Original Article

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.[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.[5] Several studies have demonstrated less incidence of post-operative nausea and vomiting,[6] earlier removal of urinary catheters,[7] less sedation in the post-operative period[8] and earlier hospital discharge.[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.[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. All the patients were premedicated with tablet alprazolam 0.5 mg on the night before surgery and 2 h before surgery. Morphine 0.15 mg/kg was used as an intraoperative analgesic and administered 10 min before induction of anaesthesia. The patients were induced with propofol 2 mg/kg and intubated after 3 min of administering cisatracurium 0.15 mg/kg. Morphine 0.05 mg/kg was administered as a top-up after 2 h of surgery. All the patients received paracetamol 15 mg/kg at the end of surgery and every 6 h intravenously for 24 h. The patients did not receive any other additional analgesics.

Patients were randomly divided into two groups by computer-generated random numbers and closed envelope method. An independent person performed allocation randomly by computer-generated number method before the start of the study. They were kept in a sealed envelope of 60. The envelope was opened at the time of each patient depending on the corresponding numbers. At the end of the surgery, Group A patients received ultrasound-guided QLB and Group B patients did not receive any block. The QLB was performed at the end of surgery before extubation in the lateral position used for surgery. All the blocks were administered by a single anaesthesiologist who had performed atleast 20 QLBs.

A GE Vivid Ultrasonogram (USG) Machine, with a 2–5 MHz curvilinear probe with colour Doppler, was used for the study. A 21G, 100 mm SonoPlex needle was used to administer the block. The skin was disinfected and draped with the patient in a lateral position. QLB type 3 (anterior) was performed in all the patients. The needle tip was placed between quadratus lumborum (QL) and psoas major (PM) muscles, and ropivacaine 0.375% 30 ml was injected between the muscles. The pressing down of PM by the local anaesthetic in the USG image confirmed the correct placement of the needle.[10] All the blocks were performed by an experienced anaesthesiologist who took no further part in the study. After extubation, the patients were shifted to the post-anaesthesia care unit. The second anaesthesiologist, who was blinded to the group allotted, monitored and recorded the data for 24 h postoperatively.

The pain was assessed by the Visual Analogue Scale (VAS) of 1–10, and the patient was explained about the same [Figure 1].[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

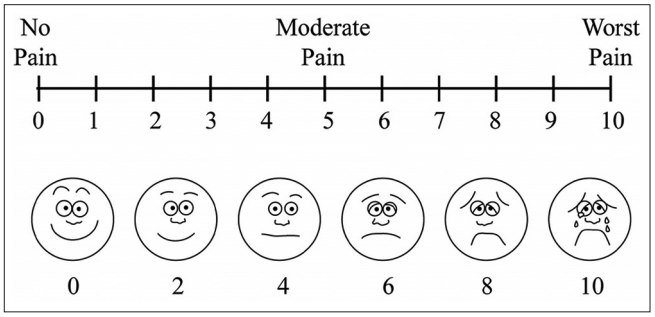

Figure 1: Visual Analogue Scale

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.

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)

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.

QLB significantly prolonged the duration of analgesia by up to 21 h, and it was around 2 h in

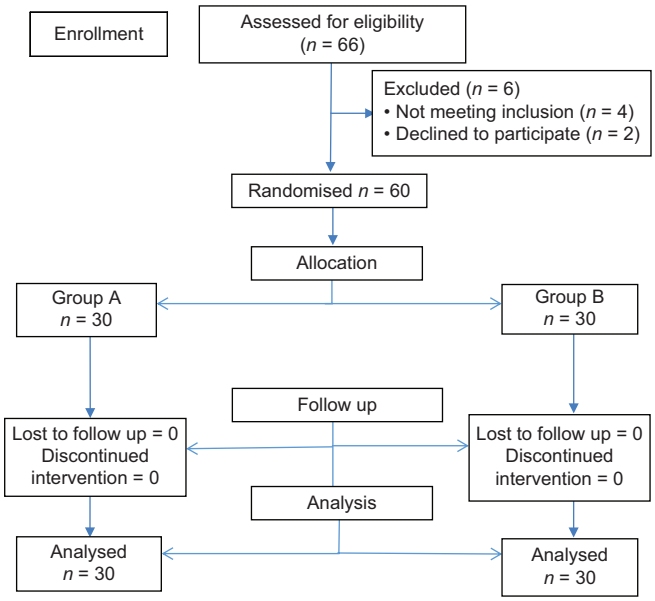

Figure 2: Consolidated Standards of Reporting Trials flow chart

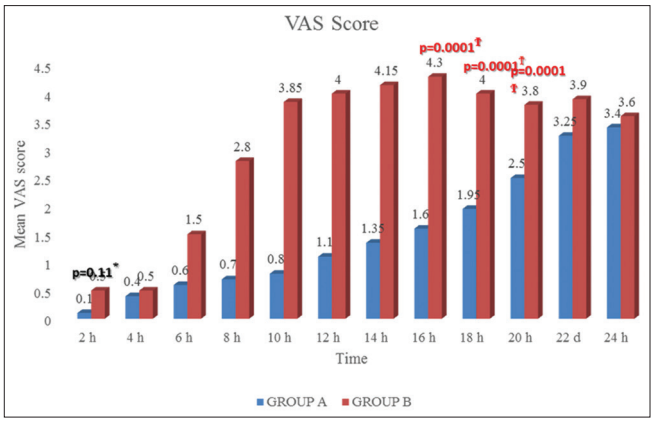

Figure 3: Comparison of Visual Analogue Scale scores (mean values). **P* value not significant, †*P* value significant

Table 3: Analgesic data

Analgesic data	Group A	Group B	*P*
Duration of post-operative analgesia (min)	1288.25±288.92	138.38±54.92	<0.001†
Total morphine consumption (mg)	3.12±0.87	10.46±1.8	<0.001†

†*P* value significant. Values are in mean±SD. SD – Standard deviation

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.[17] 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.[18] 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.[15] 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.[19]

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.[1] 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.[15] 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.[20]

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.[15]

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.[13] Warusawitharana *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.[21] The use of catheters in QLB is relatively unexplored and needs to be looked into to prolong the analgesia.[15] 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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