

# Comparative Analysis to Determine Efficacy of Dexmedetomidine and Ketamine as Adjuvant to Epidural Ropivacaine in Lower Abdominal Surgery at a Tertiary Care Centre

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## ABSTRACT

**Background:** The use of epidural analgesia for the management of post-operative pain has evolved to achieve the goal of adequate analgesia with improved outcome. Hence, the present study was conducted to compare the efficacy of dexmedetomidine and ketamine as adjuvant to epidural ropivacaine in lower abdominal Surgery.

**Materials and Methods:** A study was carried to compare the efficacy of dexmedetomidine and ketamine as adjuvant to epidural ropivacaine in lower abdominal Surgery. During preanesthetic check-up, patients were evaluated for any systemic diseases and their laboratory investigations were checked. In Group A (ropivacaine-dexmedetomidine): 15 ml of 0.75% ropivacaine+0.5µg/kg of dexmedetomidine (diluted to 1ml) was given to the patients. In group B (ropivacaine-ketamine): 15 ml of 0.75% ropivacaine +0.5mg/kg ketamine (diluted to 1ml) was given to the patients. The sensory and motor blockade were assessed. HR, SBP, DBP, MAP and SpO<sub>2</sub> were recorded. Statistical Package for Social Sciences was used to compare the variables between two groups. P< 0.001 was considered as highly significant.

**Results:** In the present study total participants were 120 which were divided into 2 group i.e. Group A (ropivacaine-dexmedetomidine) and group B (ropivacaine-ketamine). In group A males were 37 and females were 23. In group B males were 41 and females were 19. In group A an earlier onset (7.89±3.34min) of sensory block at T10 occurs in comparison to group B (10.72±1.66min). Time to max level of sensory block occur in group A in 12.54±3.56 mins and in group B in 18.43±3.12 mins. Time for onset of motor block occur in group A in 18.34±3.22 mins and in group B in 26.53±4.21. Mean

time to two segment regression was earlier in group B (124.54±8.54mins) compared to group A (134.23±11.34mins). Mean time to regression to Bromage 1 was earlier in group B (223.56±27.75mins) compared to group A (260.31±24.57mins). Mean time to sensory regression at S 1. was earlier in group B (289.76±34.29mins) compared to group A (321.39±38.24mins). Time to rescue analgesic was earlier in group B (312.24±32.45mins) compared to group A (312.24±32.45mins).

**Conclusion:** This study concluded that Dexmedetomidine is a better adjuvant to ketamine when used with epidural ropivacaine as it provides early onset of sensory and motor block and prolonged postoperative analgesia.

**Keywords:** Dexmedetomidine, Ketamine, Epidural Ropivacaine, Postoperative Analgesia.

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## INTRODUCTION

Epidural anesthesia is a versatile technique used both for providing anesthesia and postoperative analgesia. It contributes to intra operative hemodynamic stability and has shown to reduce perioperative stress response thereby causing a decrease in complications and improving patient outcome. It helps in early mobilization by relieving postoperative pain, which decreases the incidence of thromboembolic events.<sup>1-5</sup>

Ropivacaine produces lesser motor blockade compared to bupivacaine thus making it suitable for postoperative pain management.<sup>6</sup> Various additives have been used for extending the duration of epidural block to prolong the effect of ropivacaine which helps in reducing total required dose of ropivacaine. These include drugs like opioids, midazolam, neostigmine and α<sub>2</sub> adrenergic agonists like clonidine and dexmedetomidine which

have their own side effects.<sup>7</sup> One of the major advantages of epidural analgesia is that it facilitates early postoperative mobilisation and rehabilitation with minimally associated pain and discomfort. This will help patient in terms of shorter hospital stay and decreased expenditure. This is highly important in terms of physical, psychological and economic factors.<sup>8,9</sup>

Dexmedetomidine is an  $\alpha_2$ -agonist having an eightfold greater affinity for  $\alpha_2$ -adrenergic receptors than clonidine and much less  $\alpha_1$  effects. A major advantage of dexmedetomidine is its higher selectivity compared with clonidine for  $\alpha_{2A}$  receptors which is responsible for the hypnotic and analgesic effects.<sup>10,11</sup> Dexmedetomidine possesses anxiolytic, sedative, sympatholytic, and analgesic properties without respiratory depressant effect.<sup>12</sup> Epidural ketamine produces analgesia at spinal cord level without systemic side effects.<sup>13</sup> The present study was conducted to compare the efficacy of dexmedetomidine and ketamine as adjuvant to epidural ropivacaine in lower abdominal Surgery.

## MATERIALS AND METHODS

Present study was carried to compare the efficacy of dexmedetomidine and ketamine as adjuvant to epidural ropivacaine in lower abdominal Surgery at Department of Anesthesia & Critical Care, World College of Medical Sciences Research and Hospital, Jhajjar, Haryana, India. Before the commencement of the study ethical approval was taken from the Ethical Committee of the institute and written informed consent was obtained from the patients.

120 patients belonging to physical status ASA class I and II, aged 20-60 years, scheduled for lower abdominal surgical procedures were included in this study. Patient's refusal for regional anesthesia, pregnancy, coagulopathy, uncontrolled hypertension, diabetes mellitus, local infection and allergy to local anesthetics were excluded from the study. During preanesthetic check-up, patients were evaluated for any systemic diseases and their laboratory investigations were checked. The patients were premedicated with tablet alprazolam 0.5 mg and tablet ranitidine 150 mg orally at bed time on the night before surgery. The study population was randomly divided into 2 groups with 60 patients in each group.

In Group A (ropivacaine-dexmedetomidine): 15 ml of 0.75% ropivacaine+0.5 $\mu$ g/kg of dexmedetomidine (diluted to 1ml) was given to the patients. In group B (ropivacaine-ketamine): 15 ml of 0.75% ropivacaine +0.5mg/kg ketamine (diluted to 1ml) was given to the patients. A peripheral I.V line was secured with an 18 G (gauge) cannula. The patients were preloaded with 10ml/kg of Ringer's Lactate 30 minutes prior to the epidural procedure. Baseline heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) and

SpO<sub>2</sub> was recorded. With the patients in sitting position, under all available aseptic precautions, the epidural space was identified. An epidural catheter was threaded and fixed at 4cm in the epidural space. A test dose of 3ml of 2% lignocaine with 1:200000 adrenaline was injected through the epidural catheter after aspiration. After ruling out the intrathecal and intravascular placement of the tip of the catheter, the study drug (16ml) was injected and the patient was then turned to supine position. The sensory blockade was assessed by pinprick method using a short bevel 22G needle in a 3-point scale at every minute till onset of block at T10. 0-normal sensation, 1- loss of sensation to pin prick, 2-loss of sensation of touch.<sup>14</sup> Motor blockade was assessed using Bromage scale at 5 min interval till Bromage grade 3 block was achieved. Bromage scale for motor blockade: 0- No block, 1-inability to raise extended leg, 2-inability to flex knee, 3-inability to flex ankle and foot.<sup>15</sup> HR, SBP, DBP, MAP and SpO<sub>2</sub> was recorded every 5 minutes till the end of first hour and then every 15 minutes till the end of surgery. After the surgery, patients were referred to the post anesthesia care unit. The parameters like heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), SpO<sub>2</sub> and VAS were recorded at every 15 minutes.

At the end of the study, all the data was compiled systematically and analysed using unpaired student's t-test, chi-square test. All the values were expressed as mean  $\pm$  standard deviation. Statistical Package for Social Sciences was used to compare the variables between two groups. P< 0.001 was considered as highly significant.

## RESULTS

In the present study total participants were 120 which were divided into 2 group i.e. Group A (ropivacaine-dexmedetomidine) and group B (ropivacaine-ketamine). In group A males were 37 and females were 23. In group B males were 41 and females were 19. In group A an earlier onset (7.89 $\pm$ 3.34min) of sensory block at T10 occurs in comparison to group B (10.72 $\pm$ 1.66min). Time to max level of sensory block occur in group A in 12.54 $\pm$ 3.56 mins and in group B in 18.43 $\pm$ 3.12 mins. Time for onset of motor block occur in group A in 18.34 $\pm$ 3.22 mins and in group B in 26.53 $\pm$ 4.21. Mean Time to two segment regression was earlier in group B (124.54 $\pm$ 8.54mins) compared to group A (134.23 $\pm$ 11.34mins). Mean time to regression to Bromage 1 was earlier in group B (223.56 $\pm$ 27.75mins) compared to group A (260.31 $\pm$ 24.57mins). Mean time to sensory regression at S 1. was earlier in group B (289.76 $\pm$ 34.29mins) compared to group A (321.39 $\pm$ 38.24mins). Time to rescue analgesic was earlier in group B (312.24 $\pm$ 32.45mins) compared to group A (312.24 $\pm$ 32.45mins).

**Table 1: Demographic profile of patients of both groups.**

Variables	Group A (n=60)	Group B(n=60)
<b>Gender</b>		
<b>Male</b>	37	41
<b>Female</b>	23	19
<b>Mean age(years)</b>	48.7 $\pm$ 10.2	55.4 $\pm$ 11.3

**Table 2: Comparison of preoperative block characteristics.**

Block characteristics	Group A (n=60)	Group B(n=60)	p-value
Onset time of sensory block at T 10(min)	7.89±3.34	10.72±1.66	< 0.001
Max sensory block level	T7-T8	T7-T8	
Time to max level of sensory block(min)	12.54±3.56	18.43±3.12	
Time for onset of motor block(min)	18.34±3.22	26.53±4.21	

**Table 3: Comparisons of post op block characteristics.**

Block characteristics	Group A (n=60)	Group B(n=60)	p-value
Mean time to two segment regression (min)	134.23±11.34	124.54±8.54	< 0.001
Mean time to regression to Bromage 1(min)	260.31±24.57	223.56±27.75	
Mean time to sensory regression at S 1(min)	321.39±38.24	289.76±34.29	
Time to first rescue top up(min)	363.36±34.67	312.24±32.45	

## DISCUSSION

Pain is perhaps the most feared symptom of disease, which a human being is always trying to alleviate and conquer since ages.<sup>16</sup> Epidural anesthesia is considered as a gold standard technique as it provides complete and dynamic anesthesia. The benefits include suppression of stress response by sympatholysis, stable hemodynamics with reduction in cardiac morbidity, reduction in pulmonary complications due to active physiotherapy and early mobilization, reduced blood loss and decrease in thromboembolic complications following surgery.<sup>17-19</sup>

In the present study total participants were 120 which were divided into 2 group i.e. Group A (ropivacaine-dexmedetomidine) and group B (ropivacaine-ketamine). In group A males were 37 and females were 23. In group B males were 41 and females were 19. In group A an earlier onset (7.89±3.34min) of sensory block at T10 occurs in comparison to group B (10.72±1.66min). Time to max level of sensory block occur in group A in 12.54±3.56 mins and in group B in 18.43±3.12 mins. Time for onset of motor block occur in group A in 18.34±3.22 mins and in group B in 26.53±4.21. Mean Time to two segment regression was earlier in group B (124.54±8.54mins) compared to group A (134.23±11.34mins). Mean time to regression to Bromage 1 was earlier in group B (223.56±27.75mins) compared to group A (260.31±24.57mins). Mean time to sensory regression at S 1. was earlier in group B (289.76±34.29mins) compared to group A (321.39±38.24mins). Time to rescue analgesic was earlier in group B (312.24±32.45mins) compared to group A (312.24±32.45mins).

Sukhminder Singh et al 2011 found that onset of analgesia and time to maximum sensory block level was less in dexmedetomidine group than in fentanyl group.<sup>20</sup>

In a study by Bajwa SJ et al 2011 it was found that there was an early onset of sensory block, higher dermatomal spread, less time to reach the peak effect and prolonged two segment regression time in dexmedetomidine-ropivacaine group compared to clonidine-ropivacaine group.<sup>21</sup>

Studies of Salgado PFS et al, Bajwa SJ et al have proved that epidural dexmedetomidine prolongs the duration of post-operative analgesia and reduces the number of rescue analgesics.<sup>22,21</sup>

Regarding the onset of sensory block, Agarwal et al (2015) observed the time for sensory block at T10 level and upto T6 level

for dexmedetomidine group to be 8.40 ± 2.92 minute and 13.4 ± 3.01 min respectively which was shorter compared to clonidine group which was 10.53 ± 2.38 min and 15.66 ± 2.38 min respectively.<sup>23</sup>

Regarding the time taken for maximum motor block, Agarwal et al (2015) observed that the time taken by Dexmedetomidine group is 18.80 ± 3.37 minute which was shorter than time taken by the Clonidine group which was 21.24 ± 3.46 minute.<sup>23</sup>

Agarwal et al (2015) observed recovery time of motor block to Bromage 1 in Dexmedetomidine group to be 314±38.78minute which was longer compared to Clonidine group 282.60±7.50 minute.<sup>23</sup>

Agarwal et al (2015) observed that the time for first rescue analgesia was 434.33 ± 50.83 minute in Dexmedetomidine group which was longer compared to Clonidine group which was 399.33 ± 32.80 minute.<sup>23</sup>

Waleed et al carried out a study to compare the analgesic efficacy and safety of ketamine and magnesium sulfate in combination with bupivacaine for caudal block in pediatric patients for inguinoscrotal operations They observed that caudal administration of ketamine is efficient and safe for pediatric inguinoscrotal operations with longer postoperative analgesia than magnesium sulfate.<sup>24</sup>

Sonawane et al in a pilot study of 60 patients compared epidural infusion of bupivacaine plus dexmedetomidine or ketamine and concluded that dexmedetomidine with epidural bupivacaine reduced pain for longer period compared to epidural ketamine. Receding time for sensory block and receding time for motor block was delayed in dexmedetomidine group compared to ketamine group. But they have opined that a large randomized multicenter study is required to draw definite conclusion.<sup>25</sup>

## CONCLUSION

Dexmedetomidine is a better adjuvant to ketamine when used with epidural ropivacaine as it provides early onset of sensory and motor block and prolonged postoperative analgesia.

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