Section: Anaesthesia

Original Research Article

COMPARISON OF DEXMEDETOMIDINE AND CLONIDINE AS ADJUVANT TO ROPIVACAINE IN EPIDURAL ANAESTHESIA FOR LOWER ABDOMINAL SURGERIES

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ABSTRACT

Background: The effects of clonidine on local anesthetics have been extensively studied, there are limited studies demonstrating the effects of epidural dexmedetomidine on local anesthetics. Epidural anaesthesia using Inj. Ropivacaine results in an effective anaesthesia and postoperative analgesia and addition of adjuvants would be advantageous. The aim of our study is to compare the effect of clonidine and dexmedetomidine when used as an adjuvant to epidural ropivacaine in lower abdominal and lower limb surgeries. **Materials and Methods:** This prospective, randomized, double blind study involved 60 patients was done in Government Thiruvarur Medical college and Hospital, Tamilnadu, India. Patients were met eligibile criteria randomized into three groups-group A Ropivacaine alone group B ropivacaine with dexmedetomidine and group C ropivacaine with clonidine received epidurally. Onset of sensory analgesia using cold swab, onset of motor blockade using Bromage scale, time to 2 dermatome regression of sensory level, time to first demand for analgesia, sedation using Ramsay sedation scale, intra operative hemodynamic parameters and complications were assessed and compared between these 3 groups. **Result:** The onset of sensory blockage and long duration was substantially faster in the group B (Ropivacaine with dexmedetomidine) than in group A (Ropivacaine) and C (Ropivacaine with Clonidine) with (p=0.034). The Group B (220.5 ± 22.8 min) and group C (210.1 ± 21.5 min) experienced considerably longer motor blockage than the group A (160.2 ± 18.7 min) .($p < 0.001$). The hemodynamic parameters showed statistically significant differences at several time points, with the group B indicating more stable hemodynamics. **Conclusion:** Dexmedetomidine and clonidine as adjuvants with ropivacaine in epidural for surgeries done in the lower abdomen significantly improves anesthesia quality, prolongs analgesia, and enhances patient satisfaction without increasing adverse effects. Dexmedetomidine, in particular, offers additional benefits of faster onset and greater hemodynamic stability.

INTRODUCTION

Epidural anaesthesia has been used for decades to facilitate surgery having the additional advantage of its use in postoperative period for analgesia. 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.[1,2]

Ropivacaine is being increasingly used in comparison to bupivacaine due to similar analgesic properties, reduced cardio toxicity and lesser motor blockade.[3]

The quality and duration of analgesia is improved when a local anesthetic is combined with alpha 2

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adrenergic agonist. Both clonidine and dexmedetomidine are alpha 2 adrenergic agonists, which have analgesic properties and potentiate local anesthetic effects.[4,5,6] Neuraxial clonidine, enhances the action of local anesthetics, increases the intensity and duration of analgesia.[7,8]

Dexmedetomidine is about 8 times more selective towards the alpha 2 adrenoreceptor than clonidine and hence allows the use of higher doses with less α1 effect. It has been found to have hemodynamic stability, sedative, anxiolytic, analgesic, neuroprotective and anesthetic sparing effect. It causes more intense motor blockade and co-operative sedation without increasing the incidence of side effects.[9,10] The aim of our study was to compare the effect of clonidine and dexmedetomidine when given as an adjuvant to ropivacaine in epidural anesthesia.

Aims & Objectives

1. To compare the Motor and Sensory effects of clonidine and dexmedetomidine as adjuvants to ropivacaine in epidural anaesthesia for lower abdominal procedures
2. To compare Haemodynamic changes of clonidine and dexmedetomidine as adjuvants to ropivacaine in epidural anaesthesia for lower abdominal procedures.

MATERIALS AND METHODS

This randomized double-blinded study was carried out in 60 patients admitted in Governmnet Thiruvar Medical College and Hospital, Tamilnadu, India undergoing lower abdominal and lower limb surgeries. After getting approval from the lnstitutional Ethics and Research Committee, patients of both genders, aged 18-60 years of physical status American Society of Anesthesiologists I or II satisfying inclusion criteria, were recruited.

During preanesthetic visit the patients were explained about the study purpose, merits and demerits of the procedure and instructed to demand analgesia as per need and informed written consent was obtained. Patients were fasted for 8 h and premedicated with tablet ranitidine 150 mg and tablet alprazolam 0.5 mg in the night, the day before and in the morning of the day of surgery. All patients were preloaded with 10 ml/kg of ringer lactate, and baseline reading of the study parameters were recorded.

Patients were randomized into three groups ropivacaine alone (Group A), ropivacaine with clonidine (Group C) and ropivacaine with dexmedetomidine ((Group B) by computer generated numbers. Group R received 15 ml of 0.75% ropivacaine, Group RC received 15 ml of 0.75% ropivacaine with 1 μg/kg clonidine, and group RD received 15 ml of 0.75% ropivacaine with 1 μg/kg dexmedetomidine epidurally.

In the operation theater after connecting standard monitoring, the epidural space was identified and confirmed using loss of resistance to air. A test dose of 3 ml of 2% lignocaine with 1:200,000 adrenaline was administered following which 16 ml of the study drug was administered epidurally as per randomization.

Onset of sensory block was evaluated by using cold swab along the midline at every minute till onset of block at T10. The degree of motor block was assessed using the Bromage motor scale: 0-Free movement of legs and feet, 1-able to flex knee with free movement of feet, 2-unable to flex knees, but movement of feet, 3-unable to move legs or feet.

The assessment for motor block was done every 5 min after administration of study drug till a block of Bromage grade 3 motor blockade was achieved. The level of sedation was assessed 10 min after grade 3 motor blockade and at the end of surgery based on the Ramsay sedation scale.

Hemodynamic parameters were monitored every 5 min for the first 30 min, every 10 min thereafter till the end of surgery. Patients received inj. Atropine 0.6 mg when the heart rate (HR) fell below 20% of baseline (bradycardia) and injection mephentermine in titrated boluses when there was hypotension (fall below 20% of baseline). Any side-effects seen after administration of study drug was noted and treated appropriately.

Onset of sensory analgesia was defined as the time taken to achieve loss of cold sensation at T10 dermatome level from the end of injection of the study drug. Duration of analgesia was defined as the time taken from the onset of sensory block at T10 to the time of pain sensation at the surgical site with a visual analog scale score of >3. Peak sensory level was defined as the highest dermatome level of sensory blockade achieved after administration of study drug. Time to two dermatome regression was defined as the time interval from the sensory block at the highest dermatome to the regression of sensory blockade by two dermatomes. The sensory level was assessed every 15 min after 2 h of epidural bolus injection till 2 dermatome regression of sensory level was observed. The time to motor blockade was defined as the time interval from the administration of epidural study drug to the achievement of grade 3 motor blockade in the lower limbs. The assessment for motor block was done every 5 min after administration of study drug till a block of Bromage grade 3 motor blockade was achieved.

The data were analyzed using SPSS version 19 and Microsoft Excel 2011 (IBM). The following statistical tests were used for analysis. Demographic data:, onset of Sensory block and motor block: ANOVAs test, Sedation: Chi-square test, hemodynamic variation: ANOVAs test, complications: Chi-square test.

RESULTS

Patients were randomized into three groups 20 patients in each group. The groups were comparable as there was no significant difference between the

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two groups in respect to age and sex distribution, height and weight characteristics. [Table 1]

The start of sensory blockage was substantially faster 12 ± 3 min in the group B (Ropivacaine with dexmedetomidine) than in group A, 15.2± 3.5 (Ropivacaine) and Group B 13.8 ± 3.2 min (Ropivacaine with Clonidine) with (p=0.034). The Group B (252.7 ± 25.4 min) and group C (236.8 ± 23.5 min) experienced considerably longer sensory blockage than the group A (184.5 ± 20.3) .($p < 0.001$). [Figure1].

The start of Motor blockage was substantially faster 14.7 ± 3.6 min in the group B (Ropivacaine plus dexmedetomidine) than in group A, 18.5 ± 4.3 min (Ropivacaine) and group B 16.9 ± 3.9 min (Ropivacaine with clonidine) (p=0.02). The Group B (220.5 ± 22.8 min) and group C (210.1 ± 21.5 min) experienced considerably longer motor blockage than the group A (160.2 ± 18.7 min) .($p < 0.001$). [Figure 2].

The hemodynamic parameters showed statistically significant differences at several time points, with the group B demonstrating lower heart rates and blood pressure values compared to group A and C, indicating more stable hemodynamics (HR: $p < 0.05$, BP: $p < 0.05$). [FIGURE 3, 4]

Group B has longer duration of analgesia ($p < 0.001$). In comparison to the group A, the group B and C having a considerably longer duration to 2 dermatome regression ($p < 0.001$). [Table 2]

Assessment of Satisfaction score by VAS score showed higher satisfaction with Group B compared to other groups which is statistically significant ($p<0.001$) .[TABLE 3]

VAS scores for pain were recorded at 0, 1, 2, 4, 6, 8, and 12 hours postoperatively. Statistically significant differences were observed, with the dexmedetomidine group B reporting lower pain scores at all-time points ($p < 0.05$).

The most common side effects observed were hypotension, Bradycardia, Nausea, Vomiting, Pruritis. No statistically significant differences ($p > 0.05$) was seen in incidence of adverse effects in three groups. [Table 4]

Table 1: Age Distribution

Variable	Group A	Group B	Group C	p- value
Age (Years)	41 ± 2.2	42 ± 1.8	42 ± 2	>0.05
Gender (Male:Female)	12 : 8	10 :10	8 :12	>0.05
Mean Duration of Surgery	76 ± 2.2	88 ± 2.6	82 ± 2.4	>0.05

P <0.05 significant using Chi Square Test

Table 2: Duration of Analgesia and Regression

Variable	Group A	Group B	Group C	p-value
Analgesia duration (min)	194.5 ± 21.8	264.7 ± 26.4	247.8 ± 24.5	<0.001
Time for 2 dermatome regression (min)	85.2 ± 12.5	115.7 ± 14.6	110.5 ± 13.8	<0.001

P <0.05 significant using Anova Test

Table 3: Satisfaction of the patient

Variable	Group A	Group B	Group C	p- value
VAS	7.6 ± 1.1	8.7 ± 1.0	8.5 ± 1.1	0.005*

Visual Analog Score: *P <0.05 significant using Anova Test

Table 4: VAS Scores Over Time

Time (hours)	Group A VAS	Group B VAS	Group C VAS	p- value
0	0	0	0	-
1	1.5 ± 0.6	1.0 ± 0.5	1.2 ± 0.5	0.045*
2	2.0 ± 0.7	1.2 ± 0.6	1.4 ± 0.6	0.037*
4	3.0 ± 0.8	1.5 ± 0.7	2.0 ± 0.7	0.031*
6	3.5 ± 0.9	1.8 ± 0.8	2.5 ± 0.8	0.029*
8	4.0 ± 1.0	2.0 ± 0.9	3.0 ± 0.9	0.027*
12	4.5 ± 1.1	2.5 ± 1.0	3.5 ± 1.0	0.026*

****P <0.05 Statistically significant using Anova Test***

Table 5: Adverse Effects

Adverse Effect	Group A	Group B	Group C	p- value
Hypotension	2 (10%)	2 (10%)	3 (15%)	0.897 (NS)
Bradycardia	1 (5%)	2 (10%)	2 (10%)	0.763 (NS)
Nausea	2 (10%)	1 (5%)	2 (10%)	0.871 (NS)
Vomiting	1 (5%)	1 (5%)	2 (10%)	0.856 (NS)
Pruritus	1 (5%)	0 (0%)	1 (5%)	0.612 (NS)

P <0.05 significant using Chi Square Test

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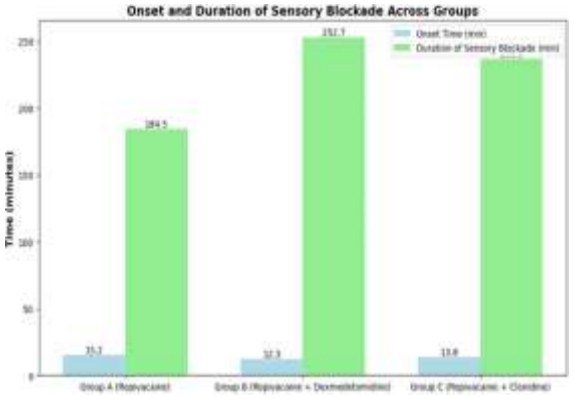

Figure 1: Initiation and Duration of Sensory Blockage

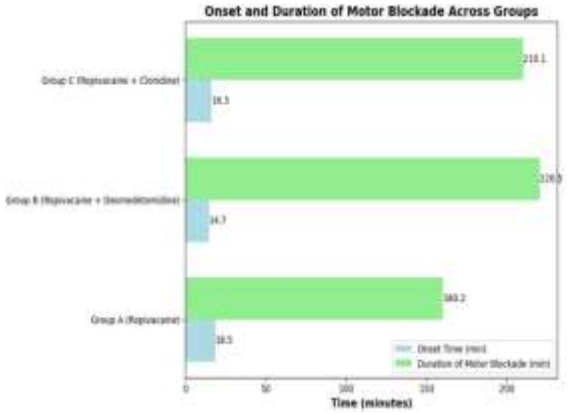

Figure 2: Initiation and Duration of Motor Blockage

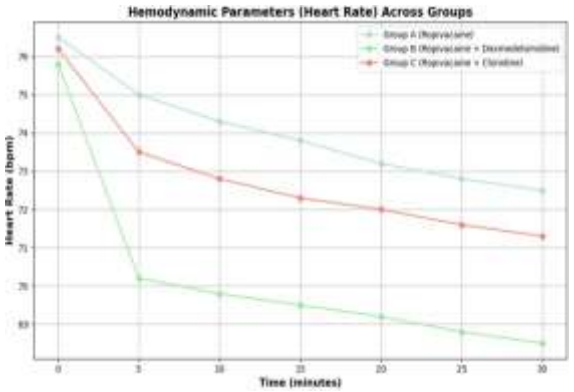

Figure 3: Hemodynamic Parameters Over Time Heart Rate

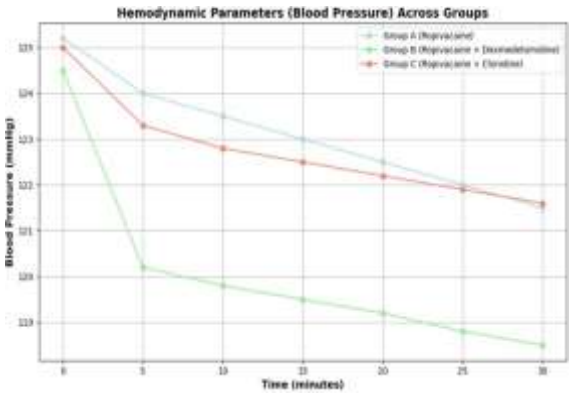

Figure 4: Hemodynamic Parameters Over Time Blood Pressure

DISCUSSION

Epidural anaesthesia has been a technique of choice for lower abdominal and lower limb surgeries especially when surgery is anticipated to be longer or as a technique for achieving postoperative pain relief.[11] Ropivacaine is a longer acting amide local anaesthetic with good anaesthetic and analgesic effects when administered epidurally.[12] It is less cardiotoxic and less neurotoxic when compared to bupivacaine.[3,4] Hence it has been increasingly used in the past decade. We chose ropivacaine over bupivacaine for its lesser incidence of cardiotoxicity and neurotoxicity. Epidural anesthesia is considered as a gold standard technique as it provides complete and dynamic anesthesia.

Gender distribution was evenly balanced across the three study groups, mitigating potential gender-related biases. A study done by Holte & Kehlet, 2002, stated that Gender can influence pain perception, anesthetic requirements, and recovery profiles.[2]

BMI, a critical parameter affecting anesthetic management, was similarly distributed across all groups. Anesthesia and analgesia outcomes can vary significantly with BMI due to differences in drug distribution, metabolism, and clearance as show in study done by Moraca et al., 2004.[13] Comorbidities like hypertension, diabetes mellitus, asthma, chronic kidney disease, and cardiovascular disease can significantly impact perioperative management and outcomes in epidural anasetehsia as noted by Chandran et al.[14]

In our study when compared to the group A and group B, the dexmedetomidine group B experienced sensory blockage far more quickly. Reflecting the potent synergistic effects of dexmedetomidine with ropivacaine in enhancing the onset of anesthesia, similarly the duration of sensory blockage was in long in group B. Similar findings were observed in study done by Bajwa et al., 2011 and Arun kumar S et al.,2015.[5,15]

When compared to the control group, the dexmedetomidine group experienced motor blockage far more quickly. indicating a more rapid achievement of surgical anesthesia consistent with the study results of Bajwa et al., 2011 and Arun kumar S et al.,2015.[5,15]

The duration of motor blockade was also significantly longer in the dexmedetomidine and clonidine groups, which is advantageous for extended surgeries and provides prolonged postoperative immobility, enhancing patient comfort and recovery consistent with the study results of Bajwa et al., 2011 and Arun kumar S et al.,2015.[5,15]

The hemodynamic parameters showed statistically significant differences at several time points, with the group B demonstrating lower heart rates and blood pressure values compared to the control group, indicating more stable hemodynamics, Study done by Grewal, 2011showed similar results with dexmedetomidine.[16]

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In our study when compared to group A, the dexmedetomidine and clonidine groups experienced analgesia for a noticeably longer period of time, corroborating findings from previous studies that demonstrated the efficacy of these adjuvants in prolonging analgesia Bajwa et al &). Shaikh et al showed similar finidngs.[5,17]

This results were inconsistent with Neogi et al found that the mean duration of analgesia was not significantly prolonged between the groups receiving clonidine (13.17 ± 0.68 h) and dexmedetomidine (13.17 ± 0.68 h).[18]

The time for 2 dermatome regression was longer in the dexmedetomidine and clonidine groups. The extended regression time suggests a more sustained sensory blockade, which is advantageous for managing postoperative pain and prolonging the analgesic effects of epidural anesthesia. This indicates that the addition of dexmedetomidine or clonidine to ropivacaine does not increase the risk of adverse effects such as hypotension, bradycardia, nausea, vomiting, pruritus, respiratory depression, or allergic reactions, similar findings observed in a study done by Oriol-Lopez et al in 2008.[19]

Findings were similar to studies done by Bajwa et al,[5] and Swami et al,[19] who also found no significant differences in terms of hypotension and bradycardia between the patients receiving dexmedetomidine or clonidine.

Satisfacation of patient scores were higher with dexmedetomidine and clonidine groups reflecting better overall patient experiences with these adjuvants similar to study done by Bajwa et al.[5]

Statistically significant differences were observed, with the dexmedetomidine group reporting lower pain scores at all time points. This finding aligns with the known analgesic properties of dexmedetomidine, which enhances the pain-relieving effects of local anesthetics, thereby improving postoperative pain management consistent results obtained in studies done by Bajwa et al & Srinivas et al.[5,19]

Dexmedetomidine, in particular, provides more stable hemodynamics and lower pain scores as measured by VAS.

CONCLUSION

The results demonstrated several significant findings that highlight the benefits of using these adjuvants. When dexmedetomidine was added, both sensory and motor blockades started more quickly, resulting in speedier surgical anaesthetic. Hemodynamic stability was another critical outcome observed in this study. The dexmedetomidine group demonstrated lower heart rates and blood pressure values at several time points, indicating more stable hemodynamic profiles. Patient satisfaction was significantly higher in the groups receiving dexmedetomidine and clonidine, reflecting better overall patient experiences.

In conclusion, dexmedetomidine and clonidine as adjuvants with ropivacaine in epidural for surgeries done in the lower abdomen significantly improves anesthesia quality, prolongs analgesia, and enhances patient satisfaction without increasing adverse effects. Dexmedetomidine, in particular, offers additional benefits of faster onset and greater hemodynamic stability. These findings support the incorporation of these adjuvants in clinical practice to optimize anesthetic outcomes and patient care.

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