made.

He was started on medical management with Acetazolamide at a dose of 250 mg b.d. Patient improved neurologically and was extubated the next day. He was discharged with complete neurological recovery on 22<sup>nd</sup> day.

## Discussion

Rebound intracranial hypertension is a clinical entity characterized by an increase in the absolute or relative ICP leading to severe headache, nausea and vomiting. It can occur secondary to EBP administered for Intracranial hypotension. Our case report intends to sensitize anaesthesiologists to the possibility of RIH following a blood patch. Multiple factors may be responsible including persistence of the compensatory changes to Intracranial hypotension or anatomical abnormalities like transverse sinus stenosis.<sup>3</sup> Misdiagnosing RIH as an Intracranial Hypotension may lead to potentially dangerous interventions such as a second blood patch and worsening of the RIH.

In the present case, the patient had multiple lumbar punctures as part of Intrathecal Chemotherapy for his Lymphoma. He presented with neurological deterioration with a SDH. Takahashi et al have recommended the Epidural blood patch as first line of treatment in stable patients with Spontaneous intracranial hypotension (SIH) presenting with SDH.<sup>4</sup> In his series of SIH with SDH, 45% and 35% of patients had CSF leaks in the lumbar area and thoracic region respectively. Correcting the low intracranial pressure with the EBP often leads to spontaneous resolution of the SDH.<sup>5</sup> In patients with poor GCS, Takhashi has suggested Burr hole evacuation following an EBP. We decided upon a similar course for our patient.

CSF myelography is the gold standard to identify

CSF leak.<sup>5</sup> It was not carried out in this patient in view of bilateral SDH. C-ARM guided EBP with radiopaque dye confirmed epidural space and extent of spread of the injectate as recommended by White et al.<sup>1</sup>

As the patient deteriorated neurologically after a temporary improvement, rebound intracranial hypertension due to epidural blood patch was suspected. RIH was then confirmed by the opening pressure of the CSF by lumbar puncture of 25 cm of water mandating medical therapy.

Kranz et al, in their series of RIH, however have warned that the absolute opening pressure may be less important in this situation and the relative rise in pressure compared to the low baseline pressure may play a significant role.<sup>2,3</sup>

The type of headache may help to differentiate RIH and Refractory Intracranial hypotension. The frontal and peri-orbital headache in RIH have characteristics similar to those seen in raised ICP and is worse in supine with associated vomiting with a morning prevalence.

In intracranial hypotension, the evening headache is occipital in distribution and worse in upright position.<sup>2,3</sup>

The volume of blood for the EBP correlated poorly with the likelihood of developing RIH. Kranz et al, in their series of 9 patients had used between 5ml to 40 ml of blood in his patients who subsequently developed RIH.<sup>2</sup> It is important to note that RIH should be kept as a part of the differential diagnosis as the time frame in the series varied between 2 hours to days and with one case presenting after one year.

Treatment for RIH is decreasing CSF pressure by CSF drainage with carbonic anhydrase inhibitor acetazolamide 250 mg BD and IV glycerol may be added.<sup>6</sup>

## Conclusion

Rebound intracranial hypertension is a lesser known complication of epidural blood patch. Any post epidural blood patch complaints of front orbital headache, vomiting, blurring of vision should elicit a strong suspicion of this condition. Anaesthesiologists must be aware about this condition and efforts at adequate monitoring to detect and report this entity after an EBP. The possible occurrence of this condition must be discussed with the patient and family. As in our case, a good outcome is assured by timely diagnosis and medical management.

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- Double spacing
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- Uniformly American English
- Abbreviations spelt out in full for the first time. Numerals from 1 to 10 spelt out
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- No repetition of data in tables and graphs and in text.
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