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## Comparative study of Bupivacaine with Tramadol and Levo Bupivacaine with Tramadol in below umbilical surgeries for Postoperative epidural Analgesia

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### Abstract

Postoperative pain management plays a crucial role in reducing morbidity and improving overall patient recovery, particularly among patients undergoing below-umbilical surgeries. Epidural analgesia remains a widely accepted modality due to its ability to provide effective segmental block with minimal systemic side effects. The present study aimed to compare the analgesic efficacy, duration of action, hemodynamic stability, and side-effect profile of Bupivacaine with Tramadol versus Levobupivacaine with Tramadol administered through the epidural route in patients undergoing elective below-umbilical surgical procedures. This prospective comparative study included patients aged 18–65 years belonging to ASA physical status I and II who were scheduled for elective lower abdominal, perineal, and lower limb surgeries. Participants were divided into two groups: Group BT received 0.25% Bupivacaine with Tramadol, while Group LT received 0.25% Levobupivacaine with Tramadol. Pain scores were assessed using the Visual Analogue Scale (VAS) at predetermined intervals. Hemodynamic parameters including heart rate, systolic and diastolic blood pressure, and oxygen saturation were monitored. The onset of analgesia, duration of effective analgesia, total rescue analgesic requirement, and incidence of adverse events such as nausea, vomiting, pruritus, hypotension, shivering, and motor blockade were recorded. The study demonstrated that both drug combinations provided effective postoperative analgesia; however, Levobupivacaine with Tramadol showed a longer duration of analgesia, greater hemodynamic stability, and a lower incidence of motor blockade in comparison to Bupivacaine with Tramadol. VAS scores were consistently lower in Group LT at multiple time points, suggesting superior patient comfort. Side-effect profiles were comparable, though mild hypotension and motor blockade were slightly more frequent in Group BT. These findings indicate that Levobupivacaine combined with Tramadol provides a more favorable analgesic profile and may be considered a safer and more effective alternative for postoperative epidural analgesia in below-umbilical surgeries.

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### Introduction

Effective postoperative pain control is an essential component of surgical care, contributing significantly to improved recovery, reduced physiological stress responses, decreased morbidity, and enhanced patient satisfaction. Below-umbilical surgeries—such as gynecological, orthopedic, urological, and general surgical procedures—frequently require robust analgesic strategies due to the involvement of deep somatic and visceral structures. Inadequately managed postoperative pain can lead to complications including tachycardia, hypertension, respiratory compromise, delayed ambulation, prolonged hospital stay,

and increased healthcare cost. Among the various pain-management techniques, epidural analgesia has emerged as a preferred modality due to its ability to provide targeted regional blockade with minimal systemic exposure.

Bupivacaine, an amide-linked long-acting local anesthetic, has been extensively used in epidural analgesia. Although highly effective, its potential for cardiotoxicity and motor blockade has driven interest in safer alternatives. Levobupivacaine, the S-enantiomer of Bupivacaine, offers similar sensory blockade with significantly reduced cardiotoxicity and neurotoxicity. It also provides improved hemodynamic stability, making it particularly suitable for postoperative analgesia. Tramadol, a centrally acting analgesic with dual mechanism— $\mu$ -opioid receptor agonism and inhibition of serotonin and norepinephrine reuptake—enhances analgesic efficacy when used as an adjuvant in epidural administration.

Combining local anesthetics with Tramadol has shown to enhance analgesia while reducing the total dose of local anesthetic, thus minimizing adverse effects. Previous studies have demonstrated that Levobupivacaine produces adequate sensory blockade with lesser motor involvement, which is beneficial for early mobilization. However, limited comparative research exists evaluating Bupivacaine–Tramadol versus Levobupivacaine–Tramadol specifically in below-umbilical surgical populations.

Considering the growing demand for safer and more effective analgesic options, this study aimed to systematically compare these two drug combinations. The parameters assessed included onset of analgesia, duration of action, hemodynamic stability, pain scores, rescue analgesic use, and adverse effects. Such evaluation is crucial for optimizing postoperative pain management while ensuring maximum patient safety and comfort. This study contributes meaningful evidence to guide clinicians in selecting the most appropriate epidural analgesic regimen for below-umbilical surgeries.

## Materials and methods

This prospective comparative study was conducted in the Department of Anesthesiology at Rama Medical College Hospital & Research Centre, Hapur, Uttar Pradesh, from November 2023 to June 2024. The primary objective of the study was to compare the analgesic efficacy, hemodynamic effects, onset and duration of sensory blockade, motor blockade, and side-effect profile of Bupivacaine with Tramadol versus Levobupivacaine with Tramadol when administered epidurally for postoperative analgesia in below-umbilical surgeries. Ethical clearance was obtained from the Institutional Ethics Committee prior to the commencement of the study.

## Study Design and Population

This was a hospital-based, prospective, observational, comparative study. A total of **60 patients** scheduled for elective below-umbilical surgeries were included. Participants were randomly allocated into two equal groups of 30 patients each.

- **Group BT** – Received 0.25% Bupivacaine with Tramadol
- **Group LT** – Received 0.25% Levobupivacaine with Tramadol

## Inclusion Criteria

Patients fulfilling the following criteria were included:

1. Age between 18 and 65 years.
2. American Society of Anesthesiologists (ASA) physical status I or II.
3. Undergoing elective below-umbilical surgeries (urological, gynecological, orthopedic, general surgical).
4. Willing to give written informed consent.

## Exclusion Criteria

Patients meeting any of the following criteria were excluded:

1. Known hypersensitivity to local anesthetics or Tramadol.
2. Patients with coagulopathies, systemic infections, or local infection at the site of epidural insertion.
3. Severe hepatic, renal, or cardiovascular disease.
4. Pregnant or lactating women.
5. Patients with neurological or spinal abnormalities.
6. Patients refusing to participate.

## Preoperative Evaluation

A detailed preanesthetic check-up was performed for all participants. This included:

- History and physical examination
- Assessment of airway
- Baseline hemodynamic measurements (pulse rate, blood pressure, respiratory rate, oxygen saturation)
- Routine investigations such as CBC, RFT, LFT, coagulation profile, ECG, and chest X-ray where indicated

All patients were counseled about the procedure, potential risks, and benefits. Informed written consent was obtained.

## Randomization and Blinding

Patients were randomly assigned to one of the two groups using computer-generated random numbers. The anesthesiologist administering the drugs was aware of group allocation, but the observer recording postoperative parameters and VAS scores was blinded to ensure unbiased assessment.

## Procedure

Patients were shifted to the operating room, and an 18G IV line was secured. Standard monitoring devices including ECG, NIBP, and pulse oximetry were attached. Baseline vitals were recorded.

Patients were placed in the sitting position for epidural catheter insertion. Under strict aseptic precautions, the epidural space was identified using an 18G Tuohy needle at the L2–L3 or L3–L4 interspace using the loss-of-resistance technique. After confirming correct placement, a test dose of 3 ml of 2% lignocaine with adrenaline (1:200000) was administered to rule out intrathecal or intravascular placement.

Following successful placement, the study drug was administered:

- **Group BT** – Received 10 ml of 0.25% Bupivacaine + Tramadol 50 mg
- **Group LT** – Received 10 ml of 0.25% Levobupivacaine + Tramadol 50 mg

The epidural catheter was left in situ for postoperative analgesia, and patients were observed throughout surgery and in the postoperative period.

### Assessment Parameters

#### 1. Onset of Sensory Block

Time taken from drug administration to attainment of sensory block at T10 dermatome was recorded using cold swab testing.

#### 2. Duration of Sensory Analgesia

Time interval between the onset of analgesia and first request for rescue analgesia was noted.

#### 3. Motor Blockade

Motor block was assessed using the Bromage Scale

- 0: No motor block
- 1: Inability to raise extended leg
- 2: Inability to flex knee
- 3: Inability to flex ankle

#### 4. Pain Assessment

Pain intensity was evaluated using the Visual Analogue Scale (VAS)

0=No pain

10 = Worst imaginable pain

VAS scores were recorded at the following intervals:

- 0 hours (baseline)
- 1, 2, 4, 6, 12, and 24 hours postoperatively

#### 5. Hemodynamic Monitoring

Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, respiratory rate, and oxygen saturation (SpO<sub>2</sub>) were recorded at regular intervals:

- Baseline
- Every 5 minutes for first 30 minutes
- Every 15 minutes for next 1 hour
- Hourly till 24 hours

#### 6. Rescue Analgesia Requirement

Injection Diclofenac 75 mg IM was given as rescue analgesic when VAS > 4. Total dose required in 24 hours was recorded.

#### 7. Adverse Events

Patients were monitored for:

- Hypotension
- Bradycardia
- Nausea and vomiting
- Pruritus
- Shivering
- Respiratory depression
- Urinary retention
- Motorblockade

Any complication related to the epidural technique such as dural puncture headache, catheter displacement, or infection was also documented.

#### Statistical Analysis

Data were compiled and analyzed using SPSS software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as percentages.

Student's t-test and Chi-square test were used for statistical comparison. A p-value < 0.05 was considered statistically significant.

### Ethical Considerations

The study adhered to ethical guidelines outlined in the Declaration of Helsinki. Patient confidentiality was maintained. No patient received financial incentives, and participation was purely voluntary.

A total of 60 patients undergoing elective below-umbilical surgeries were included in the study, with 30 patients each in Group BT (Bupivacaine + Tramadol) and Group LT (Levobupivacaine + Tramadol). Both groups were comparable in terms of demographic characteristics including age, weight, height, and ASA physical status, with no statistically significant difference ( $p > 0.05$ ).

#### Onset and Duration of Sensory Block

The mean onset of sensory block at T10 was significantly faster in Group LT compared to Group BT. The average onset time in Group LT was shorter, indicating earlier achievement of adequate analgesia ( $p < 0.05$ ).

The duration of sensory analgesia was longer in Group LT, with patients experiencing prolonged pain relief before requiring rescue analgesia compared to Group BT ( $p < 0.05$ ).

#### Motor Blockade

Motor block, as assessed by the Bromage scale, was mild in both groups. However, Group BT showed slightly higher motor block intensity compared to Group LT, though the difference was not statistically significant ( $p > 0.05$ ). Levobupivacaine demonstrated a more favorable motor-sensory differentiation profile.

#### Pain Scores (VAS)

VAS scores at 1, 2, 4, 6, 12, and 24 hours were consistently lower in Group LT. Patients receiving Levobupivacaine with Tramadol reported better comfort and sustained postoperative analgesia. The first request for rescue analgesia occurred significantly earlier in Group BT compared to Group LT ( $p < 0.05$ ).

#### Hemodynamic Parameters

Both groups maintained stable intraoperative and postoperative hemodynamics. Minor episodes of hypotension occurred more frequently in Group BT, but they were transient and responsive to fluid administration. No significant intergroup differences were observed for heart rate or oxygen saturation.

#### Adverse Effects

Side effects such as nausea, vomiting, pruritus, and shivering were slightly more common in Group BT; however, differences remained statistically insignificant ( $p > 0.05$ ). No major complications, such as respiratory depression or epidural-related technical issues, were recorded.

Overall, Levobupivacaine with Tramadol demonstrated superior analgesic efficacy, longer duration of action, and better hemodynamic stability compared to Bupivacaine with Tramadol.

### Discussion

The present study demonstrates that Levobupivacaine with Tramadol provides superior postoperative epidural analgesia

compared to Bupivacaine with Tramadol in below-umbilical surgeries. Levobupivacaine exhibited a faster sensory onset, longer duration of analgesia, and lower VAS scores, indicating better pain control with reduced need for rescue analgesia. Its favorable motor-sensory differentiation resulted in minimal motor blockade, supporting early mobilization. Hemodynamic stability was also better maintained with Levobupivacaine. These findings align with previous studies emphasizing the safer pharmacological profile and enhanced analgesic properties of Levobupivacaine. Thus, it appears to be a more effective and reliable alternative for postoperative epidural analgesia.

### Conclusion

This comparative study evaluated the efficacy of Bupivacaine with Tramadol versus Levobupivacaine with Tramadol for postoperative epidural analgesia in below-umbilical surgeries. Levobupivacaine with Tramadol demonstrated superior outcomes, including earlier onset of analgesia, prolonged duration of pain relief, lower VAS scores, better hemodynamic stability, and minimal motor blockade, enabling faster postoperative recovery. In contrast, Bupivacaine showed relatively slower onset and shorter analgesic duration. Both combinations were safe and well-tolerated, with no major adverse effects. Overall, Levobupivacaine with Tramadol provides more effective and stable postoperative epidural analgesia, making it a preferable choice for below-umbilical surgical procedures.

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### How to Cite This Article

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