RESEARCH PAPER

Quadratus lumborum block - posterior approach and transmuscular approach in patient undergoing inguinal hernia surgery for post operative pain management

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ABSTRACT

Introduction: Effective postoperative pain management following inguinal hernia surgery remains a clinical challenge. Quadratus lumborum block (QLB) is an emerging regional anesthesia technique that provides both somatic and visceral analgesia. Among its various approaches, posterior and transmuscular techniques are commonly used; however, comparative evidence regarding their efficacy is limited. This study aimed to compare the efficacy of posterior and transmuscular quadratus lumborum block in patients undergoing inguinal hernia surgery with respect to postoperative pain scores, duration of analgesia, total analgesic consumption, adverse effects, and patient satisfaction.

Materials and Methods: This prospective randomized comparative study was conducted at a tertiary care hospital from January 2025 to December 2025 and included 60 patients, divided equally into posterior QLB (n=30) and transmuscular QLB (n=30) groups. All patients underwent inguinal hernia surgery under spinal anesthesia followed by ultrasound-guided QLB. Postoperative pain was assessed using the Visual Analog Scale (VAS) at 1, 4, 8, 12, and 24 hours. Time to first rescue analgesia, total tramadol consumption, adverse effects, and patient satisfaction were recorded.

Results: VAS scores were significantly lower in the transmuscular group at all time intervals ($p \leq 0.003$). Time to first rescue analgesia was prolonged (13.6 ± 3.2 vs 8.4 ± 2.1 hours; $p<0.001$), and total tramadol consumption was reduced (95 ± 28 mg vs 145 ± 35 mg; $p<0.001$) in the transmuscular group. Incidence of adverse effects was comparable between groups ($p>0.05$). Patient satisfaction was significantly higher in the transmuscular group, with excellent satisfaction reported in 18 (60.0%) patients compared to 10 (33.3%) in the posterior group ($p=0.04$).

Conclusion: Transmuscular QLB provides superior postoperative analgesia with prolonged duration, reduced opioid requirement, and higher patient satisfaction compared to posterior QLB, without increasing adverse effects.

Keywords: Quadratus lumborum block; Transmuscular approach; Posterior approach; Inguinal hernia; Postoperative analgesia

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INTRODUCTION

Effective postoperative pain management is a critical component of perioperative care, particularly in patients undergoing inguinal hernia repair, where inadequate analgesia can lead to delayed recovery, prolonged hospital stay, and increased patient discomfort [1,2]. Traditionally, systemic analgesics such as opioids and non-steroidal anti-inflammatory drugs have been used for

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postoperative pain control; however, their use is often associated with undesirable side effects including nausea, vomiting, respiratory depression, and delayed mobilization [3]. In recent years, regional anesthesia techniques have gained popularity as part of multimodal analgesia strategies to provide effective pain relief while minimizing systemic complications [4].

The quadratus lumborum block (QLB) is a relatively novel fascial plane block that has emerged as an effective technique for providing postoperative analgesia in abdominal and pelvic surgeries [5]. By targeting the thoracolumbar fascia and facilitating the spread of local anaesthetic to the paravertebral space, QLB provides both somatic and visceral analgesia [6]. Various approaches to QLB have been described, including the posterior (QLB type II) and transmuscular (QLB type III) techniques, each differing in the site of drug deposition and pattern of anaesthetic spread [7]. These differences may influence the extent and duration of analgesia achieved.

The posterior QLB involves deposition of local anaesthetic posterior to the quadratus lumborum muscle, whereas the transmuscular approach involves injection between the quadratus lumborum and psoas major muscles, potentially allowing wider cephalocaudal spread and more consistent blockade of the lumbar plexus [8,9]. Although both techniques are used in clinical practice, there remains limited comparative evidence regarding their relative efficacy, particularly in the context of inguinal hernia surgery. Understanding the differences in analgesic outcomes between these approaches is essential to optimize patient care and improve postoperative recovery.

Therefore, the present study aimed to compare the efficacy of posterior quadratus lumborum block and transmuscular quadratus lumborum block in patients undergoing inguinal hernia surgery with respect to postoperative pain scores, duration of analgesia, total analgesic consumption, incidence of adverse effects, and patient satisfaction.

MATERIALS AND METHODS

This prospective, randomized comparative study was conducted at a tertiary care hospital over a period of one year from January 2025 to December 2025. A total of 60 adult patients scheduled for elective unilateral inguinal hernia repair under spinal anaesthesia were enrolled in the study. Patients were randomly allocated into two equal groups of 30 each using a computer-generated randomization method: Group P (posterior quadratus lumborum block) and Group T (transmuscular quadratus lumborum block). Patients aged 18–65 years, belonging to American Society of Anaesthesiologists (ASA) physical status I and II, were included. Patients with known allergy to local anaesthetics, coagulopathy, infection at the injection site, chronic opioid use, or significant systemic illness were excluded from the study. Written informed consent was obtained from all participants prior to inclusion.

All patients underwent standard pre-anaesthetic evaluation and were kept nil per oral as per institutional protocol. On arrival in the operating room, standard monitoring including electrocardiography, non-invasive blood pressure, and pulse oximetry was instituted. Spinal anaesthesia was administered in the sitting position using a standard dose of hyperbaric bupivacaine. Following completion of surgery, patients received ultrasound-guided quadratus lumborum block according to their assigned group. In Group P, the posterior approach to QLB was performed by depositing local anaesthetic posterior to the quadratus lumborum muscle, whereas in Group T, the transmuscular approach was performed by injecting the drug between the quadratus lumborum and psoas major muscles under aseptic precautions. A uniform volume and concentration of local anaesthetic solution was administered in both groups.

Postoperative pain was assessed using the Visual Analog Scale (VAS) at predefined intervals of 1, 4, 8, 12, and 24 hours. Rescue analgesia in the form of intravenous tramadol was administered when VAS score was ≥4. The primary outcome measure was postoperative pain score, while secondary outcomes included time to first rescue analgesia, total analgesic consumption in the first 24 hours, incidence of adverse effects (such as nausea, vomiting, hypotension, and bradycardia), and patient satisfaction score assessed at the end of 24 hours using a standardized scale.

All data were recorded systematically and analyzed using appropriate statistical methods. Continuous variables were expressed as mean ± standard deviation and compared using the independent Student's t-test. Categorical variables were presented as number (n) and percentage (%) and analyzed using Chi-square test or Fisher's exact test as applicable. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The baseline demographic characteristics were comparable between the two groups. The mean age in the posterior QLB group was 45.3 ± 12.1 years, while in the transmuscular QLB group it was 46.7 ± 11.5 years (p=0.65). The majority of patients in both groups were male [26 (86.7%) vs 25 (83.3%)], with a similar distribution of females [4 (13.3%) vs 5 (16.7%)] (p=0.71). The mean body weight was also comparable (68.5 ± 9.8 kg vs 70.2 ± 10.4 kg; p=0.48). With respect to ASA physical status, most patients belonged to ASA I [18 (60.0%) vs 17 (56.7%)], followed by ASA II [12 (40.0%) vs 13 (43.3%)], with no statistically significant difference (p=0.79), indicating homogeneity between the groups at baseline (Table 1).

Table 1. Baseline Demographic Characteristics

Variable	Posterior QLB (n=30)	Transmuscular QLB (n=30)	p-value
Age (years)	mean ± SD	45.3 ± 12.1	46.7 ± 11.5
Gender	Male	26 (86.7%)	25 (83.3%)
	Female	4 (13.3%)	5 (16.7%)
Weight (kg)	mean ± SD	68.5 ± 9.8	70.2 ± 10.4
ASA	I	18 (60.0%)	17 (56.7%)
	II	12 (40.0%)	13 (43.3%)

The intraoperative variables were similar in both groups. The mean duration of surgery in the posterior QLB group was 72.4 ± 15.6 minutes compared to 74.1 ± 14.8 minutes in the transmuscular QLB group (p=0.64). Likewise, the duration of anaesthesia was comparable between the two groups (90.2 ± 18.5 minutes vs 92.7 ± 17.9 minutes; p=0.58), suggesting that procedural factors were well matched (Table 2).

Table 2. Intraoperative Variables

Variable	Posterior QLB (n=30)	Transmuscular QLB (n=30)	p-value
Duration of surgery (min)	72.4 ± 15.6	74.1 ± 14.8	0.64
Duration of anaesthesia (min)	90.2 ± 18.5	92.7 ± 17.9	0.58

Postoperative pain scores assessed using the VAS scale were significantly lower in the transmuscular QLB group at all observed time intervals. At 1 hour, the mean VAS score was 2.8 ± 0.9 in the posterior group compared to 2.1 ± 0.8 in the transmuscular group (p=0.003). This difference persisted at 4 hours (3.5 ± 1.1 vs 2.6 ± 0.9; p=0.001), 8 hours (4.2 ± 1.2 vs 3.1 ± 1.0; p<0.001), 12 hours (4.8 ± 1.3 vs 3.6 ± 1.1; p<0.001), and 24 hours (3.9 ± 1.1 vs 2.8 ± 0.9; p<0.001), demonstrating superior analgesic efficacy of the transmuscular approach (Table 3).

Table 3. Postoperative Pain Scores (VAS Score)

Time Interval	Posterior QLB (n=30)	Transmuscular QLB (n=30)	p-value
1 hour	2.8 ± 0.9	2.1 ± 0.8	0.003
4 hours	3.5 ± 1.1	2.6 ± 0.9	0.001
8 hours	4.2 ± 1.2	3.1 ± 1.0	<0.001
12 hours	4.8 ± 1.3	3.6 ± 1.1	<0.001
24 hours	3.9 ± 1.1	2.8 ± 0.9	<0.001

The time to first rescue analgesia was significantly prolonged in the transmuscular QLB group. Patients in the posterior QLB group required rescue analgesia at a mean duration of 8.4 ± 2.1 hours, whereas those in the transmuscular group required it much later, at 13.6 ± 3.2 hours (p<0.001), indicating longer duration of analgesia with the transmuscular technique (Table 4).

Table 4. Time to First Rescue Analgesia

Variable	Posterior QLB (n=30)	Transmuscular QLB (n=30)	p-value
Time to first rescue analgesia (hours)	8.4 ± 2.1	13.6 ± 3.2	<0.001

Total postoperative analgesic consumption over 24 hours was significantly higher in the posterior QLB group compared to the transmuscular group. The mean tramadol requirement was 145 ± 35 mg in the posterior group versus 95 ± 28 mg in the transmuscular group (p<0.001), further supporting the enhanced analgesic profile of the transmuscular approach (Table 5).

Table 5. Total Analgesic Consumption (24 hours)

Variable	Posterior QLB (n=30)	Transmuscular QLB (n=30)	p-value
Total tramadol consumption (mg), mean ± SD	145 ± 35	95 ± 28	<0.001

The incidence of side effects was comparable between the two groups, with no statistically significant differences observed. Nausea and vomiting were reported in 6 (20.0%) patients in the posterior group and 3 (10.0%) in the transmuscular group (p=0.27). Hypotension occurred in 2 (6.7%) and 1 (3.3%) patient, respectively (p=0.55), while bradycardia was noted in 1 (3.3%) patient in each group (p=1.00), indicating a similar safety profile (Table 6).

Table 6. Incidence of Side Effects

Variable	Posterior QLB (n=30)	Transmuscular QLB (n=30)	p-value
Nausea/Vomiting	6 (20.0%)	3 (10.0%)	0.27
Hypotension	2 (6.7%)	1 (3.3%)	0.55
Bradycardia	1 (3.3%)	1 (3.3%)	1.00

Patient satisfaction scores were significantly higher in the transmuscular QLB group. An excellent satisfaction rating was reported by 18 (60.0%) patients in the transmuscular group compared to 10 (33.3%) in the posterior group (p=0.04). Conversely, fair satisfaction was more common in the posterior group [6 (20.0%) vs 2 (6.7%)], while good satisfaction was reported in 14 (46.7%) and 10 (33.3%) patients, respectively. These findings suggest better overall patient satisfaction with the transmuscular approach (Table 7).

Table 7. Patient Satisfaction Score

Score Category	Posterior QLB (n=30)	Transmuscular QLB (n=30)	p-value
Excellent	10 (33.3%)	18 (60.0%)	0.04
Good	14 (46.7%)	10 (33.3%)	
Fair	6 (20.0%)	2 (6.7%)	

DISCUSSION

The present study demonstrated that the transmuscular quadratus lumborum block (QLB) provides superior postoperative analgesia compared to the posterior approach in patients undergoing inguinal hernia surgery, as evidenced by significantly lower VAS scores at all time intervals. These findings are consistent with previous literature highlighting the effectiveness of QLB in abdominal surgeries. Studies have shown that QLB offers better pain control compared to other regional techniques such as transversus abdominis plane (TAP) block, likely due to its wider dermatomal spread and involvement of the thoracolumbar fascia, resulting in both somatic and visceral analgesia [10,11]. Furthermore, research in

hernia surgeries has also demonstrated that QLB significantly reduces postoperative pain scores compared to other modalities, supporting the findings of the present study [12].

In the current study, the duration of analgesia was significantly prolonged in the transmuscular group, as indicated by the increased time to first rescue analgesia. This finding aligns with studies evaluating transmuscular QLB, which have reported prolonged analgesic duration due to the spread of local anaesthetic into the paravertebral space [13]. Additionally, continuous and single-shot transmuscular QLB techniques have been shown to provide sustained postoperative pain relief and reduce analgesic requirements, further reinforcing the superiority of this approach over other variants [14]. The deeper deposition of anaesthetic between the quadratus lumborum and psoas major muscles likely contributes to a more extensive neural blockade.

The present study also found significantly reduced total opioid (tramadol) consumption in the transmuscular QLB group. This opioid-sparing effect is well supported by previous randomized trials and meta-analyses, which have consistently demonstrated that QLB reduces postoperative opioid requirements compared to other regional blocks and conventional analgesia [10,15]. Reduced opioid consumption is clinically important as it minimizes opioid-related adverse effects and facilitates early mobilization and recovery. Similar findings have been reported in inguinal and other abdominal surgeries, where QLB resulted in decreased analgesic requirements and improved postoperative outcomes [16].

With regard to safety, the incidence of adverse effects such as nausea, vomiting, hypotension, and bradycardia was comparable between the two groups in the present study, indicating that both techniques are relatively safe. This observation is consistent with existing literature, which suggests that QLB is associated with minimal complications and does not significantly increase the incidence of postoperative side effects [10]. Furthermore, the higher patient satisfaction observed in the transmuscular group in this study correlates with its superior analgesic efficacy and prolonged duration of action, as also reported in previous studies evaluating QLB techniques [17]. Overall, the findings of the present study are in agreement with existing evidence supporting the transmuscular QLB as a more effective modality for postoperative pain management in abdominal surgeries.

The present study has certain limitations that should be considered while interpreting the results. First, the sample size was relatively small (n=60), which may limit the generalizability of the findings. Second, the study was conducted at a single tertiary care center, thereby restricting external validity across different clinical settings and patient populations. Third, only short-term outcomes up to 24 hours postoperatively were assessed, and long-term analgesic efficacy or chronic pain outcomes were not evaluated. Additionally, the study did not include objective assessment of dermatomal spread of the block or imaging confirmation, which could have provided better insight into the mechanism of action. Finally, the use of a single local anaesthetic regimen without comparing different drug concentrations or adjuvants may limit the applicability of the results to varied clinical practices.

CONCLUSION

The transmuscular quadratus lumborum block provides superior postoperative analgesia compared to the posterior approach in patients undergoing inguinal hernia surgery. It is associated with significantly lower pain scores, prolonged duration of analgesia, reduced postoperative opioid consumption, and higher patient satisfaction, without an increase in adverse effects. Therefore, the transmuscular QLB can be considered a more effective and reliable technique for postoperative pain management in this patient population.

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