Evaluation of ultrasound-guided quadratus lumborum block for post-operative analgesia in unilateral laparoscopic renal surgeries – A randomised controlled trial

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ABSTRACT

Background and Aims: Quadratus lumborum block (QLB) is a novel anaesthetic technique for abdominal wall block providing excellent post-operative analgesia. The primary objective of this study was to evaluate the duration of post-operative analgesia with QLB in unilateral laparoscopic renal surgeries. The secondary objectives were to assess total morphine consumption during the first 24 h postoperatively and observe for complications. Methods: Sixty patients undergoing unilateral laparoscopic renal surgeries were randomly divided into two groups, with patients receiving QLB (Group A) or no block (Group B) at the end of surgery. General anaesthesia was standardised in both the groups. The pain was assessed by a Visual Analogue Scale (VAS) of 1–10. The duration of analgesia was taken as time from extubation to VAS of ≥3. Morphine was administered in patient-controlled analgesia pump with a bolus of 1 mg and a lockout interval of 10 min (min). The total morphine consumption was recorded. The statistical analysis was performed with the Student's t-test and Chi-square test. Results: The duration of post-operative analgesia was significantly prolonged in Group A (1288 ± 288.92 min) than Group B (138 ± 54.92 min). Morphine consumption was also less in Group A (3.1 ± 0.87 mg) than Group B (10.46 ± 1.8 mg). There was a significant difference in the VAS score from 16 to 20 h. No complications were recorded. Conclusions: Ultrasound-guided QLB after laparoscopic renal surgery is safer to perform, effective with an increased post-operative duration of analgesia, reduces the consumption of opioids and is associated with fewer side effects.

Key words: Patient-controlled analgesia, quadratus lumborum block, ultrasound guided

INTRODUCTION

The laparoscopic technique provides multiple advantages over open urological procedures such as nephrectomy, pyelolithotomy and pyeloplasty. This includes a smaller incision, rapid recovery, less tissue damage and shorter hospital stay. The post-operative pain following laparoscopic urological procedures may prolong hospital stay, cause psychological disturbances, increased morbidity and affect enhanced recovery programs.[1] Regional anaesthesia is an important component of multimodal analgesia in reducing the consumption of opioids, minimising its adverse effects and facilitating early discharge.[2,3] Quadratus lumborum block (QLB) is a novel anaesthetic technique for abdominal wall block providing excellent post-operative analgesia. The

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ultrasound is a valuable adjunct in peripheral nerve blockade.\textsuperscript{[4]} It is easier to perform due to clear anatomical landmarks under ultrasound, providing long-lasting analgesia of 24–48 h and devoid of any serious complications.\textsuperscript{[5]} Several studies have demonstrated less incidence of post-operative nausea and vomiting,\textsuperscript{[6]} earlier removal of urinary catheters,\textsuperscript{[7]} less sedation in the post-operative period\textsuperscript{[8]} and earlier hospital discharge.\textsuperscript{[9]} Early mobilisation and oral food intake achieved with good pain control after QLB facilitate greater potential in the area of enhanced recovery after surgery.\textsuperscript{[5]}

The primary objective of this study was to evaluate the duration of post-operative analgesia with QLB in unilateral laparoscopic renal surgeries. The secondary objectives were to assess total morphine consumption during the first 24 h postoperatively and observe for any complications.

**METHODS**

After institutional ethical committee approval, this study was prospectively registered in Clinical Trials Registry India (CTRI/2019/01/017254). This prospective, randomised and observer-blinded study was done on 60 patients undergoing elective unilateral laparoscopic renal surgeries between 1 February 2019 and 30 October 2019. Patients with American Society of Anaesthesiologists physical status I, II and III, weighing between 40 and 100 kg and in the age group of 18–60 years were included in the study. Patients with coagulation abnormalities, chronic cardiac, pulmonary and hepatic diseases and those who were allergic to amide local anaesthetics were excluded from the study. The written informed consent was obtained from all the patients. General anaesthesia was standardised in all the patients. Patients with coagulation abnormalities, chronic cardiac, pulmonary and hepatic diseases and those who were allergic to amide local anaesthetics were excluded from the study. The written informed consent was obtained from all the patients. General anaesthesia was standardised in all the patients. The primary objective of this study was to evaluate the duration of post-operative analgesia with QLB in unilateral laparoscopic renal surgeries. The secondary objectives were to assess total morphine consumption during the first 24 h postoperatively and observe for any complications.

The pain was assessed by the Visual Analogue Scale (VAS) of 1–10, and the patient was explained about the same [Figure 1].\textsuperscript{[11]} All the patients were started on patient-controlled analgesia (PCA) with morphine. The bolus dose was fixed at 1 mg and a lockout interval of 10 min with a baseline infusion of 0.1 mg/h. The patients were advised to use a bolus dose when VAS >3. The duration of post-operative analgesia was taken as the time elapsed from the extubation to the first dose

![Visual Analogue Scale](image-url)
of morphine bolus. The total consumption of morphine in the first 24 h postoperatively was recorded. All the patients were monitored continuously with a pulse oximeter, electrocardiogram and non-invasive blood pressure and recorded 2 hourly. VAS score was also recorded every 2 h. The incidence of complications of QLB such as blood haematoma, infection and organ injuries was noted. The adverse effects of morphine use such as nausea, vomiting, pruritus and sedation were also observed.

We hypothesised that the QLB provided a longer duration of analgesia in laparoscopic renal surgeries. The sample size calculation was based on an initial pilot study involving twenty patients with the duration of post-operative analgesia as the primary endpoint of the study. For the study to have 80% power and alpha error at 0.05, a minimum of 60 min would be required in each group to detect a 20% difference in duration of post-operative analgesia. The sample size was calculated to be 22 patients in each group. To minimise the effect of data loss, we decided to include 30 patients in each group. The data from the pilot study were not included in the final analysis. Data were entered in the MS Excel spreadsheet (2010) and were analysed using the Statistical Package for the Social Sciences version 22 (trial version) (SPSS, Chicago, Illinois). Descriptive statistics including proportions, measures of central tendency and measures of dispersion were used to describe the data. Further, Student’s t-test was used to compare means between the groups and the Chi-square test was used to compare proportions. \( P < 0.05 \) was considered to be statistically significant, and \( P < 0.001 \) was considered statistically highly significant.

**RESULTS**

Sixty-six patients were recruited into the study, of which 60 patients were selected for the study. No patient was lost due to follow-up. The Consolidated Standards of Reporting Trials flow diagram depicting the passage of participants to the study is depicted in Figure 2. The two groups were comparable in terms of demographic profile [Table 1]. There was no difference in the duration and type of surgery between the two groups [Tables 1 and 2]. All the data obtained showed a normal distribution, and no skewed distribution was reported.

The duration of post-operative analgesia was significantly prolonged in Group A (1288.25 ± 288.92 min) than Group B (138.38 ± 54.92 min). The \( P \) value was <0.001 and it was statistically highly significant. Morphine consumption was also less in Group A (3.12 ± 0.87 mg) than Group B (10.46 ± 1.8 mg). The \( P \) value was <0.001 and it was statistically highly significant [Table 3]. There was no difference in VAS score between the two groups in the first 4 h postoperatively. There was a statistically significant difference in the VAS score from 6 to 20 h (h). There was no difference after 20 h [Figure 3]. There was no evidence of complications of the block such as haematoma, infection or organ injury. Three patients had nausea and two patients had vomiting in Group B.

**DISCUSSION**

QLB has evolved significantly in the last decade since its first introduction by Blanco.\(^{[12,13]}\) QLB is being utilised as a procedure in perioperative pain management in all age groups.\(^{[14-16]}\) The current literature evidence shows four different types of QLB. We performed a Type 3 block also known as transmuscular QLB or anterior QLB. In this type of QLB, the drug is injected between QL and PM muscles. The mechanism of action of QLB is by the spread of local anaesthetics into the thoracic paravertebral space and transversalis fascia.\(^{[1]}\) The anterior QLB is a deeper nerve block in comparison to the posterior or lateral block. The objective of this study was to evaluate the efficacy of QLB for post-operative analgesia in unilateral laparoscopic renal surgeries.

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**Table 1: Demographic characteristics**

| Demographic profile          | Group A (n=30) | Group B (n=30) | \( P \) |
|-----------------------------|----------------|----------------|-------|
| Gender (male/female)        | 24/6           | 23/7           | 0.11* |
| Age (years)                 | 38.51±13.24    | 45.92±9.08     | 0.111*|
| Height (cm)                 | 167.21±7.92    | 165.18±10.14   | 0.317*|
| Weight (kg)                 | 75.23±12.18    | 72.14±13.62    | 0.504*|
| ASA PS (I/II/III)           | 12/8/10        | 11/8/11        | 0.09* |
| Duration of surgery (min)   | 111.7±36.6     | 113.2±35.3     | 0.971*|

\*P not significant. Values are in mean±SD or number of patients. SD – Standard deviation; ASA PS – American Society of Anaesthesiologists physical status

**Table 2: Type of surgery**

| Type of surgery                | Group A, n (%) | Group B, n (%) | \( P \) |
|--------------------------------|----------------|----------------|-------|
| Laparoscopic pyelolithotomy    | 12 (40)        | 10 (33.3)      | 0.54* |
| Laparoscopic pyeloplasty       | 8 (26.7)       | 12 (40)        |       |
| Laparoscopic nephrectomy       | 10 (33.3)      | 8 (26.7)       |       |

\*P not significant. Values are in number of patients (percentage of patients)
patients without block. Verma et al. compared the transversus abdominis plane block (TAPB) with QLB for post-operative analgesia following the caesarean section. Both the blocks were performed bilaterally with 0.2% ropivacaine at the end of surgery. They found that the duration of post-operative analgesia was significantly prolonged in QLB by 68.77 ± 1.74 h compared to 13.3 ± 1.21 h with TAPB. The authors describe that prolonged analgesia achieved in their study was due to the spread of local anaesthetic along the thoracolumbar fascia and the endothoracic fascia into the paravertebral space. The difference in duration of analgesia may be due to the nature of surgery compared to our study.

Yousef compared ultrasound-guided bilateral QLB with TAPB following total abdominal hysterectomy. They observed that QLB produced analgesia for 15.1 ± 2.12 h in comparison to 8.33 ± 4 h achieved with TAPB. The duration of analgesia is similar to our study.

Blanco et al. conducted a study comparing QLB with TAPB in caesarean delivery. They were able to demonstrate that QLB produced long-lasting analgesia for more than 24 h and required less consumption of opioids. Öksüz et al. in their study compared TAPB with QLB in paediatric patients undergoing lower abdominal surgeries. They observed that QLB produced significant analgesia for up to 24 h.

In our study, the consumption of morphine was only 3 mg when QLB was performed compared to around 10 mg required for 24 h without the block. Zhu et al. studied the analgesic effects of subcostal approach to transmuscular QLB following laparoscopic nephrectomy. All the blocks were performed with 0.4 ml/kg of 0.3% ropivacaine under ultrasound guidance. They studied sufentanil consumption in the first 24 h of surgery through a PCA pump. They concluded that sufentanil consumption was significantly less, with 34.1 ± 9.9 µg in the QLB group compared to 42.1 ± 11.6 µg in the control group. Blanco et al. concluded that morphine consumption was significantly less in the QLB group at 12, 24 and 48 h after caesarean delivery. İpek et al. compared ultrasound-guided TAPB, QLB and caudal epidural in paediatric lower abdominal surgeries. They were able to demonstrate a significant reduction in analgesic consumption in the QLB group than the TAPB group, but it was not better than the caudal epidural group.

In our study, VAS score was not statistically significant in the first 4 h of surgery. This was probably due to the analgesic action of morphine including top-up given 2 h after the first dose and paracetamol used intraoperatively in both groups. VAS score was significantly reduced in the QLB group lasting for 20 h. Blanco et al. demonstrated a significant reduction in VAS score at rest for 12 h and with the movement for 48 h.

We did not encounter any complications in our study. Our search on several studies and review articles did not reveal any complications being encountered with QLB. Since QLB is a deep block compared to TAPB,
we must be vigilant to observe for blood haematoma, infections and organ injuries. Waruswitharana et al. published a case series of nine patients of continuous ultrasound-guided QLB for open renal surgeries. They found that it was better than continuous wound infusion analgesia. The use of catheters in QLB is relatively unexplored and needs to be looked into to prolong the analgesia. However, several studies have claimed analgesia up to 48 h. The use of catheters may not be beneficial in these cases.

There are a few limitations in our study. First, we did not encounter any complications in our study. However, because of the smaller sample size and block being performed by an experienced anaesthesiologist, we cannot say this will be the same for all QLBs. Hence, a larger sample size may be needed, and an inexperienced anaesthesiologist needs to get trained adequately before performing the block. The amount of morphine consumption in the control group was only above 10 mg, and only incidences of nausea and vomiting were encountered. No serious adverse effects were noted due to PCA morphine. Second, we did not study the local anaesthetic concentration in plasma. Third, one study has recommended a subcostal approach to QLB for laparoscopic nephrectomy. However, we were able to achieve adequate analgesia with regular transmuscular QLB. Fourth, we did not study other types of QLB. A separate study may be needed to compare the different types of QLB.

**CONCLUSIONS**

Ultrasound-guided QLB provides prolonged duration of post-operative analgesia and reduces the consumption of opioids following laparoscopic renal surgeries.

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**Conflicts of interest**

There are no conflicts of interest.

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