Comparative Study of Postoperative Analgesia Between 0.25% Levobupivacaine with Dexamethasone And 0.25% Ropivacaine with Dexamethasone in Ultrasound-Guided Tap Block for Lower Abdominal Surgeries

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Abstract*— Postoperative pain management plays a critical role in patient recovery following lower abdominal surgeries. Transversus abdominis plane (TAP) block, a regional anesthesia technique, provides effective somatic pain relief. This study aimed to compare the efficacy of 0.25% levobupivacaine with dexamethasone and 0.25% ropivacaine with dexamethasone in ultrasound-guided TAP blocks. A prospective, randomized, double-blind controlled study was conducted on 52 patients undergoing lower abdominal surgeries. Patients were randomized into two groups: Group Ld (20 mL of 0.25% levobupivacaine + 2 mL dexamethasone) and Group Rd (20 mL of 0.25% ropivacaine + 2 mL dexamethasone). Pain was assessed at predefined time intervals (0–24 hours) using the Visual Analog Scale (VAS). Rescue analgesia was provided for VAS scores >4. Patients in Group Ld experienced significantly lower VAS scores at 4, 8, 12, and 20 hours postoperatively compared to Group Rd ($p < 0.01$). The duration of analgesia was longer in Group Ld, with fewer rescue analgesia requirements. Both groups demonstrated comparable safety profiles without notable adverse effects. The combination of levobupivacaine with dexamethasone offers superior postoperative pain control compared to ropivacaine with dexamethasone in TAP blocks for lower abdominal surgeries. These findings highlight the potential clinical advantage of levobupivacaine as a preferred local anesthetic in managing postoperative pain.

Indexed Terms- Levobupivacaine, Ropivacaine, Dexamethasone, TAP Block, Postoperative Pain

I. INTRODUCTION

Lower abdominal surgeries are among the most commonly performed procedures, often associated with significant postoperative pain. This pain, primarily stemming from incisions in the abdominal wall, can hinder recovery, reduce patient comfort, and increase the risk of complications such as immobility-related issues and hospital-acquired infections [1].

For postoperative analgesia, a variety of techniques are used, including intravenous opioids, NSAIDs, epidural analgesia, local wound infiltration, and regional nerve blocks. The TAP block is a widely adopted regional anesthesia technique that provides somatic pain relief by targeting the anterior abdominal wall [2].

Levobupivacaine and ropivacaine are commonly used local anesthetics for TAP blocks due to their favorable safety profiles. Adding adjuvants such as dexamethasone to local anesthetics further enhances their analgesic effect. Dexamethasone, a potent corticosteroid, prolongs the duration of anesthesia and reduces inflammatory responses, thus improving postoperative pain relief.

Ultrasound guidance has revolutionized the administration of TAP blocks by enhancing the precision and safety of local anesthetic delivery

[3,4,5,6]. By accurately depositing the drug into the transversus abdominis plane, ultrasound guidance ensures consistent efficacy while minimizing complications.

The present study aims to evaluate and compare the efficacy of ultrasound-guided TAP blocks using 0.25% levobupivacaine with dexamethasone versus 0.25% ropivacaine with dexamethasone for managing postoperative pain in lower abdominal surgeries.

II. MATERIALS AND METHODS

Subjects

This prospective, randomized double blinded controlled study was conducted at the department of anesthesiology in the multi-speciality operation theatre of the Fortis hospital, Mohali, Punjab, India. The present study was based on purposively selected 52 patients (age ranged between 20-80 years) belonging to American Society of Anesthesiology (ASA) grade I-II, who were undergoing lower abdominal surgery.

In this study, subjects were further divided into two groups for intervention. Group-Ld consisted of randomly selected 26 patients who received 20 ml of 0.25% levobupivacaine + 2ml of dexamethasone (8mg) a total of 22 ml. Similarly, Group-Rd consisted of randomly selected 26 patients who received 20 ml of 0.25% ropivacaine + 2ml of dexamethasone (8mg) a total of 22 ml. Prior to undergoing surgery, all subjects received comprehensive explanations regarding every step of the intervention. Written informed consent was obtained from each participant before the procedure. The study received institutional ethics committee approval before initiation.

Study Design

Randomization

Patients were randomly divided into two groups using the research randomizer software. Group Ld received transverse abdominal block with 20 ml of 0.25% levobupivacaine + 2 ml of dexamethasone (8mg), totaling 22 ml. Group Rd received transverse abdominal block with 20 ml of 0.25% ropivacaine + 2ml of dexamethasone (8mg), totaling 22 ml.

Pre-operative Evaluation and Preparation

Patients underwent thorough pre-anaesthetic check-ups and pre-operative investigations, including CBC, serum electrolytes, random blood sugars, renal and liver function tests, electrocardiogram (ECG), chest X-ray, and coagulation profile. Patients were educated about the visual analogue scale (VAS) for pain assessment.

Intraoperative Procedures.

Upon receiving the patient in the operating room, monitors for ECG, NBP, and SpO_2 were attached, and IV access was secured with maintenance fluids. Baseline vitals were recorded before induction with glycopyrrolate 0.2 mg IV, fentanyl 2 mcg/kg IV, and ondansetron 0.1 mg/kg IV. After preoxygenation with 100% oxygen, induction was done using propofol 2 mg/kg IV, followed by succinylcholine 2 mg/kg IV for intubation. Anesthesia was maintained with O_2:N_2O (50:50), isoflurane, and atracurium 0.1mg/kg IV. The TAP block was performed under ultrasound guidance at the end of surgery. After preparing the abdominal wall, a 23G Quincke needle was used to inject the drug into the neurofascial plane. Residual neuromuscular blockade was reversed, and patients were extubated after regaining spontaneous respiration.

Postoperative Monitoring

Patients were shifted to the post-anesthesia care unit, and further monitoring continued in the medical ICU. Pain was assessed using VAS at various time intervals (0, 1, 2, 4, 8, 12, 16, 20, 24 hours). Postoperatively, rescue analgesia (intravenous diclofenac) was administered if VAS>4.

Statistical analysis

Data were analyzed using SPSS v20. Continuous variables were compared using an independent t-test, while categorical data were analyzed using the chi-square test. A p-value < 0.05 was considered statistically significant.

Results

This study was conducted on purposively selected 52 patients undergoing lower abdominal surgery. These patients then randomly divided into two groups each group contain 26 patients. As shown in table1, both groups were comparable in age, weight, height, gender distribution, and ASA grades, minimizing confounding variables. After the TAP block, patients

were monitored at different time intervals using the VAS pain scale. As shown in table2, and figure1, Group Ld shows lower pain as compared to group Rd. Table3, table4 and figure2 shows that Group Ld reported significantly lower VAS scores compared to Group Rd at 4, 8, 12, and 20 hours ($p < 0.05$).

Duration of pain management is also longer in group Ld then group Rd. Resue analgesia was also required more in Rd group. Group Ld consistently reported lower VAS scores than Group Rd across all time intervals, with the most notable differences observed at 4, 8, 12 and 20 hours postoperatively (p-value<0.05). Patients in Group Ld experienced a longer duration of pain relief, with fewer requiring rescue analgesia compared to Group Rd. The incidence of adverse effects was comparable between the groups, with no notable differences observed.

Table 1: Distribution of demographical variables between the groups (Ld and Rd)

Parameter	Levobupivacaine + Dexamethasone	Ropivacaine + Dexamethasone	p-value
Sample Size (n)	26	26	—
Mean Age (Years)	40 ± 10	42 ± 11	> 0.05
Mean Weight (kg)	70 ± 8	72 ± 7	> 0.05
Mean Height (cm)	168 ± 6	170 ± 7	> 0.05
Gender Distribution	30 M / 20 F	28 M / 22 F	> 0.05
ASA Grade I	60%	58%	> 0.05
ASA Grade II	40%	42%	> 0.05

Table 2: Average Pain Scores Over Time (Group Ld vs. Group Rd)

Time Interval (hours)	Group Ld (Levobupivacaine + Dexamethasone)	Group Rd (Ropivacaine + Dexamethasone)
0 hours	2.96	3.00
1 hour	2.50	3.08
2 hours	0.73	1.23
4 hours	0.35	0.77
8 hours	0.19	0.58
12 hours	0.27	0.73
16 hours	0.31	0.92
20 hours	0.46	1.19
24 hours	0.54	1.46

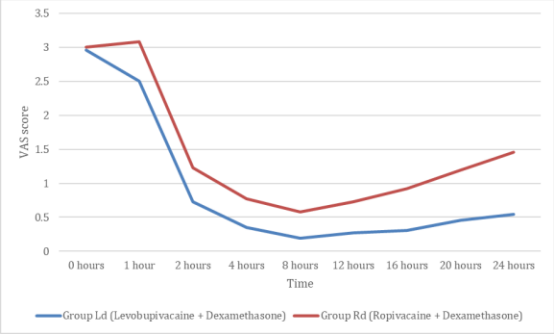

Figure 1: VAS score at different time intervals between the Ld and Rd group

Table 3: Distribution of VAS scores at 4, 8, 12, and 20 hours (Group Ld vs. Group Rd)

Time (hours)	Group Ld (Mean ± SD)	Group Rd (Mean ± SD)	p-value
4	0.35 ± 0.12	0.77 ± 0.25	< 0.01
8	0.19 ± 0.09	0.58 ± 0.21	< 0.01
12	0.27 ± 0.11	0.73 ± 0.18	< 0.01
20	0.46 ± 0.15	1.19 ± 0.32	< 0.01

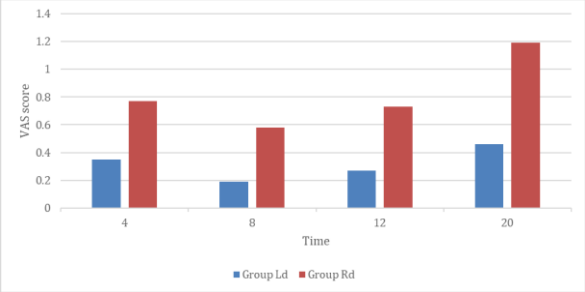

Figure 2: VAS score at 4th ,8th ,12th and 20th hour between the two groups.

Table 4: Time to First Rescue Analgesia (VAS ≥ 4)

Group	Number of Patients	Time to First Rescue Analgesia (hours)	Percentage (%)
Group Ld (Levobupivacaine + Dexamethasone)	26	24	100 %
Group Rd (Ropivacaine + Dexamethasone)	26	16	69.23%

DISCUSSION

The study evaluated the comparative efficacy of 0.25% levobupivacaine with dexamethasone (Group Ld) and 0.25% ropivacaine with dexamethasone (Group Rd) in ultrasound-guided transversus abdominis plane (TAP) blocks for postoperative analgesia in lower abdominal surgeries. The findings reveal significant differences in postoperative pain scores and the duration of analgesia between the two groups, highlighting the role of drug choice in enhancing patient comfort and recovery outcomes.

Levobupivacaine demonstrated superior pain control compared to ropivacaine across most time intervals. Notably, at 4, 8, 12, and 16 hours, Group Ld reported consistently lower Visual Analogue Scale (VAS) scores, suggesting a more prolonged analgesic effect. This aligns with existing literature suggesting that levobupivacaine, a longer-acting local anesthetic, can provide extended pain relief when used with adjuvants like dexamethasone [7,8,9]. The lower pain scores in Group Ld may be attributed to levobupivacaine's slower systemic absorption and enhanced local effects. Dexamethasone, a potent anti-inflammatory agent, likely contributed to the prolonged analgesic effects in both groups. However, the difference in efficacy between the two local anesthetics underscores the importance of selecting the appropriate agent for optimizing postoperative pain management [10,11].

McLeod and Burke (2001) reported that levobupivacaine's enantiomeric properties result in a longer duration of action compared to racemic bupivacaine and ropivacaine [10]. These properties make levobupivacaine particularly suitable for prolonged postoperative analgesia. Dexamethasone, a well-documented anti-inflammatory agent, likely contributed to the prolonged analgesic effects observed in both groups. Dexamethasone enhances local anesthetic efficacy by reducing perineural inflammation and prolonging the duration of nerve blockade [12,13].

Conversely, ropivacaine, though effective, exhibited a shorter duration of pain relief, which emphasized its comparatively moderate duration of action [14]. Secondary outcomes, including baseline demographics and ASA grading, were similar across both groups, ensuring comparability and reducing confounding factors. The absence of significant differences in adverse effects between the groups supports the safety profiles of both local anaesthetics [11,15].

CONCLUSION

This comparative study highlights that 0.25% levobupivacaine with dexamethasone provides superior postoperative analgesia compared to 0.25% ropivacaine with dexamethasone in ultrasound-guided TAP blocks for lower abdominal surgeries. Levobupivacaine not only resulted in lower pain scores but also prolonged the duration of analgesia, reducing the need for rescue analgesics. The findings support the clinical preference for levobupivacaine with dexamethasone in managing postoperative pain in similar surgical settings. Further studies with larger sample sizes could validate these results and explore additional benefits of this analgesic combination.

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