ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 02 | February - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

# ANALGESIC EFFICACY OF LEVOBUPIVACAINE WITH BUPRENORPHINE VERSUS LEVOBUPIVACAINE WITH DEXMEDETOMIDINE IN ULTRASOUND-GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCK FOR LOWER ABDOMINAL SURGERIES

Anaesthesiology

**Dr Prachi Bhageria** Junior Resident, B.R.D. Medical College, Gorakhpur, U.P., India
**Dr. Sunil Kumar Arya** HOD, B.R.D. Medical College, Gorakhpur, U.P., India
**Dr. Shailendra Upadhyay** MD, B.R.D. Medical College, Gorakhpur, U.P., India
**Dr. Satish Kumar** MD, B.R.D. Medical College, Gorakhpur, U.P., India
**Dr. Shahbaz Ahmed** MD, B.R.D. Medical College, Gorakhpur, U.P., India
**Dr. Mahtab Alam** MD, B.R.D. Medical College, Gorakhpur, U.P., India

## ABSTRACT

**Background and Aims:** Lower abdominal surgeries are often associated with significant postoperative pain requiring effective management. Ultrasound-guided Transversus Abdominis Plane (TAP) block using levobupivacaine provides effective analgesia but with limited duration. This study aimed to compare dexmedetomidine and buprenorphine as adjuvants to levobupivacaine in TAP blocks for enhanced analgesic efficacy and duration. **Methods:** This prospective, randomized study included 60 ASA I-II patients undergoing lower abdominal surgeries under spinal anesthesia. Patients were randomized into two groups: Group LB received 20 ml of 0.25% levobupivacaine with 150 mcg buprenorphine, and Group LD received 20 ml of 0.25% levobupivacaine with 0.5 mcg/kg dexmedetomidine. Postoperative pain (VAS scores at rest and movement), time to first rescue analgesia, total fentanyl consumption, adverse effects, and patient satisfaction were assessed over 24 hours. Ethical approval and informed consent were obtained. **Results:** Group LD demonstrated a significantly prolonged time to first rescue analgesia (749.17 ± 68.55 min vs. 692.67 ± 45.02 min; $p < 0.01$) and consistently lower VAS scores compared to Group LB. Total fentanyl consumption was lower in Group LD (56.7 ± 17.29 µg vs. 65 ± 23.3 µg; $p = 0.123$). Adverse effects, including nausea (6.7% vs. 13.3%) and sedation (13.3% vs. 20%), were fewer in Group LD, which also had higher patient satisfaction (83.33% extremely satisfied vs. 66.7%). **Conclusion:** Dexmedetomidine as an adjuvant to levobupivacaine provides superior analgesia, prolonged pain relief, reduced opioid consumption, and fewer side effects, making it a preferable choice over buprenorphine for lower abdominal surgeries.

## KEYWORDS

Levobupivacaine, Dexmedetomidine, Buprenorphine, TAP Block, Postoperative Analgesia.

## INTRODUCTION

Lower abdominal surgeries, such as inguinal hernioplasty, abdominal hysterectomy, caesarean sections, and colorectal surgeries, are widely performed to address both benign and malignant conditions. (1,2) These procedures are often associated with significant postoperative pain due to full-thickness incisions and manipulation of the abdominal wall. This pain, peaking in the first 48 hours after surgery, can lead to complications such as impaired wound healing, venous thromboembolism, pulmonary dysfunction, and delayed recovery if not effectively managed. (3,4)

Postoperative pain involves both somatic and visceral components, requiring comprehensive analgesic strategies to address these distinct pain pathways. (5) Traditional pain management approaches, including systemic opioids and NSAIDs, are commonly used but are often inadequate for complete pain relief and carry risks of adverse effects such as respiratory depression, nausea, gastrointestinal irritation, and renal impairment. More invasive methods, like epidural analgesia, though effective, are associated with complications such as hypotension, motor blockade, and procedural risks, highlighting the need for safer, more effective alternatives. (6,7,8)

Ultrasound-guided Transversus Abdominis Plane (TAP) block has gained prominence as a regional anesthesia technique for postoperative pain management in lower abdominal surgeries. By delivering local anesthetics into the neurofascial plane between the internal oblique and transversus abdominis muscles, TAP blocks effectively target the nerves supplying the anterior and lateral abdominal wall, providing excellent somatic pain relief. However, the duration of analgesia with local anesthetics like levobupivacaine alone is limited, typically lasting 4–6 hours. (9,10)

To extend the duration of analgesia and improve patient outcomes, adjuvants such as buprenorphine and dexmedetomidine have been explored. Buprenorphine, a partial opioid agonist, enhances the analgesic effects of local anesthetics and offers a favorable safety profile due to its ceiling effect on respiratory depression. Dexmedetomidine, an alpha-2 adrenergic agonist, provides sedative and analgesic benefits without respiratory compromise. These agents, when combined with levobupivacaine, have shown promise in enhancing the efficacy and duration of TAP block analgesia. (11,12)

This study aims to compare the efficacy of buprenorphine and dexmedetomidine as adjuvants to isobaric levobupivacaine in ultrasound-guided TAP blocks for lower abdominal surgeries. By evaluating pain scores, opioid consumption, and the incidence of side effects, this research seeks to identify the superior combination for postoperative analgesia, contributing to improved patient outcomes and advancing regional anesthesia techniques.

## Material and Methods

### Study Setting and Participants

This prospective observational study was conducted in the Routine Operation Theatre of the Department of Anaesthesiology at Nehru Hospital, B.R.D. Medical College, Gorakhpur, from March 2023 to March 2024. Ethical approval was obtained from the institutional ethical committee, and informed written consent was acquired from all participants. The study included patients aged 18–60 years, classified as ASA physical status I–II, scheduled for lower abdominal surgeries under spinal anesthesia.

### Study Design and Sample Size

The study was designed to compare the efficacy of buprenorphine and dexmedetomidine as adjuvants to levobupivacaine in ultrasound-guided TAP blocks. Based on previous studies, the sample size was calculated to detect a significant difference in the time to first rescue analgesia between the two groups, with a power of 90% and an alpha level of 0.05. A total of 60 patients were enrolled, randomized into two groups of 30 each.

### Randomization and Group Allocation

Patients were randomized using the chit-and-box method into two groups:

- Group LB (n=30): Received 20 ml of 0.25% levobupivacaine with

150 mcg buprenorphine (diluted in 2 ml saline) on each side.
- Group LD (n=30): Received 20 ml of 0.25% levobupivacaine with 0.5 mcg/kg dexmedetomidine (diluted in 2 ml saline) on each side.

**Inclusion Criteria**
- Age 18–60 years.
- ASA physical status I–II.
- Scheduled for lower abdominal surgeries under spinal anesthesia.

**Exclusion Criteria**
- Refusal to participate.
- BMI ≥ 35 kg/m².
- Allergy to local anesthetics or study drugs.
- Contraindications to spinal anesthesia.
- Inability to use the Visual Analog Scale (VAS) for pain assessment.

**Preoperative Assessment and Preparation**

Preoperative anesthesia assessment was conducted a day prior. Patients were briefed about the procedures and educated on using the VAS for pain evaluation. Routine investigations were performed per hospital protocols. Premedication included oral ranitidine 150 mg and alprazolam 0.25 mg administered the night before surgery and on the morning of surgery. All patients adhered to ASA guidelines for nil per oral status.

**Procedure**

Spinal anesthesia was administered under aseptic conditions with a 25G spinal needle at the L2–L3 or L3–L4 space using 2.2–3.5 ml of 0.5% bupivacaine heavy. Following spinal anaesthesia, ultrasound-guided TAP blocks were performed using a high-frequency linear probe (5–13 MHz). The probe was placed at the mid-axillary line between the iliac crest and subcostal margin. A 22G echogenic needle was inserted using an in-plane technique, and the neurofascial plane between the internal oblique and transversus abdominis muscles was identified. After hydrodissection with 2 ml saline, the respective drug combination was injected incrementally under ultrasound guidance, ensuring proper distribution.

**Postoperative Care and Assessments**

Patients were monitored in the postoperative care unit (PACU). Pain was assessed using the VAS at rest and during movement at 2, 4, 6, 8, 12, and 24 hours. Intravenous paracetamol (1 g) was administered every 8 hours. Rescue analgesia with intravenous fentanyl (50 mcg) was provided for VAS ≥ 4, and the time to first rescue analgesia was recorded. Total analgesic consumption and adverse effects were documented.

**Outcome Measures**
1. **Primary Outcome:** Time to first rescue analgesia (VAS ≥ 4).
2. **Secondary Outcomes:** Total fentanyl consumption, VAS scores at rest and during movement, and incidence of adverse effects (nausea, vomiting, sedation, dry mouth, headache).

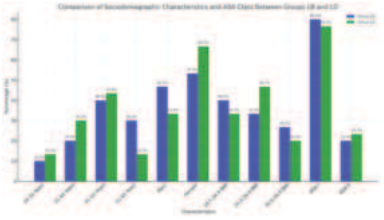
**Statistical Analysis**

Data were analyzed using SPSS v28. Continuous variables were expressed as mean ± SD and compared using the unpaired t-test or Mann-Whitney U test. Categorical variables were analyzed using the chi-square test or Fisher's exact test. A p-value < 0.05 was considered statistically significant.


**RESULTS**

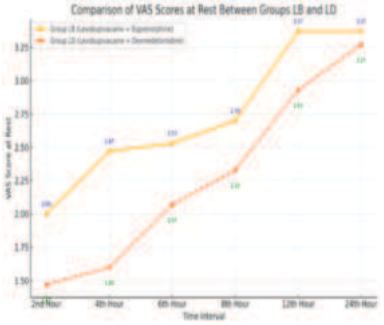
The distribution of age, gender, BMI, and ASA classification across Groups LB (Levobupivacaine + Buprenorphine) and LD (Levobupivacaine + Dexmedetomidine) is shown in Table 1. Both groups demonstrate comparable distributions, with slight variations in specific categories like gender and BMI.

| Socio-demographic Characteristics | | Group LB (Levobupivacaine + Buprenorphine) | | Group LD (Levobupivacaine + Dexmedetomidine) | | P-value |
|---|---|---|---|---|---|---|
| Age Group (Years) | Values | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) | |
| | 18-30 | 3 | 10.0 | 4 | 13.3% | 0.439 |
| | 31-40 | 6 | 20.0 | 9 | 30.0% | |
| | 41-50 | 12 | 40.0 | 13 | 43.4% | |
| | 51-60 | 9 | 30.0 | 4 | 13.3% | |
| Gender | Male | 14 | 46.7% | 10 | 33.3% | 0.292 |
| | Female | 16 | 53.3% | 20 | 66.7% | |
| BMI | 18.5-24.9 Kg/m2 | 12 | 40.0% | 10 | 33.3% | |
| | 25.0-29.9 Kg/m2 | 10 | 33.3% | 14 | 46.7% | 0.567 |
| | 30.0-34.9 Kg/m2 | 8 | 26.7% | 6 | 20% | |
| ASA Class | I | 24 | 80.0% | 23 | 76.6% | 1.000 |
| | II | 6 | 20.0% | 7 | 23.3% | |
| Time of 1st analgesic dose | Mean+SD | 692.67+45.02 | | 749.17+68.55 | | <0.01 |



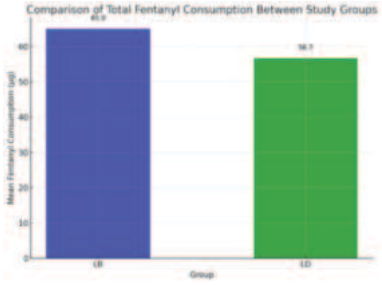
The VAS scores at rest and movement across different postoperative time intervals for Groups LB (Levobupivacaine + Buprenorphine) and LD (Levobupivacaine + Dexmedetomidine). Group LD consistently demonstrated lower VAS scores at rest and during movement compared to Group LB, indicating better postoperative pain relief.

| Time Interval | VAS Score at Rest (Group LB) Mean+SD | VAS Score at Rest (Group LD) Mean+SD | Unpaired t Test p-value | VAS Score at Movement (Group LB) Mean+SD | VAS Score at Movement (Group LD) Mean+SD | Unpaired t Test p-value |
|---|---|---|---|---|---|---|
| 2nd Hour | 2.00+0.26 | 1.47+0.51 | <0.01 | 2.13+0.43 | 1.87+0.35 | <0.05 |
| 4th Hour | 2.47+0.63 | 1.60+0.56 | <0.01 | 2.63+0.49 | 2.20+0.41 | <0.01 |
| 6th Hour | 2.53+0.57 | 2.07+0.25 | <0.01 | 2.67+0.48 | 2.47+0.51 | 0.12 |
| 8th Hour | 2.70+0.53 | 2.33+0.48 | <0.01 | 2.87+0.51 | 2.67+0.48 | 0.12 |
| 12th Hour | 3.37+0.56 | 2.93+0.64 | <0.01 | 3.90+0.31 | 3.37+0.56 | <0.01 |
| 24th Hour | 3.37+0.56 | 3.27+0.69 | <0.01 | 3.63+0.49 | 3.63+0.56 | 1.00 |



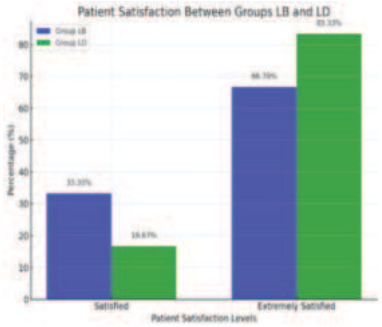

Mean, median, and standard deviation of fentanyl consumption in Groups LB (Levobupivacaine + Buprenorphine) and LD (Levobupivacaine + Dexmedetomidine) is shown in table 3. Although Group LD had slightly lower mean fentanyl consumption, the difference was not statistically significant (p=0.123).

| Total amount of Fentanyl consumption | Group LB (µg) | Standard Deviation | Group LD (µg) | Standard Deviation | P-Value |
|---|---|---|---|---|---|
| Mean | 65 | 23.30 | 56.7 | 17.29 | 0.123 |
| Median | 50.0 | | 50.0 | | |



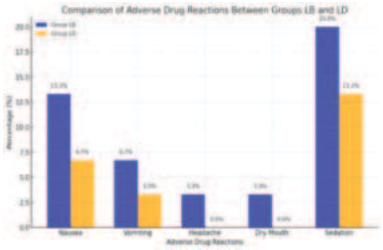

Levels of patient satisfaction between Groups LB (Levobupivacaine + Buprenorphine) and LD (Levobupivacaine + Dexmedetomidine) is shown in Table 4. Group LD demonstrated a higher percentage of "Extremely Satisfied" patients (83.33%) compared to Group LB (66.7%), indicating superior satisfaction with postoperative analgesia.

| Patient Satisfaction | Group LB (Levobupivacaine + Buprenorphine) | | Group LD (Levobupivacaine + Dexmedetomidine) | | P Value |
|---|---|---|---|---|---|
| | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) | |
| Satisfied | 10 | 33.3 | 5 | 16.67 | |
| Extremely Satisfied | 20 | 66.7 | 25 | 83.33 | 0.23 |
| Total | 30 | 100.0 | 30 | 100.0 | |




The comparison of adverse drug reactions between Groups LB (Levobupivacaine + Buprenorphine) and LD (Levobupivacaine + Dexmedetomidine) is shown in Table 5. Group LB showed higher incidences of side effects, particularly nausea (13.3%) and sedation (20%), compared to Group LD.

| Adverse Drug Reaction | Group LB | | Group LD | |
|---|---|---|---|---|
| | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) |
| Nausea | 4 | 13.3% | 2 | 6.7% |
| Vomiting | 2 | 6.7% | 1 | 3.3% |
| Headache | 1 | 3.3% | 0 | 0% |
| Dry Mouth | 1 | 3.3% | 0 | 0% |
| Sedation | 6 | 20% | 4 | 13.3% |




## DISCUSSION

This study compared the efficacy of dexmedetomidine and buprenorphine as adjuvants to levobupivacaine in TAP blocks for patients undergoing lower abdominal surgeries.

The time to first analgesic request was significantly longer in Group LD (levobupivacaine + dexmedetomidine) at 749.17 ± 68.55 minutes compared to Group LB (levobupivacaine + buprenorphine) at 692.67 ± 45.02 minutes ($p < 0.01$). These results align with studies by Parameswari et al, (13) where the time for rescue analgesia was prolonged in the dexmedetomidine group (14.25 hours vs. 7.73 hours in the bupivacaine-alone group). Similarly, Almarakbi et al (14) and Mohanty et al (15) reported significantly longer analgesic durations in dexmedetomidine groups.

In our study VAS Scores, At rest, Group LD showed consistently lower VAS scores at all postoperative intervals (e.g., 2 hours: 1.47 vs. 2.00, $p < 0.01$) compared to Group LB. During movement, Group LD had significantly lower VAS scores at the 2nd and 4th hours (1.87 vs. 2.13 and 2.20 vs. 2.63, $p < 0.05$). However, no significant difference was observed beyond the 8th hour. These findings are consistent with those of Neethirajan et al (16), who observed lower pain scores at 2, 4, and 6 hours in the dexmedetomidine group, and Mohanty et al (15), who noted superior pain control with dexmedetomidine.

Regarding Opioid Consumption, Total fentanyl consumption was lower in Group LD (56.7 ± 17.29 µg) compared to Group LB (65 ± 23.3 µg) over 24 hours, though the difference was not statistically significant. This finding aligns with studies by Kassim et al (17), where total rescue opioid consumption was lower in the dexmedetomidine group, and Sherif et al (18), who reported reduced morphine requirements in dexmedetomidine groups.

Both groups were hemodynamically stable, with no significant differences in pulse rate, blood pressure, or oxygen saturation. One case of bradycardia in Group LD was managed with atropine. These results were similar with findings of Parameswari et al (13), who reported minimal hemodynamic changes in dexmedetomidine groups, although Neethirajan et al (16) noted transient reductions in heart rate and blood pressure with higher dexmedetomidine doses.

The Side Effects in Group LD experienced fewer adverse effects compared to Group LB. Nausea (6.7% vs. 13.3%) and sedation (13.3% vs. 20%) were less frequent in Group LD. These findings are consistent with studies by Mohanty et al (15) and Almarakbi et al (13), who reported minimal differences in side effects between dexmedetomidine and control groups.

Regarding Patient Satisfaction, both groups reported high levels of satisfaction, Group LD had a higher proportion of extremely satisfied patients (83.33% vs. 66.7% in Group LB), highlighting the superior analgesic efficacy and tolerability of dexmedetomidine.

The findings of our study indicate that dexmedetomidine as an adjuvant to levobupivacaine in TAP blocks provides superior analgesia, prolongs the duration of pain relief, and reduces opioid consumption compared to buprenorphine. Additionally, dexmedetomidine demonstrated fewer side effects, making it a preferable choice for postoperative analgesia in lower abdominal surgeries. These results, supported by prior studies, highlight the potential of dexmedetomidine to enhance patient outcomes and satisfaction while minimizing analgesic-related complications. Further large-scale studies are warranted to validate these findings and refine clinical guidelines.

## LIMITATIONS

This study was limited by its relatively small sample size and single-center design, which may restrict the generalizability of the findings.

Additionally, long-term outcomes beyond 24 hours postoperatively were not evaluated.

**Recommendations**

Future studies should include larger, multicenter trials with extended follow-up periods to assess long-term analgesic outcomes. Incorporating a placebo-controlled design and exploring additional adjuvants or combinations in TAP blocks could further refine postoperative pain management strategies for lower abdominal surgeries.

## CONCLUSION

The study concluded that dexmedetomidine as an adjuvant to levobupivacaine in TAP blocks provides superior postoperative analgesia compared to buprenorphine. Group LD showed a significantly longer time to first analgesic dose, consistently lower VAS scores, higher patient satisfaction (83.33% extremely satisfied vs. 66.7%), and fewer side effects like nausea and sedation. While fentanyl consumption was slightly lower in Group LD, the difference was not statistically significant. These findings suggest that dexmedetomidine offers prolonged analgesia, better pain control, and improved tolerability, making it a preferable choice over buprenorphine for lower abdominal surgeries.

**Conflict of Interest:** The authors declare no conflicts of interest.
**Funding:** No funding was received.
**Consent:** Written consent from participants has been obtained and preserved.
**Ethical Approval:** Ethical approval was obtained and documented as per institutional guidelines.

## REFERENCES

1. Arbel T. Pain management following abdominal hysterectomy: novel approaches and review of the literature. J Clin Gynecol Obstet. 2013.
2. Wall PD, Melzack R, editors. Textbook of Pain. 4th ed. Edinburgh: Churchill Livingstone; 1999.
3. The use of NSAIDs in the postoperative period: advantage and disadvantages. J Anesth Crit Care. 2015;3.
4. Hindle A. Intrathecal opioids in the management of acute postoperative pain. Contin Educ Anaesth Crit Care Pain. 2008;8(3):81–5.
5. Rawal N. Epidural analgesia for postoperative pain: improving outcomes or adding risks? Best Pract Res Clin Anaesthesiol. 2021;35:53–65.
6. O'Donnell BD, McDonnell JG, McShane AJ. The transversus abdominis plane (TAP) block in open retropubic prostatectomy. Reg Anesth Pain Med. 2006;31(1):91.
7. McDonnell JG, O'Donnell B, Curley G, Heffernan A, Power C, Laffey JG. The analgesic efficacy of transversus abdominis plane block after abdominal surgery: a prospective randomized controlled trial. Anesth Analg. 2007;104(1):193–7.
8. Garg R. Regional block: walking away from central to peripheral nerves and planes for local anaesthetic drug deposition. Indian J Anaesth. 2019;63:517–9.
9. Burlacu CL, Buggy DJ. Update on local anesthetics: focus on levobupivacaine. Ther Clin Risk Manag. 2008;4:381–92.
10. Sun Q, Liu S, Wu H, Ma H, Liu W, Fang M, et al. Dexmedetomidine as an adjuvant to local anesthetics in transversus abdominis plane block. Clin J Pain. 2019;35:375–84.
11. Aksu R, Patmano G, Biçer C, Emek E, Çoruh AE. Efficiency of bupivacaine and association with dexmedetomidine in transversus abdominis plane block ultrasound guided in postoperative pain of abdominal surgery. Braz J Anesthesiol (Engl Ed). 2018;68:49–56.
12. Elshalakany NA, Salah AM. Effect of transversus abdominis plane block with or without buprenorphine after inguinal hernia surgery on postoperative pain. Anaesthesiol Intensive Ther. 2023;55:277–84.
13. Parameswari AR, Udayakumar P. Comparison of efficacy of bupivacaine with dexmedetomidine versus bupivacaine alone for transversus abdominis plane block for postoperative analgesia in patients undergoing elective caesarean section. J Obstet Gynaecol India. 2018;68:98–103.
14. Almarakbi W, Kaki A. Addition of dexmedetomidine to bupivacaine in transversus abdominis plane block potentiates postoperative pain relief among abdominal surgeries. Saudi J Anaesth. 2014;8(2):220–4.
15. Mohanty S, Das P, Sethi A, Routray S, Sidharth D. Efficacy of dexmedetomidine as an adjuvant to levobupivacaine in transversus abdominis plane block for gynecological laparoscopic surgery: a randomized double-blind study. Indian J Pain. 2018;32(3):144–9.
16. Neethirajan SGR, Kurada S, Parameswari A. Efficacy of dexmedetomidine as an adjuvant to bupivacaine in ultrasound-guided transversus abdominis plane block for laparoscopic appendicectomy: a randomised controlled study. Turk J Anaesthesiol Reanim. 2020;48:364–70.
17. Kassim DY, Mahmoud HEM, Fakhry DM, Mansour MAES. Comparative study of dexmedetomidine versus fentanyl as adjuvants to bupivacaine in ultrasound-guided transversus abdominis plane block in patients undergoing radical cystectomy: a prospective randomized study. BMC Anesthesiol. 2022;22:120.
18. El Sherif FA, Abdel-Ghaffar H, Othman A, Mohamed S, Omran M, Shouman S, et al. Pharmacokinetics and pharmacodynamics of dexmedetomidine administered as an adjunct to bupivacaine for transversus abdominis plane block in patients undergoing lower abdominal cancer surgery. J Pain Res. 2022;15:1–12.