Section: Anaesthesiology

Original Research Article

COMPARATIVE STUDY OF POSTOPERATIVE EPIDURAL ANALGESIA BETWEEN 0.125% BUPIVACAINE WITH FENTANYL AND 0.2% ROPIVACAINE WITH FENTANYL FOLLOWING TOTAL ABDOMINAL HYSTERECTOMIES

I.Priyadharshini[1], Arivarasan A.[2], M.Subhashini[3]

[1]Assistant Professor, Department of Anaesthesiology, KAPV Government Medical College Hospital, Tamilnadu, India.
[2]Senior Assistant Professor, Department of Anaesthesiology, KAPV Government Medical College Hospital, Tamilnadu, India.
[3]Assistant Professor, Department of Anaesthesiology, KAPV Government Medical College Hospital, Tamilnadu, India.

Received : 08/12/2025
Received in revised form : 20/01/2026
Accepted : 13/02/2026

Keywords:
Anesthesia, Epidural; Bupivacaine; Fentanyl; Hysterectomy; Pain, Postoperative; Ropivacaine.

Corresponding Author:
Dr. I. Priyadharshini,
Email: drpriya0907@gmail.com

DOI: 10.47009/jamp.2026.8.1.184

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (1); 965-970

ABSTRACT

Background: Epidural analgesia is widely used after lower abdominal surgeries. Bupivacaine and ropivacaine differ in analgesic onset, duration, and hemodynamic effects, making comparative evaluation clinically important. **Aims and Objectives:** To compare the onset and duration of analgesia and haemodynamic effects of epidural 0.125% bupivacaine with fentanyl versus 0.2% ropivacaine with fentanyl in patients undergoing total abdominal hysterectomy. **Materials and Methods:** This prospective intergroup comparative study was conducted at a tertiary care teaching hospital and included 60 ASA physical status I–II patients randomly allocated into two equal groups. Group B received 0.125% bupivacaine with fentanyl, and Group R received 0.2% ropivacaine with fentanyl via an epidural catheter. The primary outcomes were the onset and duration of analgesia, which were assessed using a Visual Analogue Scale. The haemodynamic parameters were recorded at predefined intervals. Statistical analyses were performed using appropriate comparative tests, with $p < 0.05$ considered statistically significant. **Results:** The mean onset of analgesia was significantly faster in Group B (11.8 ± 1.6 min) than in Group R (14.2 ± 1.9 min) ($p < 0.001$). The mean duration of analgesia was significantly longer in Group R (326.4 ± 28.7 min) than in Group B (289.6 ± 24.3 min) ($p < 0.001$). The haemodynamic parameters remained comparable between the groups throughout the study period, and the incidence of adverse effects was low and similar in both groups. **Conclusion:** Epidural 0.125% bupivacaine with fentanyl provides a faster onset of analgesia, whereas 0.2% ropivacaine with fentanyl offers a longer duration of postoperative analgesia, with comparable haemodynamic stability in patients undergoing total abdominal hysterectomy.

INTRODUCTION

Postoperative pain is a major concern among patients undergoing major surgeries.1 Effective postoperative analgesia is essential for early recovery mobilisation and patient satisfaction. Among the various techniques available, epidural analgesia is widely regarded as the gold standard for postoperative pain relief following abdominal surgeries.[1,2] Epidural analgesia provides dynamic and segmental analgesia, allowing patients to resume normal physiological functions without being limited by pain.[3] The placement of an epidural catheter enables the continuous administration of analgesics, making it suitable for prolonged postoperative pain control. In addition to effective analgesia, epidural blockade attenuates the surgical stress response and contributes to improved postoperative outcomes.[4,5]

Central neuraxial blockade produces predictable physiological changes, primarily alterations in heart rate and blood pressure.[6] These changes result from sympathetic blockade and parasympathetic activity. While these effects are usually well tolerated, maintaining haemodynamic stability remains a key consideration during epidural analgesia.[6,7] An ideal local anaesthetic should provide a rapid onset of action, adequate sensory blockade, minimal motor blockade, stable haemodynamics, and minimal systemic toxicity.[6,8] Several agents, such as

mepivacaine, tetracaine, and chloroprocaine, have been used earlier; however, their adverse effect profiles limit their widespread acceptance. Currently, lignocaine, bupivacaine, levobupivacaine and ropivacaine are commonly used for epidural analgesia.[6,8,9]

Bupivacaine is widely used because of its long duration of action and effective sensory blockade. However, inadvertent intravascular injection or systemic absorption can result in severe cardiotoxicity, which is often difficult to manage.[9,10] This concern has led to the search for alternative long-acting local anaesthetics with improved safety profiles.[10] Ropivacaine is a newer long-acting amide local anaesthetic derived from bupivacaine. It is a pure S enantiomer and has been shown to have reduced cardiovascular and central nervous system toxicity.[10,11] Ropivacaine provides sensory blockade comparable to bupivacaine while producing a less intense motor block and offering a wider margin of safety. Due to these properties, ropivacaine is increasingly being evaluated as a safer alternative to bupivacaine for epidural analgesia.[10,11,12]

Several studies have compared different concentrations, dosages, and routes of administration of bupivacaine and ropivacaine.[12,13] However, variability exists in the reported onset time, duration of analgesia, and haemodynamic effects, particularly when combined with opioid adjuvants.[13] Despite the widespread use of both drugs, limited data are available comparing equipotent low concentrations of bupivacaine and ropivacaine combined with fentanyl for postoperative epidural analgesia following total abdominal hysterectomy. Therefore, this study aimed to assess the onset of analgesia, duration of analgesia, and haemodynamic changes following postoperative epidural administration of 0.125% bupivacaine with fentanyl and 0.2% ropivacaine with fentanyl in patients undergoing elective total abdominal hysterectomy.

Aim and Objectives

Aim

To compare the efficacy and haemodynamic effects of postoperative epidural analgesia using bupivacaine with fentanyl and ropivacaine with fentanyl in patients undergoing elective total abdominal hysterectomy.

Objectives

- To compare the onset of analgesia between bupivacaine–fentanyl and ropivacaine–fentanyl epidural regimens.
- To compare the duration of postoperative analgesia between the two groups.
- To assess and compare haemodynamic parameters and oxygen saturation following epidural administration.

MATERIALS AND METHODS

This prospective observational study included 60 patients undergoing elective total abdominal hysterectomy at the Department of Anaesthesiology, K.A.P.V. Government Medical College, Trichy, India for one year. Institutional ethics committee approval was obtained, and written informed consent was obtained from all participants.

Inclusion and Exclusion Criteria

Patients aged between 18 and 60 years, belonging to ASA physical status I or II, who were scheduled for elective total abdominal hysterectomy, were willing to receive epidural analgesia, and provided written informed consent were included.

Patients who did not provide consent, those with bleeding disorders, infection at the epidural insertion site, known allergy to the study drugs, significant cardiac or respiratory illness, or pre-existing neurological disorders were excluded.

Methods

Sixty patients undergoing elective total abdominal hysterectomy were randomly divided into two groups of 30 each. Group B received 10 ml of 0.125% bupivacaine with fentanyl 25 µg, and Group R received 10 ml of 0.2% ropivacaine with fentanyl 25 µg for postoperative epidural analgesia. Randomisation was performed using a computer-generated random number sequence, and group allocation was concealed using sequentially numbered, opaque, sealed envelopes opened only after patient enrolment. Preoperative details, such as age, weight, height, comorbid illnesses, baseline investigations, pulse rate, blood pressure, and oxygen saturation, were recorded. The ASA physical status was assessed and documented for all patients.

All patients were explained the visual analogue scale (VAS) before surgery. On the day of surgery, after confirming fasting status and consent, baseline vital parameters were noted. Epidural catheterisation was performed at the L1–L2 interspace under aseptic precautions using a 16G Tuohy needle by the loss of resistance technique, and 5 cm of the catheter was kept inside the epidural space. A test dose of 3 ml of 1.5% lignocaine with adrenaline was administered epidurally. A subarachnoid block was administered at the L3–L4 space using a 25G Quincke needle with 3.5 ml of 0.5% hyperbaric bupivacaine. Postoperatively, when the VAS score was ≥3, the respective epidural drug was administered. The VAS scores and haemodynamic parameters were monitored to assess the onset and duration of analgesia. The onset of analgesia was defined as the time taken to achieve a VAS score of 0, and the duration of effective analgesia was defined as the time period during which the VAS score remained ≤2.

Rescue analgesia with intramuscular tramadol 1–2 mg/kg was administered if adequate analgesia was not achieved within 25 min of epidural top-up, and such patients were excluded from the final analysis. Adverse effects, such as hypotension, bradycardia, ECG changes, nausea, and vomiting, were monitored throughout the study period. Outcome assessments were performed using predefined criteria to minimise observer variability.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

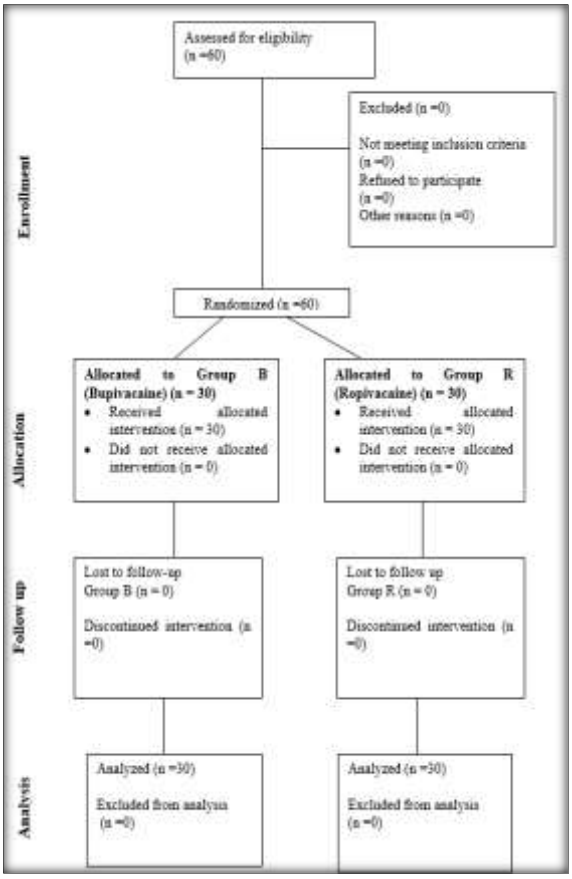

Figure 1: Consort flow diagram

Statistical Analysis

Data were analysed using SPSS v29. Continuous variables are expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Intergroup comparisons were performed using the chi-square test, two-tailed Fisher's exact test, ANOVA, and Bonferroni's correction for multiple comparisons. Statistical significance was set at $p < 0.05$. All enrolled participants completed the study protocol, and no missing data were observed; therefore, no imputation methods were required.

RESULTS

The mean age was comparable between Groups B (55.70 ± 3.78 years) and R (56.87 ± 4.17 years) ($p = 0.462$). Most patients had ASA physical status I, with no significant difference between Groups B (83.3%) and R (96.7%) ($p = 0.085$).

The baseline haemodynamic parameters were similar between the two groups. The mean heart rate was 85.13 ± 9.95 beats/min in Group B and 89.17 ± 7.35 beats/min in Group R ($p = 0.079$). The mean systolic blood pressure (116.69 ± 7.64 vs. 117.10 ± 7.06 mmHg; $p = 0.831$), diastolic blood pressure (77.27 ± 5.94 vs. 78.00 ± 5.41 mmHg; $p = 0.619$), mean arterial pressure (91.17 ± 5.87 vs. 90.50 ± 5.82 mmHg; $p = 0.661$), and oxygen saturation (98.57 ± 0.68% vs. 98.57 ± 0.73%; $p = 1.0$) did not differ significantly between Groups B and R. [Table 1]

Table 1: Baseline demographic characteristics, ASA physical status, and preoperative hemodynamic parameters

Variable	Group B	Group R	p value
Age (years)	55.70 ± 3.78	56.87 ± 4.17	0.462
ASA I	25 (83.3%)	29 (96.7%)	0.085
ASA II	5 (16.7%)	1 (3.3%)	
Heart rate (beats/min)	85.13 ± 9.95	89.17 ± 7.35	0.079
Systolic BP (mmHg)	116.69 ± 7.64	117.10 ± 7.06	0.831
Diastolic BP (mmHg)	77.27 ± 5.94	78.00 ± 5.41	0.619
MAP (mmHg)	91.17 ± 5.87	90.50 ± 5.82	0.661
SpO_2 (%)	98.57 ± 0.68	98.57 ± 0.73	1

The onset of analgesia was significantly faster in Group B (14.20 ± 1.00 min) than in Group R (18.97 ± 0.96 min) ($p < 0.0001$). The duration of analgesia was significantly longer in Group B (166.17 ± 7.62 min) than in Group R (145.33 ± 7.06 min) ($p < 0.0001$). [Table 2]

Table 2: Comparison of onset and duration of postoperative epidural analgesia between groups

Variable	Group B	Group R	p value
Onset of analgesia (min)	14.20 ± 1.00	18.97 ± 0.96	< 0.0001
Duration of analgesia (min)	166.17 ± 7.62	145.33 ± 7.06	< 0.0001

At baseline, the mean pulse rate was 93.60 ± 10.90 beats/min in Group B and 92.47 ± 7.54 beats/min in Group R, with no significant difference ($p = 0.641$). Throughout the 4-hour observation period, no significant intergroup difference in pulse rate was observed ($p > 0.05$). [Figure 2]

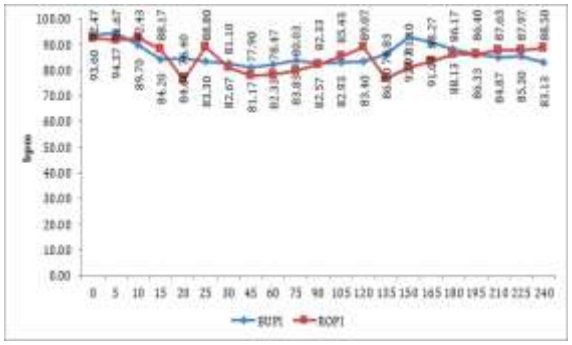

Figure 2: Comparison of pulse rate between groups

ISSN (O): 2687-5365; ISSN (P): 2753-6556

At baseline, the mean systolic blood pressure was 118.45 ± 4.26 mmHg in Group B and 117.47 ± 5.81 mmHg in Group R, with no significant difference between the groups (p = 0.56). Throughout the 4-hour observation period, no significant intergroup difference in systolic blood pressure was observed (p > 0.05). [Figure 3]

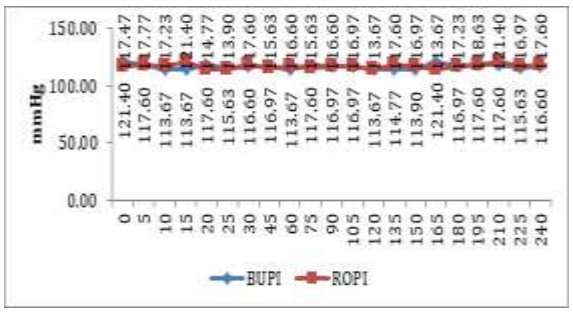

Figure 3: Comparison of systolic blood pressure between groups

At baseline, the mean diastolic blood pressure was 79.28 ± 3.42 mmHg in Group B and 78.43 ± 5.10 mmHg in Group R, with no significant difference between the groups (p = 0.261). Throughout the 4-hour observation period, no significant intergroup difference in diastolic blood pressure was observed (p > 0.05). [Figure 4]

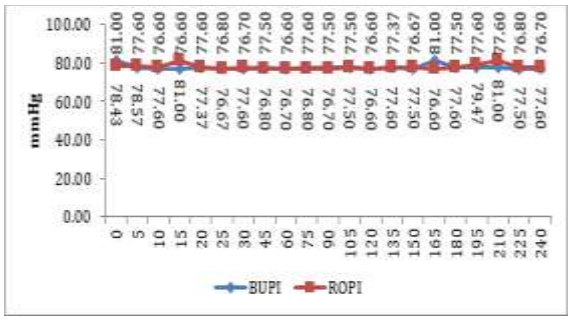

Figure 4: Comparison of diastolic blood pressure between groups

At baseline, the mean arterial pressure was 91.68 ± 3.28 mmHg in Group B and 91.00 ± 4.87 mmHg in Group R, with no significant difference between the groups (p = 0.325). Throughout the 4-hour observation period, no significant intergroup differences in mean arterial pressure were observed (p > 0.05). [Figure 5]

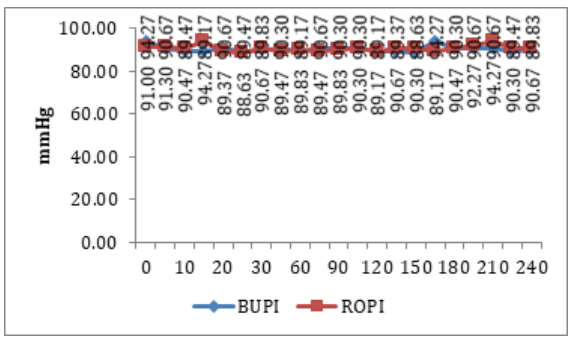

Figure 5: Comparison of MAP between groups

At baseline, the mean oxygen saturation was 98.70 ± 0.95% in Group B and 98.70 ± 0.95% in Group R, with no significant difference between the groups (p = 1.000). Throughout the 4-hour observation period, no significant intergroup differences in oxygen saturation were observed (p > 0.05). [Figure 6]

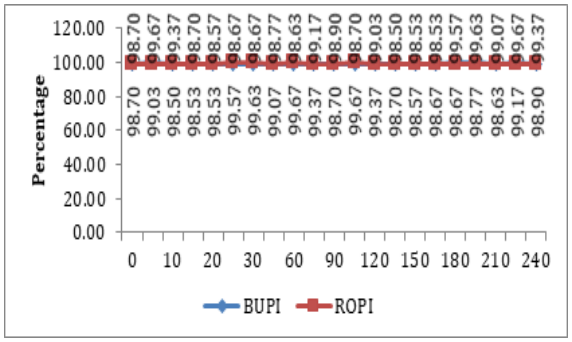

Figure 6: Comparison of oxygen saturation (SpO_2) between groups

DISCUSSION

This study showed that both groups were similar at the baseline. Bupivacaine produced an earlier onset of epidural analgesia. Heart rate, blood pressure, MAP, and oxygen saturation remained stable and similar between the groups. Both drugs provided effective and safe postoperative analgesia without significant haemodynamic differences.

In our study, the age distribution and ASA physical status were comparable between the groups, with most patients classified as ASA I and no significant differences. Similarly, Senard et al. reported no significant differences in demographic characteristics, including age and ASA physical status, among patients receiving epidural bupivacaine or ropivacaine at varying concentrations, indicating appropriate baseline comparability between groups.[14] Kumar Dash et al. found that age distribution was comparable between groups (Group R: 42.5 ± 12.4 years; Group B: 43.7 ± 11.9 years; p = 0.61). The ASA physical status was also similar, with most patients classified as ASA I (Group R: 35/20; Group B: 32/23; p = 0.56).[15] These findings support our results by showing that similar age distribution and ASA status across groups ensured true comparability. This confirms that the differences observed in our study are related to the anaesthetic drugs used rather than baseline patient characteristics.

Our study showed that the baseline heart rate, blood pressure parameters, MAP, and oxygen saturation were comparable between the groups, indicating similar preoperative physiological status. Similarly, Kalas et al. found that baseline vital parameters were comparable between groups: heart rate (Group R 98.50 ± 7.8 vs Group B 100.11 ± 3.79; p = 0.14), systolic BP (126.78 ± 10.82 vs 124.65 ± 8.4; p = 0.20), diastolic BP (68.52 ± 9.8 vs 66.79 ± 10.3; p = 0.11), and MAP (101.64 ± 12.5 vs 100.8 ± 8.23; p = 0.31), indicating comparable preoperative

ISSN (O): 2687-5365; ISSN (P): 2753-6556

physiological status.[16] These results support our study by showing that both groups started with similar heart rate, blood pressure, MAP, and oxygen saturation. This indicates that any differences observed later are due to the drugs used and not because of preoperative physiological differences.

In this study, postoperative epidural analgesia onset was earlier with bupivacaine, whereas the pulse rate remained stable and comparable between groups throughout the observation period. Similarly, Nagaraju et al. reported that the onset of epidural block was significantly faster with bupivacaine than that with ropivacaine. The onset of sensory block occurred earlier in the bupivacaine group (1.86 ± 0.65 min) than in the ropivacaine group (2.26 ± 0.91 min; p = 0.034). The onset of motor block was also earlier with bupivacaine (6.10 ± 0.94 min vs. 6.69 ± 0.98 min; p = 0.022).[17] Patil et al. found that in the postoperative period, the mean pulse rate remained comparable between the bupivacaine and ropivacaine groups, with no significant intergroup difference observed. Pulse rate stability was maintained throughout postoperative monitoring, indicating similar cardiovascular profiles in both groups.18 These studies support our findings by confirming faster onset of analgesia with bupivacaine and stable, comparable pulse rates, supporting that the observed effects are drug-related rather than due to cardiovascular variability.

Our study showed that systolic and diastolic blood pressure values were comparable between the groups throughout all observation periods, with no significant intergroup differences. Similarly, Patil et al. found that systolic blood pressure was comparable between groups at baseline (Group R: 122.4 ± 19.6 vs Group B: 127.3 ± 16.8 mmHg), immediately postoperatively (119.4 ± 17.0 vs 125.7 ± 15.8 mmHg), and at 24 h (116.1 ± 16.1 vs 113.5 ± 15.6 mmHg), with no significant intergroup differences.[18] Pandey et al. reported that systolic blood pressure was comparable between groups at baseline (Group B: 127.24 ± 8.37 vs Group R: 125.68 ± 7.28 mmHg; p = 0.594) and at all intraoperative intervals, including 5, 20, 30, 60, and 120 minutes, with no significant intergroup differences.[19]

Olapour et al. found that diastolic blood pressure trends were comparable between groups, with no significant intergroup difference on repeated-measures analysis (group effect F = 0.596, p = 0.444; time × group interaction F = 0.86, p = 0.609), indicating similar diastolic blood pressure values across all observation periods.[20] These studies support our results by showing that blood pressure remained similar in both groups at all time points. This confirms that the differences observed in our study were not due to blood pressure variations.

MAP and oxygen saturation remained stable and comparable between the groups throughout the study, with no significant intergroup differences. Similarly, Nagaraju et al. reported that MAP was comparable between groups at all-time points: 1 min (ropivacaine 80.53 ± 4.83 vs. bupivacaine 88.63 ± 5.03 mmHg; p = 0.454), 30 min (80.97 ± 0.77 vs. 77.53 ± 1.11; p = 0.543), and 120 min (82.87 ± 0.68 vs. 80.03 ± 0.96; p = 0.326).17 Patil et al. found that mean oxygen saturation remained 99% in both groups postoperatively. At 24 h, SpO_2 was 98.4 ± 3.5% in Group R and 98.4 ± 0.2% in Group B, with no significant intergroup difference; only one transient desaturation (<90%) occurred in Group R.[18] These studies support our findings by showing that both MAP and oxygen saturation remained stable and similar between groups, confirming that observed outcomes were not influenced by haemodynamic or oxygenation differences.

Strength and clinical implications

The strengths of this study were the comparable baseline characteristics, standardised methodology, and comprehensive monitoring of analgesic efficacy and haemodynamic stability.

Both agents can be safely used for epidural analgesia, with bupivacaine offering a faster onset. Future studies should assess long-term outcomes, optimal dosing, and patient-centred recovery measures.

Limitations

This study was limited by its single-centre design and modest sample size. Follow-up was short. Pain assessment was subjective in nature. Only fixed drug concentrations were used, and functional recovery and patient satisfaction were not evaluated.

CONCLUSION

Both bupivacaine and ropivacaine provide effective and safe epidural analgesia for lower abdominal surgery. Bupivacaine offers a faster onset of analgesia, while ropivacaine demonstrates a favourable safety profile. The haemodynamic parameters and oxygen saturation remained stable and comparable between the two groups. Pain control was adequate for each drug. Overall, both agents can be reliably used based on clinical requirements and patient factors.

Acknowledgment

We thank the Dean and Head of the Department of Anaesthesiology, K.A.P.V. Government Medical College, Trichy, for granting permission and providing institutional support. We acknowledge the guidance of faculty members and the assistance of operation theatre, nursing, and technical staff.

REFERENCES

1. Kehlet H, Dahl JB. Anaesthesia, surgery, and challenges in postoperative recovery. Lancet 2003;362:1921–8. https://doi.org/10.1016/S0140-6736(03)14966-5.
2. Block BM, Liu SS, Rowlingson AJ, Cowan AR, Cowan JA Jr, Wu CL. Efficacy of postoperative epidural analgesia: a meta-analysis. JAMA 2003;290:2455–63. https://doi.org/10.1001/jama.290.18.2455.
3. Wheatley RG, Schug SA, Watson D. Safety and efficacy of postoperative epidural analgesia. Br J Anaesth 2001;87:47–61. https://doi.org/10.1093/bja/87.1.47.
4. Avila Hernandez AN, Hendrix JM. Epidural anesthesia. StatPearls, Treasure Island (FL): StatPearls Publishing; 2025.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

https://www.ncbi.nlm.nih.gov/books/NBK542219/. (Accessed on 11 December 2025)
5. Boulianne M, Verret M, O'Connor S, Savard X, Neveu X, Marcoux C, et al. Intraperitoneal local anaesthetics for postoperative pain management following intra-abdominal surgery: a systematic review and meta-analysis. BMC Anesthesiol 2025;25:235. https://doi.org/10.1186/s12871-025-03105-y.
6. Sarella H, Vishal PA, Prasanna BL. A comparative study of 0.75% epidural ropivacaine and 0.75% epidural ropivacaine with dexmedetomidine for postoperative analgesia in lower abdominal surgeries. Eur J Cardiovasc Med. 2025;15(1):126–132. https://doi.org/10.5083/ejcm/25-01-21.
7. Hofhuizen C, Lemson J, Snoeck M, Scheffer G-J. Spinal anaesthesia-induced hypotension is caused by a decrease in stroke volume in elderly patients. Local Reg Anesth 2019;12:19–26. https://doi.org/10.2147/LRA.S193925.
8. Shipton EA. New formulations of local anaesthetics-part I. Anesthesiol Res Pract 2012;2012:546409. https://doi.org/10.1155/2012/546409.
9. Swain A, Nag DS, Sahu S, Samaddar DP. Adjuvants to local anaesthetics: Current understanding and future trends. World J Clin Cases 2017;5:307–23. https://doi.org/10.12998/wjcc.v5.i8.307.
10. Shafiei FT, McAllister RK, Lopez J. Bupivacaine. StatPearls, Treasure Island (FL): StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK532883/. (Accessed on 11 December 2025)
11. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. Indian J Anaesth 2011;55:104–10. https://doi.org/10.4103/0019-5049.79875.
12. Kaur A, Singh RB, Tripathi RK, Choubey S. Comparison between bupivacaine and ropivacaine in patients undergoing forearm surgeries under axillary brachial plexus block: a prospective randomised study. J Clin Diagn Res 2015;9:UC01-6. https://doi.org/10.7860/JCDR/2015/10556.5446.
13. Gour A, Joshi VM, PBJ. Comparative effect of bupivacaine local anaesthesia with ropivacaine present with fentanyl. Bioinformation 2025;21:426–33. https://doi.org/10.6026/973206300210426.
14. Senard M, Joris JL, Ledoux D, Toussaint PJ, Lahaye-Goffart B, Lamy ML. A comparison of 0.1% and 0.2% ropivacaine and bupivacaine combined with morphine for postoperative patient-controlled epidural analgesia after major abdominal surgery. Anesth Analg 2002;95:444–9. https://doi.org/10.1097/00000539-200208000-00036.
15. Kumar Dash S, Kumar Behera N, Patanaik A, Panigrahi C, Nayak K, Sahoo S. Comparative study of postoperative epidural analgesia using 0.25% ropivacaine with tramadol versus 0.25% Bupivacaine with tramadol in abdominal and lower limb surgeries. Int J Curr Pharm Rev Res 2025; 17(5); 1146-1150 https://impactfactor.org/PDF/IJCPR/17/IJCPR%2CVol17%2CIssue5%2CArticle197.pdf. (Accessed on 11 December 2025)
16. Kalas A, P Rao M, Hussain A. Comparative study of epidural ropivacaine and bupivacaine with fentanyl in abdominal surgery. Bioinformation 2025;21:1739–44. https://doi.org/10.6026/973206300211739.
17. Nagaraju A, Rajanarenderreddy V, Karishma K. Comparison of ropivacaine (0.75%) and bupivacaine (0.5%) for epidural anaesthesia in patients undergoing elective lower abdominal surgeries. J Contemp Clin Pr 2025;11:245–51. https://doi.org/10.61336/jccp/25-07-34.
18. Patil SS, Kudalkar AG, Tendolkar BA. Comparison of continuous epidural infusion of 0.125% ropivacaine with 1 μg/ml fentanyl versus 0.125% bupivacaine with 1 μg/ml fentanyl for postoperative analgesia in major abdominal surgery. J Anaesthesiol Clin Pharmacol 2018;34:29–34. https://doi.org/10.4103/joacp.JOACP_122_16.
19. Pandey S, Borkar S, Monteiro JM, Mathew S, Vernekar D, Barreto O, et al. Comparative study of 0.5% bupivacaine, 0.5% ropivacaine, and 0.75% ropivacaine with fentanyl as a continuous intraoperative epidural infusion on post-operative analgesia. Cureus 2024;16:e59477. https://doi.org/10.7759/cureus.59477.
20. Olapour A, Akhondzadeh R, Rashidi M, Gousheh M, Homayoon R. Comparing the effect of bupivacaine and ropivacaine in cesarean delivery with spinal anaesthesia. Anesth Pain Med 2020;10:e94155. https://doi.org/10.5812/aapm.94155.