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Original Article

Comparative Study of Quadrutus Lumborum Block Versus Tranversus Abdominis Plane Block for Postoperative Analgesia After Caesarean Section

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ABSTRACT

Background and Aims: Effective postoperative analgesia after caesarean section facilitates early recovery, ambulation and breast feeding. Fascial plane blocks such as transversus abdominis plane (TAP) block and quadratus lumborum (QL) block are increasingly used for postoperative pain management. So, we aimed to compare the analgesic efficacy of QL block versus TAP block after cesarean section (CS).

Material and Methods: This Prospective randomized, single blind comparative study was conducted from August 2022 to July 2024, randomized 40 patients scheduled for CS in to two groups, QL (N=20) and TAP (N= 20) receiving ultrasonography (USG) guided TAP or QL block with Inj. Ropivacaine 0.375% 15ml on each side post operatively. The primary outcome was to compare the time to first rescue analgesia between two groups. Secondary outcomes included total analgesic consumption in first 24 hours, visual analogue scale (VAS) scores at rest and during movement, and complications. The statistical software Epi Info (version 7.2) was used for all statistical analysis.

Results: The time to receiving first rescue analgesia was significantly longer in the QL group compared to the TAP group (12.9 + 1.02 hours vs. 8.8 + 0.52 hours, $P < 0.05$). Total tramadol consumption over 24 hours was significantly lower in QL group (105 + 26.40 mg vs. 196.25 + 36.6 mg, $P < 0.05$).

Conclusion: Ultrasound guided QL block provides superior postoperative analgesia compared to TAP block and is a promising new technique for postoperative pain management in CS as a part of multimodal analgesia.

Keywords: *Caesarean section, Quadratus lumboram block, TAP block, Postoperative analgesia, ultrasound- guided block.*

INTRODUCTION

Caesarean section is one of the most commonly performed surgical procedure in obstetric department. Effective postoperative pain management is essential for early mobilization, optimal maternal recovery, and initiation of breast feeding. Multimodal analgesia (MMA) is currently considered the standard approach for postoperative pain control.

Recently, fascial plane blocks (transversus abdominis plane (TAP) block and quadratus lumborum (QL) block) popular as a part of MMA especially in CS as a opioid sparing post-operative analgesia. TAP block provides somatic analgesia of the anterior abdominal wall and reducing opioid consumption [1, 2, 3]. QL block is believed to provide both somatic and visceral analgesia [4, 5] due to spread to the thoracolumbar fascia and paravertebral space in transmuscular approach (TQLB).

Hebberd at al. (2007) have described ultrasound (USG) guided approach to the TAP block [6]. Quadratus lumborum block (QLBs) was first described by Dr. Rafa Blanco in 2007[7] as a ‘‘no pops’’ transversus abdominis plane (TAP) block. QLB is known as inter fascial plane block, it requires the local anesthetic to deposit in the thoracolumbar fascia (TLF). The four puncture approaches for QLB (QLB1 or lateral QLB, QLB2 or posterior QLB, QLB3 or Anterior/ Trans muscular QLB, and QLB4 or intramuscular QLB) are named according to the position of the needle tip in relation to the QL [8]. (figure1).

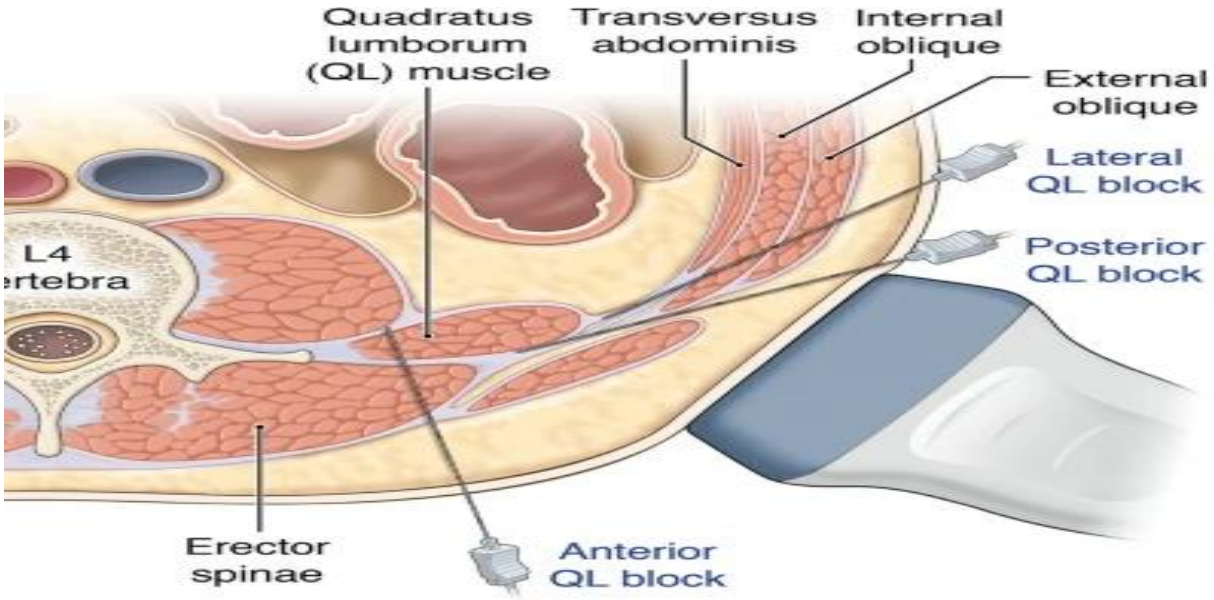

Figure 1: Types of QL blocks- Relationship of needle target & QL (Reproduced with Nysora) [9]

However, evidence comparing the efficacy of trans-muscular QL block and TAP block in caesarean section remains limited. Therefore, we conducted a single-blinded randomized trial to compare the TAP and the TQLB for postoperative analgesic effect in CS with the primary objective of comparing the duration of post-operative analgesia of Quadratus Lumborum (QL) block versus Transverse abdominis plane (TAP) block after cesarean section (Time to first rescue analgesic). The secondary objectives were comparing the quality of analgesia of individual block by using VAS score at rest and on movement, the cumulative requirement of opioid in 24 hours, comparing hemodynamic parameters after completion of the block in first 24 hours, and associated complications related to blocks.

MATERIAL AND METHODS

This Prospective, randomized, single- blind comparative study was conducted at a tertiary care center for the duration from August 2022 to July 2024, after seeking permission from the Institutional Ethics committee (Guts/Ec03/Anaesthesia -05) IKDRC Hospital, GUTS, Ahmedabad.

We recruited 40 patients from the American Society of Anaesthesiologist (ASA) grade l undergoing elective LSCS under spinal anesthesia and were able to understand the study protocol. The patients having allergy to paracetamol, diclofenac, tramadol, Hypersensitivity to LA, history of bleeding disorder, use of anticoagulants, infection at the site of block, patients requiring general anesthesia for LSCS, and patient's refusal were excluded. After dividing all patients into two groups randomly using computer generated random numbers allotment was done to one of the groups, namely group TAP (n=20)in which patients were received TAP block with Inj. Ropivacaine 0.375% - 15 ml on each side and group QL (n=20) were received TQBL with Inj. Ropivacaine 0.375% - 15 ml on each side.

All patients undergo pre-anaesthetic check up with thorough local site examination in concern with block a day before surgery. Written and informed consent was taken and adherence to standard protocol for nil per oral status was done. All the patients under study were explained about the procedure, risks and usage of data for research and educational purposes. Upon arrival in the operation theatre an intravenous line was secured with an 18 gauge, baseline vitals were recorded using ASA standard monitors and monitored throughout the surgery. All patients were administered 10ml/kg of crystalloid fluid (Ringer lactate) before administering spinal anesthesia. Under strict asepsis, spinal anesthesia was administered in sitting position, using 2.0-2.5 ml of 0.5% bupivacaine heavy at the level of L2-L3 or L3-L4 using a 23G “Quincke’s” spinal needle. Sensory block level was checked every 2 min using pin prick method and the surgery was commenced once an adequate block level (T6) had reached. At the end of surgical closure of the wound, patients were positioned in supine position for TAP block was performed bilaterally, by using ultrasonography (Vivid iq SGCART, GE, USA) needle entry side was identified between the iliac crest and the costal margin in the anterior axillary line. A 6-13 MHz linear probe was placed transversely on the skin after taking all aseptic and antiseptic measures. In QL block via USG guided TQBL block was administered by using low frequency curvilinear probe 3-5 MHz to visualize the “Shamrock” sign (figure2). Patients

were kept in supine position only with wedge kept in midline. This allow us to have access of more posterior part of flank region by laterally.

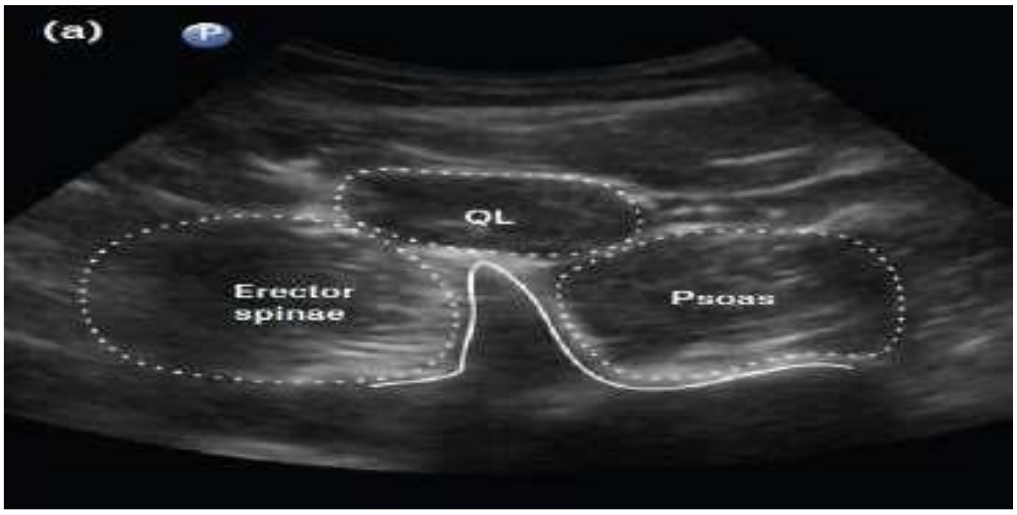

Figure 2: Shamrock sign

Simplex Stim 22G, 80 mm needle was inserted under ultrasound guidance in an in-plane technique to position the tip of the needle between the internal oblique and transverse abdominis in case of TAP block (figure 3) and tip of the needle between Quadratus Lumborum and Psoas major muscle in QL block (figure 4). One ml of sterile water was injected prior to LA injection to confirm the correct position of the needle tip. Distribution of LA was observed on ultrasound as a hypoechoic enlargement between the fascial planes as a real-time image.

Figure 3: Correct local anaesthetic deposition in the transversus abdominis plane

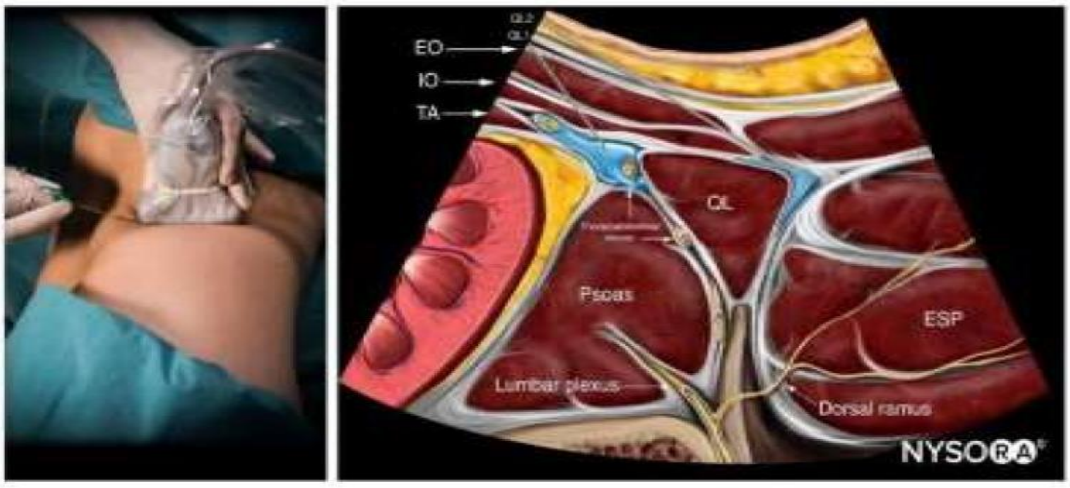

Figure 4: Schematic image of injectate in QL **(Reproduce with Nysora.com)** [9]

All patients received Inj. Diclofenac 75mg intravenously at the end of block and after 12 hours, as a part of multimodal analgesia. Heart rate, mean arterial pressure, SpO2, VAS score were recorded at 1st, 2nd, 3rd, 4th, 8th, 12th, and 24th postoperative hours. All patients were educated preoperatively about how to use and record the visual analogue scale (VAS) for both somatic and visceral pain. One 10cm scale was provided for reporting pain, zero being no pain and 10 being the worst imaginable pain. Rescue analgesia of 1.5mg/kg tramadol in 100 ml normal saline over 20 min was given either on patient's request or if VAS was >3. In case of reported nausea within 24hr, ondansetron 4 mg intravenously was given. Patients were assessed for and data recorded as time to first rescue analgesia- described as time interval between the end of block performance and first demand by patient for rescue analgesia, total amount of rescue analgesia required- described as total dose of tramadol required in 24hr since the end of block performance. The primary objective was to compare the time to first rescue analgesia between the two groups. The secondary objectives were to compare the total amount of rescue analgesia required in first 24hrs postoperatively, VAS scores at rest and on movement and adverse effect

[Nausea /vomiting, hypotension (< 30% from baseline)] and complications [motor blockade (using modified bromage scale), infection and hematoma] related to block between the two groups.

Statistics

Based on previous studies[10, 12] assuming a standard deviation of 1.49 and a minimum clinically significant difference in postoperative pain scores (VAS score) of 1.38 between the two groups, with a confidence level of 95%, power of 80%, and a two-sided alpha error of 0.05, the required sample size was estimated to be 19 patients per group. We have included 20 patients in each group to secure against patient dropouts. So, a total sample size of 40 was estimated for study.

All data were analyzed using Epi Info software (version 7.2, CDC, Atlanta, USA), and Microsoft Office 2021 was used for generating tables and graphs. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as numbers and percentages. Intergroup comparisons were performed using the Student's unpaired t-test for continuous variables and Fisher's exact test for categorical variables, as appropriate. Repeated measures of VAS scores over time were analyzed using repeated measures analysis of variance (ANOVA) for normally distributed variables. A *P* value <0.05 was considered statistically significant.

RESULTS

In this study, 40 patients were recruited and randomized in to two groups for the analysis. None of the patients were excluded from the analysis. Figure 5 shows the CONSORT flow diagram for the study.

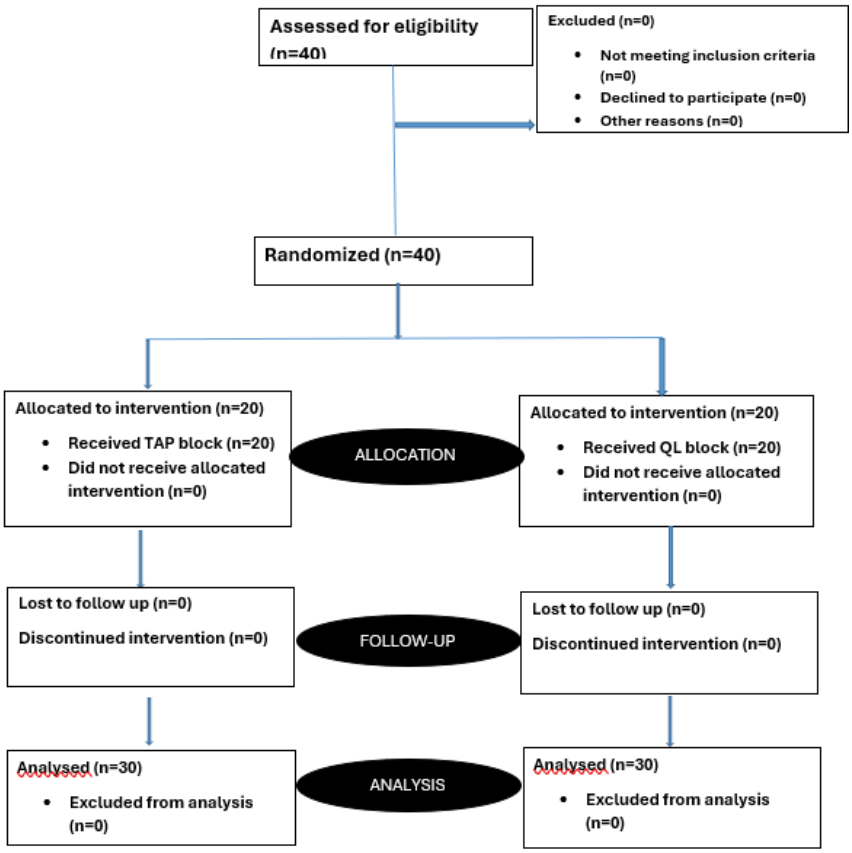

FIGURE 5: Consolidation standards of reporting trials (CONSORT) flow diagram

The demographic were comparable in both groups, and the differences were not statistically significant (P>0.05) (TABLE 1).

Table 1: Demographic data, Physical status, and duration of surgery

	TAP BLOCK	QL BLOCK	P VALUE
AGE (YEARS)	29.5 ±4.08	29.1 +3.37	0.368
WEIGHT (KG)	64.75 ±6.92	62.8 ± 5.99	0.173
HEIGHT (CM)	153.25± 6.71	152.2 ± 7.12	0.321
DURATION OF SURGERY (MINUTES)	43.3 ± 4.75	43.5 ± 5.29	0.450

P* > 0.05

The time to first rescue analgesia was significantly longer in the QL group compared to TAP group (12.9 ± 1.02 hours vs. 8.8 ± 0.52 hours, P <0.05) indicating prolonged duration of postoperative analgesia in QL group (Figure6).

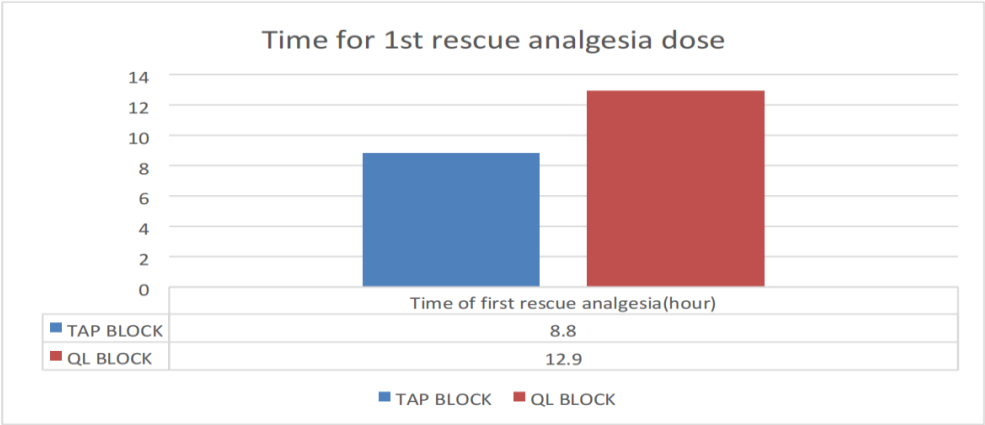

FIGURE 6: Time for 1st rescue analgesia dose

The Total tramadol dose consumption during the first 24hours postoperatively was significantly lower in the QL group to the TAP group (105 ± 26.40 mg vs. 196.25 ± 36.6mg, P <0.05) (Figure 7).

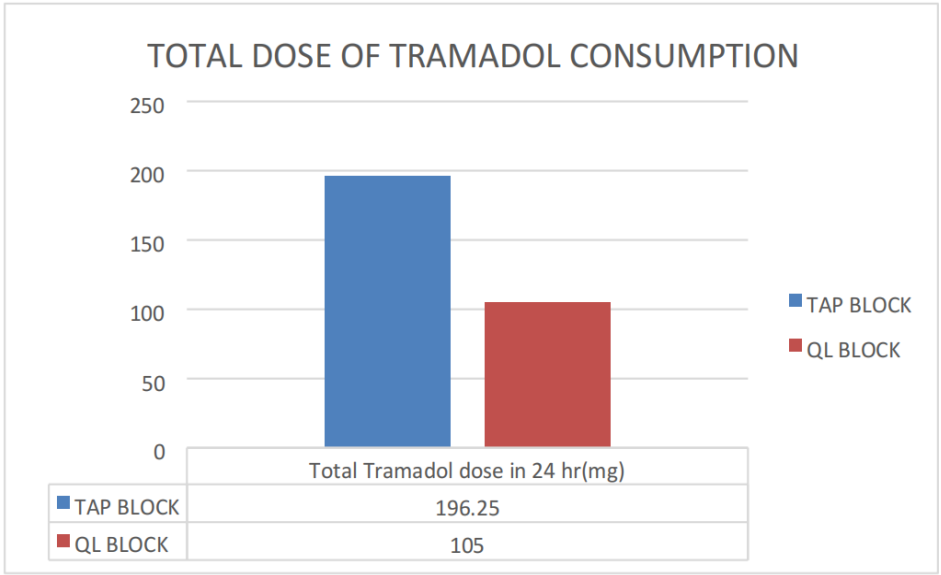

FIGURE 7: Total dose of tramadol consumption

VAS scores at rest and during movement were consistently lower in the QL group compared to the TAP group at most postoperative time intervals. The differences were statistically significant at 1, 2, 4, 8, and 24 hours (P <0.05). However, at the 12th postoperative hour, the difference between the two groups was not statistically significant (P > 0.05) (Figures 8, 9)

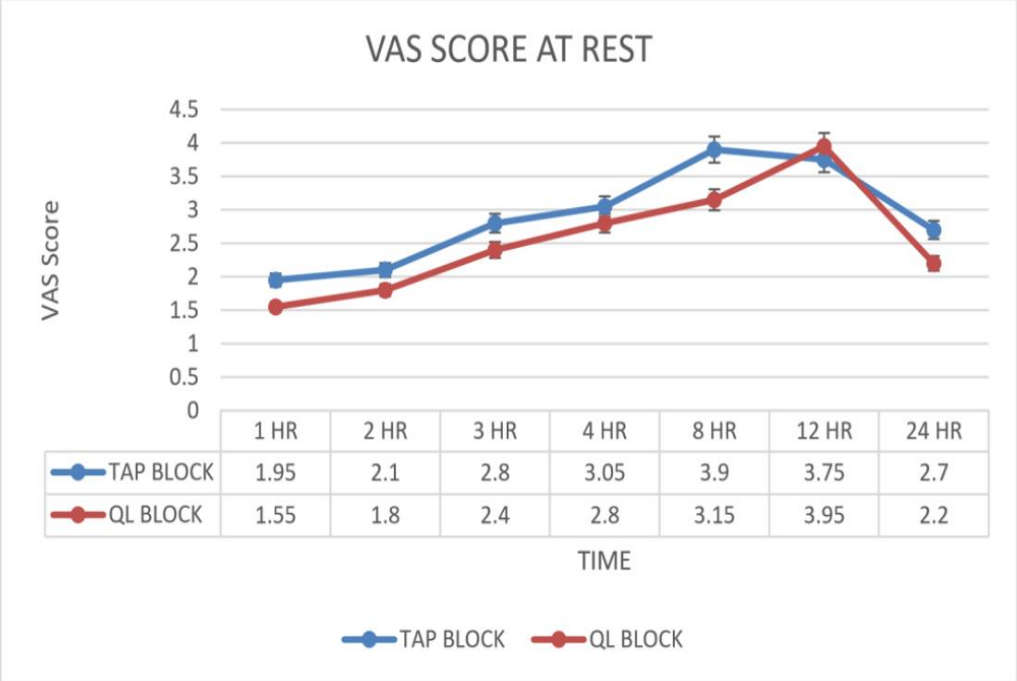

FIGURE 8: Postoperative VAS score observed at different time intervals at rest

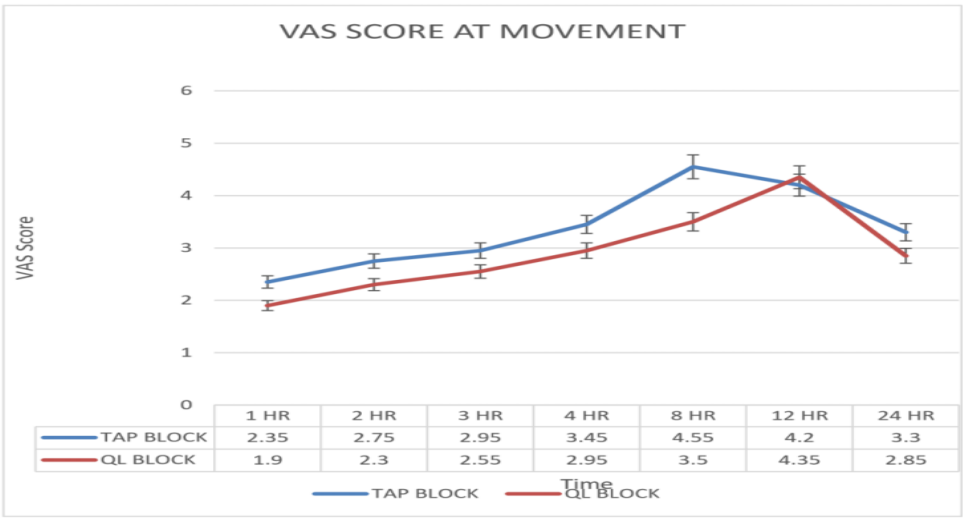

FIGURE 9: Postoperative VAS score observed at different time interval at movement

Both heart rate (HR) and mean arterial pressure (MAP) remained stable in both groups throughout the observation period. The values were comparable at most time intervals. However, at 8th postoperative hour HR and MAP were significantly higher in the TAP group (P<0.05), while at the 12th hour, these parameters were significantly higher in the QL group (P< 0.05). These differences were transient and clinically significant (figure 10, 11).

No major complications such as hematoma, infection, hypotension, or motor blockade were observed in either group during the study period.

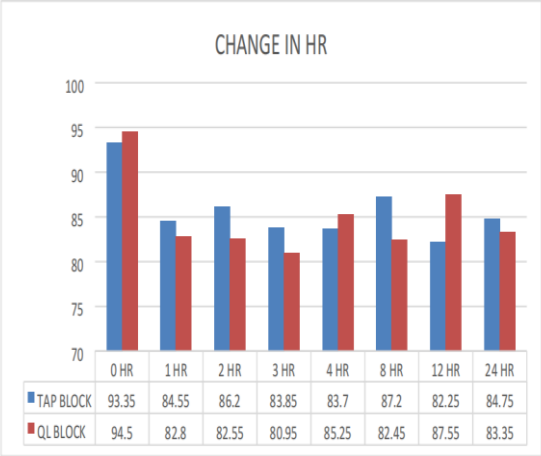

FIGURE: 10

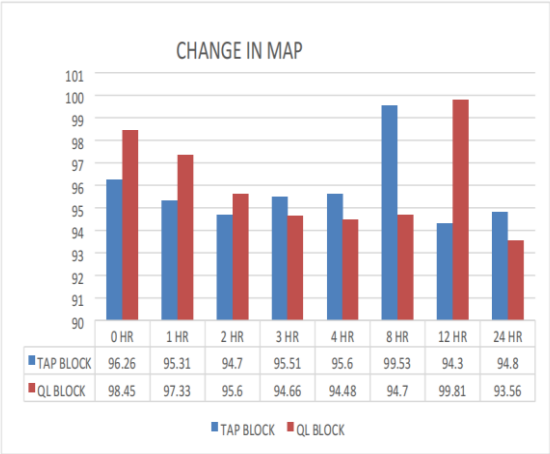

FIGURE 11

FIGURE 10, 11: Comparison of hemodynamic parameter

DISCUSSION

The present study demonstrated that ultrasound-guided QL block provides superior postoperative analgesia compared to TAP block in patients undergoing caesarean section. Patients receiving QL block showed a significantly longer duration of postoperative analgesia, lower VAS scores at rest and on movement, and reduced opioid consumption in the first 24 hours following surgery. These findings suggest that QL block is a more effective component of multimodal analgesia in caesarean section when compared to TAP block.

Our findings are consistent with several previously published studies comparing QL block and TAP block for postoperative analgesia. Blanco et al. reported that QL block provided significantly prolonged analgesia and reduced opioid consumption compared to TAP block in patients undergoing cesarean section [10]. Similarly, Jadon et al. observed significantly lower VAS scores and reduced postoperative analgesic requirements in the QL block group compared to the TAP group [11]. Yousef et al. in patients undergoing abdominal surgeries, also observed a longer duration of analgesia and reduced opioid consumption in the QL group compared to TAP group [12].

Verma et al. also demonstrated that patients receiving QL block experienced prolonged duration of analgesia (68.77 $\pm$ 1.74 hour) and reduced opioid consumption following caesarean section [13]. They used posterior approach for QL block. So, the reason behind this extensive analgesia is possible due to spread of drug along thoracolumbar fascia and the endothoracic fascia in to paravertebral space. The results of the present study are therefore in agreement with the existing literature and further support the superior analgesic efficacy of QL block [14].

The improved analgesic efficacy of QL block may be explained by its anatomical and physiological characteristics. Unlike the TAP block, which primarily provides somatic analgesia of the anterior abdominal wall, QL block is believed to provide both somatic and visceral analgesia. This is due to the spread of local anesthetic into the thoracolumbar fascia and possibly into the paravertebral space [14], which allows blockade of the ventral rami of spinal nerves from T7 to L1. In addition, the thoracolumbar fascia contains sympathetic fibers, and the spread of local anesthetic in this plane may contribute to the visceral analgesic effect observed with QL block [15, 16]. This wider dermatomal coverage and deeper spread of local anesthetic may explain the prolonged duration of analgesia observed in the QL group in the present study. In the present study, the total tramadol consumption during the first 24 hours postoperatively was significantly lower in the QL group. Reduced opioid consumption is particularly beneficial in cesarean section patients, as it helps minimize opioid-related side effects such as nausea, vomiting, sedation, and respiratory depression.

Lower pain scores during movement are particularly important in cesarean section patients, as movement-related pain may interfere with early ambulation and maternal care of the newborn. The improved quality of analgesia observed with QL block in the present study is therefore clinically relevant and supports its use as an effective alternative to TAP block in multimodal analgesia protocols.

In the present study, hemodynamic parameter remained stable in both groups throughout the observation period. However, a statistically significant increase in the HR and MAP was observed at the 8th postoperative hour in the TAP group and 12th hour in the QL group. This variation may be attributed to the wearing off of the analgesic effect of the respective block, leading to increased pain perception and subsequent sympathetic stimulation. The delayed occurrence of these changes further supports the longer duration of analgesia provided by the QL block compared to TAP block.

No major complications such as hematoma, infection, hypotension, or motor blockade were observed in either group in the present study. This suggests that both TAP block and QL block are safe procedures when performed under ultrasound guidance. The use of ultrasound allows accurate needle placement and visualization of local anesthetic spread, which may help reduce the risk of complications and improve the success rate of the block.

Ropivacaine, being a pure S (-) enantiomer and due to its rapid clearance, is safer in terms of cardiotoxicity and neurotoxicity as compared to the racemic mixture of Bupivacaine. Owing to its lesser penetration in large myelinated fibres, Ropivacaine produces less intense motor blockade with similarly efficient sensory blockade as compared to Bupivacaine, depending also on the area of its application. The local anesthetic systemic toxicity (LAST) is a serious concern whenever a large amount of local anesthetics used. To obtain an optimal dose of LA for the QL block without compromising on safety (to avoid LAST), the dose reference was taken from Murouchi et al in which 150 mg of ropivacaine (0.375%, 15 mL per side) was considered safe [17].

However, the present study has certain limitations. The sample size was relatively small, and the duration of postoperative follow-up was limited to 24 hours. In addition, this was a single center study. The absence of observed complications may be attributed to the small sample size, which may not to be sufficient to detect clinically significant adverse events. Furthermore, the study also did not assess the dermatomal spread of the blocks or long-term postoperative outcomes. Further studies with larger sample sizes and longer follow-up periods are required to validate these findings.

CONCLUSION

Ultrasound guided QL block provides superior postoperative analgesia compared to TAP block and is a promising new technique for postoperative pain management in LSCS as a part of multimodal analgesia.

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Conflicts of interest: there are no conflicts of interest.

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