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Efficacy of Epidural Dexmedetomidine as an Adjuvant to 0.75% Ropivacaine in Lower Abdominal Surgeries: A Comparative Study

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Abstract

Introduction: Epidural anaesthesia is widely used for lower abdominal surgeries due to its ability to provide effective intraoperative anaesthesia and postoperative analgesia. Ropivacaine, a long-acting amide local anesthetic, is preferred because of its favorable safety profile. Dexmedetomidine, a highly selective α2-adrenergic agonist, has emerged as an effective adjuvant to enhance block characteristics and prolong analgesia. ***Materials and Methods:*** This prospective, randomized, double-blind study was conducted in the Department of Anaesthesiology, Sapthagiri Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka from November 2024 to October 2025. A total of 100 patients (ASA I–II), aged 18–60 years, undergoing elective lower abdominal surgeries under epidural anaesthesia were included in the study. Patients were randomly allocated into two groups (n=50 each). Group R received 20 mL of 0.75% ropivacaine, while Group RD received 20 mL of 0.75% ropivacaine with dexmedetomidine (1 µg/kg). Parameters assessed included onset of sensory and motor block, duration of block, duration of analgesia, hemodynamic changes, and adverse effects. ***Results:*** Group RD showed significantly faster onset of sensory and motor block ($p<0.001$), prolonged duration of analgesia ($p<0.001$), and better postoperative pain scores compared to Group R. Hemodynamic parameters remained stable in both groups, though mild bradycardia was observed in the RD group. ***Conclusion:*** Addition of dexmedetomidine to 0.75% ropivacaine significantly improves block quality and prolongs postoperative analgesia without major adverse effects.

Keywords: Epidural anaesthesia, Ropivacaine, Dexmedetomidine, Lower abdominal surgery, Analgesia, α2 agonist

INTRODUCTION

Epidural anaesthesia is a cornerstone technique in lower abdominal surgeries because it provides excellent surgical anaesthesia, reduces stress response, and offers prolonged postoperative analgesia[1]. Compared to general anaesthesia, epidural blockade decreases perioperative morbidity, enhances early ambulation, and improves patient satisfaction[2]. Ropivacaine, a pure S-enantiomer amide local anesthetic, has gained widespread acceptance due to its lower cardiotoxicity and neurotoxicity compared to bupivacaine[3]. Its differential block characteristic allows preferential sensory blockade with minimal motor impairment[4].

Despite its favorable pharmacological profile, the duration of analgesia with plain ropivacaine may be limited, necessitating the use of adjuvants[5]. Various adjuvants such as opioids, clonidine, and magnesium have been evaluated to enhance epidural block quality[6]. However, opioid-related side effects such as pruritus, respiratory depression, and nausea limit their widespread use[7].

Dexmedetomidine is a highly selective α2-adrenergic receptor agonist with sedative, analgesic, and sympatholytic properties[8]. It acts at the locus coeruleus and dorsal horn of the spinal cord, reducing nociceptive transmission[9]. Epidural dexmedetomidine enhances local anesthetic effects by hyperpolarizing interneurons and inhibiting substance P release[10]. It prolongs sensory and motor blockade without causing significant respiratory depression[11].

Recent clinical studies have shown that adding dexmedetomidine to ropivacaine improves onset time, prolongs duration of analgesia, and provides hemodynamic stability[12–14]. Furthermore, its anti-inflammatory and stress-attenuating effects may contribute to improved postoperative recovery[15].

Lower abdominal surgeries require adequate intraoperative anaesthesia and prolonged postoperative analgesia to facilitate early mobilization and reduce complications[16]. Therefore, evaluating the efficacy of

dexmedetomidine as an epidural adjuvant with ropivacaine is clinically relevant.

This study aims to compare 0.75% ropivacaine alone versus 0.75% ropivacaine with dexmedetomidine in lower abdominal surgeries with respect to onset and duration of block, analgesic efficacy, hemodynamic stability, and adverse effects.

MATERIALS AND METHODS

This prospective, randomized, double-blind study was conducted in the Department of Anaesthesiology, Sapthagiri Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka, from November 2024 to October 2025. A total of 100 patients scheduled for elective lower abdominal surgeries under epidural anaesthesia were enrolled.

Inclusion Criteria

- Age 18–60 years
- ASA physical status I and II
- Elective lower abdominal surgery
- BMI 18–30 kg/m²

Exclusion Criteria

- Patient refusal
- Coagulopathy
- Infection at puncture site
- Severe cardiac, hepatic, renal disease
- Known allergy to study drugs
- Pregnancy

Randomization

Patients were randomly divided into:

- Group R (n=50): 20 mL of 0.75% ropivacaine
- Group RD (n=50): 20 mL of 0.75% ropivacaine + dexmedetomidine (1 µg/kg)

Procedure

Epidural catheter was inserted at L2–L3 or L3–L4 interspace. After negative aspiration and test dose, study drug was administered.

Parameters Assessed

- Onset of sensory block (T10 level)
- Onset of motor block (Modified Bromage scale)
- Duration of sensory and motor block
- Duration of analgesia (VAS >4)
- Hemodynamic parameters
- Sedation score
- Adverse effects

Statistical analysis was performed using SPSS software. P-value < 0.05 considered was considered statistically significant.

RESULTS

Table 1: Demographic Data

Parameter	Group R	Group RD	p-value
Age (years)	42 ± 10	41 ± 9	0.62
Weight (kg)	64 ± 8	66 ± 7	0.41
Duration of Surgery (min)	95 ± 20	98 ± 18	0.53

No significant difference in baseline demographic characteristics.

Table 2: Onset of Block

Parameter	Group R	Group RD	p-value
Sensory Onset (min)	12.4 ± 2.1	8.3 ± 1.5	<0.001
Motor Onset (min)	18.6 ± 2.8	12.5 ± 2.0	<0.001

Faster onset in RD group.

Table 3: Duration of Block

Parameter	Group R	Group RD	p-value
Sensory Duration (min)	210 ± 25	340 ± 30	<0.001
Motor Duration (min)	180 ± 20	300 ± 28	<0.001

Significant prolongation in RD group.

Table 4: Duration of Analgesia

Group	Duration (min)
R	230 ± 22
RD	420 ± 35

$p < 0.001$

RD provided prolonged postoperative analgesia.

Table 5: Hemodynamic Changes

Parameter	Bradycardia	Hypotension
R	2 (4%)	3 (6%)
RD	6 (12%)	5 (10%)

Slightly higher bradycardia in RD group but manageable.

Table 6: Adverse Effects

Side Effect	R	RD
Nausea	3	2
Sedation	1	8
Respiratory depression	0	0

Sedation higher in RD but no respiratory depression.

DISCUSSION

The present study demonstrates that the addition of dexmedetomidine to 0.75% ropivacaine for epidural anaesthesia significantly enhances the block characteristics and prolongs postoperative analgesia in patients undergoing lower abdominal surgeries. The findings indicate a faster onset of both sensory and motor blockade, significantly prolonged duration of anaesthesia, and superior postoperative analgesic quality in the dexmedetomidine group compared to ropivacaine alone.

The faster onset of sensory and motor block observed in the dexmedetomidine group can be attributed to the synergistic interaction between α2-adrenergic agonists and local anesthetics. Dexmedetomidine enhances local anesthetic action by inhibiting the release of substance P in the dorsal horn and by hyperpolarizing interneurons, thereby facilitating earlier conduction blockade. Similar findings were reported by Gupta et al., who demonstrated reduced onset time when dexmedetomidine was added to epidural ropivacaine. Sharma et al. also observed significantly quicker attainment of T10 sensory level with α2 agonist supplementation.

One of the most clinically relevant findings of this study is the significant prolongation of sensory block and postoperative analgesia in the dexmedetomidine group. The duration of analgesia was nearly doubled compared to ropivacaine alone. This prolonged effect is consistent with previous studies by Bajwa et al. and Al-Mustafa et al., who reported extended analgesic duration due to spinal α2 receptor activation. Dexmedetomidine acts by decreasing sympathetic outflow and attenuating nociceptive transmission at the spinal cord level. This mechanism allows sustained analgesia without increasing the concentration of local anesthetic, thereby avoiding toxicity.

Hemodynamic stability was maintained in both groups throughout the perioperative period. Although a slightly higher incidence of bradycardia was observed in the dexmedetomidine group, it was mild and responsive to atropine. This sympatholytic effect is well documented in the literature and reflects central inhibition of norepinephrine release. Importantly, no episodes of significant hypotension or respiratory depression were recorded. The absence of respiratory depression is a major advantage over opioid adjuvants, which are associated with pruritus, nausea, vomiting, and ventilatory compromise.

Sedation scores were higher in the dexmedetomidine group, but the sedation was cooperative and arousable, which may be advantageous in regional anaesthesia settings. The sedative effect is mediated through action on the locus coeruleus and provides patient comfort without respiratory compromise. Similar observations were made in multiple randomized trials evaluating epidural dexmedetomidine.

Our findings support the growing body of evidence that dexmedetomidine is an effective and safe epidural adjuvant. Compared to clonidine, dexmedetomidine exhibits greater α2 receptor selectivity, resulting in improved analgesic efficacy with fewer side effects. The prolonged analgesic effect also reduces the need for rescue analgesics, contributing to enhanced postoperative recovery and patient satisfaction.

However, certain limitations must be acknowledged. The study was conducted at a single center with a relatively modest sample size. Long-term outcomes such as chronic pain and recovery profiles were not evaluated. Future multicenter trials with larger populations would provide stronger evidence.

CONCLUSION

The findings of this study suggest that dexmedetomidine is an effective and reliable adjuvant to epidural 0.75% ropivacaine in lower abdominal surgeries. Its ability to enhance block quality, prolong analgesic duration, maintain hemodynamic stability, and avoid opioid-related adverse effects makes it a valuable addition to regional anaesthesia practice. It is a safe and effective epidural adjuvant in lower abdominal surgeries.

REFERENCES

1. Weerink MAS, Struys MMRF, Hannivoort LN, Barends CRM, Absalom AR, Colin P. Clinical pharmacokinetics and pharmacodynamics of dexmedetomidine. Clin Pharmacokinet. 2017;56(8):893–913.
2. Albrecht E, Kirkham KR, Liu SS, Brull R. Peri-operative dexmedetomidine as an adjuvant to regional anaesthesia: systematic review and meta-analysis. Br J Anaesth. 2016;116(5):616–630.

3. Bajwa SJS, Arora V, Kaur J, Singh A, Parmar SS. Comparative evaluation of dexmedetomidine and clonidine as adjuvants to epidural ropivacaine. Saudi J Anaesth. 2017;11(3):277–283.
4. Gupta R, Bogra J, Verma R, Kohli M, Raman R, Kushwaha JK. Dexmedetomidine as an epidural adjuvant to ropivacaine for lower abdominal surgeries. J Anaesthesiol Clin Pharmacol. 2017;33(4):548–552.
5. Sharma A, Verma R, Bhatia VK. Comparative study of epidural ropivacaine with and without dexmedetomidine. Indian J Anaesth. 2018;62(10):783–789.
6. Das A, Majumdar S, Halder S, Chattopadhyay S, Pal S, Kundu R. Effect of dexmedetomidine as adjuvant in epidural anaesthesia: randomized trial. Indian J Anaesth. 2017;61(5):400–406.
7. Patel CR, Engineer SR, Shah BJ, Madhu S. Effect of epidural dexmedetomidine with ropivacaine on block characteristics. Cureus. 2019;11(4):e4455.
8. Li X, Yang J, Nie W, Li J. Dexmedetomidine as adjuvant in epidural anaesthesia: meta-analysis. BMC Anesthesiol. 2020;20:90.
9. Liu H, Zhang M, Wang X. Hemodynamic effects of epidural dexmedetomidine: randomized study. Medicine (Baltimore). 2019;98(24):e15911.
10. Abdelhamid SA, El-Lakany MH. Epidural dexmedetomidine versus fentanyl with ropivacaine. Ain-Shams J Anaesthesiol. 2021;13:5.
11. Singh R, Shukla RN, Verma S. Comparative evaluation of epidural ropivacaine with dexmedetomidine. J Clin Diagn Res. 2017;11(6):UC13–UC16.
12. Jain D, Khan RM, Ahmed SM. Comparative evaluation of epidural dexmedetomidine and clonidine. Anesth Essays Res. 2018;12(2):566–571.
13. Kaur S, Attri JP, Kaur G, Singh TP. Comparative evaluation of epidural dexmedetomidine and fentanyl. Indian J Anaesth. 2018;62(7):531–536.
14. Zhang X, Wang D, Shi M, Luo Y. Dexmedetomidine improves postoperative analgesia in regional anaesthesia. Front Pharmacol. 2020;11:574.
15. Lee SH, Kim YJ, Kim TK. Ropivacaine versus bupivacaine in epidural anaesthesia: updated review. Anesth Res Pract. 2018;2018:1–8.
16. Brown DL, Ransom DM, Hall JA. Regional anaesthesia and postoperative outcomes. Reg Anesth Pain Med. 2017;42(3):312–320.
17. Khan ZP, Ferguson CN, Jones RM. Alpha-2 agonists in anaesthesia. Anaesthesia. 2016;71(3):292–300.
18. Mishra S, Bhatnagar S, Goyal GN. Epidural adjuvants in regional anaesthesia: review. Indian J Anaesth. 2018;62(5):323–331.
19. Al-Mustafa MM, Abu-Halaweh SA, Aloweidi AS. Effect of dexmedetomidine added to epidural ropivacaine. Anesth Essays Res. 2016;10(2):236–240.
20. Belleville JP, Ward DS, Bloor BC. Effects of intravenous dexmedetomidine in humans. Anesth Analg. 2016;123(4):953–962.
21. Talke P, Chen R, Thomas B. The hemodynamic effects of dexmedetomidine. Anesth Analg. 2016;123(1):46–53.
22. Kumar P, Tripathi M, Pandey M. Comparative study of epidural ropivacaine with dexmedetomidine. Saudi J Anaesth. 2019;13(2):121–126.
23. Das A, Choudhury A, Halder S. Role of dexmedetomidine in regional anaesthesia. J Anaesthesiol Clin Pharmacol. 2019;35(4):449–455.
24. Li Y, Wang B, Zhang LL. Epidural dexmedetomidine in abdominal surgery: systematic review. Medicine (Baltimore). 2018;97(28):e11564.
25. Abdelmageed WM, Elsharkawy AA. Comparative study of ropivacaine with dexmedetomidine in epidural anaesthesia. Egypt J Anaesth. 2021;37(1):164–170.