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Perioperative analgesia with ultrasound-guided quadratus lumborum block for transurethral resection of prostate

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Abstract

Background: Prostatic hyperplasia is a physiological aging process in men. After transurethral resection of prostate (TURP), visceral pain is the main cause. The effective postoperative analgesia can reduce the occurrence of postoperative complications. This study mainly studied the analgesic effect of quadratus lumborum block (QLB) on TURP.

Methods: We divided 62 patients undergoing TURP into 2 groups using a random number table method (QLB 2 group and non-QLB [control] group). Patients in the QLB group underwent ultrasound-guided posterior QLB with 20 mL of 0.25% ropivacaine on each side, and those in the control group received only general anesthesia. The primary outcome for this study was the consumption analgesic pump during 0 to 24 hours. The secondary outcomes included the first pressing time of analgesic pump during 0 to 24 hours, the pain at rest and when coughing at 1, 4, 8, 12, and 24 hours post-operation as measured with a visual analogue scale for pain, length of the hospital stay, and complications (nausea and vomiting, dizziness, and abdominal distension).

Results: Patients in the QLB group presented less consumption, later first pressing time of analgesic pump during 0 to 24 hours after surgery lower visual analogue scale scores at 1, 4, 8, 12, and 24 hours postsurgery than those in the control group. Moreover, their mean length of hospital stay was shorter ($P = .023$), and they experienced less postoperative complications than the patients in the control group.

Conclusions: Ultrasound-guided QLB in TURP provided a significant analgesic effect in our patients the first day after surgery. This analgesic model may improve the postoperative recovery after TURP.

Abbreviations: QLB = quadratus lumborum block, TPVB = thoracic paravertebral block, TURP = transurethral resection of prostate, VAS = visual analogue scale.

Keywords: analgesia, prostate, quadratus lumborum block

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The ethics committee of the Jiaxing Hospital of Traditional Chinese Medicine approved the study protocol (approval number 2019KY0452). We obtained written informed consents from patients undergoing elective transurethral resection of the prostate to participate in the study (Clinical-Trails.govID: chiCTR2000034587).

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

The authors have and conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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1. Introduction

A multimodal analgesia approach targeting multiple pain pathways has become popular due to the opioid crisis. Local anesthesia reduces intra- and postoperative opioids use.[1] Epidural local anesthetic can limit early mobilization/ambulation after surgery rather than "prolong the recovery of bed-ridden patients. The concept of quadratus lumborum block (QLB) comes from Blanco in 2007. The posterior approach was proposed to be “non-penetrating” with transverse abdominis plane stagnation.[2] The block encompasses the T6-L1 segments,[3] where local anesthetics can be spread through the thoracolumbar fascia, blocking part of the sympathetic nerve.[4]

Compared to the thoracic paravertebral block (TPVB), the QLB offers longer-lasting analgesia and a more extensive blockage range.[5] QLB inhibits both somatic and visceral pain. Reasonable multimodal analgesia is essential for patient’s recovery. TURP patients has the characteristics of visceral pain, in this prospective randomized placebo-controlled study, we tested the hypothesis that QLB in TURP can relieve acute pain after surgery resulting in a rapid recovery.

2. Methods

The ethics committee of the Jiaxing Hospital of Traditional Chinese Medicine approved the study protocol (approval number 2019KY0452). We obtained written informed consents from patients undergoing elective transurethral resection of the

prostate to participate in the study (Clinical-Trails.govID: chiCTR2000034587).

2.1. Clinical design

We conducted this singlecenter study at the Jiaxing Hospital of Traditional Chinese Medicine in China. We enrolled 64 patients (with ages ranging from 50 to 85 years) with an American Society of Anesthesiologists Physical Status Class I or II, and who had been scheduled for elective TURP. We excluded patients with coagulation disorders, puncture site infections, acute or chronic pain, cognitive impairment, drug addictions, and/or liver or kidney dysfunction.

We allocated patients randomly into one of 2 intervention groups through a computer random number generator: patients in the QLB group received an ultrasound-guided QLB with 20 mL of ropivacaine 0.25% at each side (Fig. 1), and those in the control group received no blocks. An investigator not involved in patient care, preoperative assessment, or data collection, used a random number sequence to randomize the patients. The researcher collecting the data was blinded to the treatment regimen.

3. Study protocol

All patients followed the enhanced recovery after surgery pathway reported in Table 1, which included perioperative recommendations and measures.

Before the surgery, the same anesthesiologist familiar with ultrasound-guided nerve blocks performed the posterior QLBs (double side) with the patients in the lateral position in the preoperative preparation room. Patients were monitored throughout the performance of the block. Before the block, a nurse covered the patient's head with a sterile sheet, after administering midazolam (1 mg). The ultrasound probe with regular gel was placed in a sterile glove. After cleaning the abdomen with a surgical solution, the probe was placed at the level of the anterior superior iliac spine and moved cranially until the three abdominal wall muscles were identified. Then it was moved posteriorly to the level where the transversus abdominis muscle gives way to its aponeurosis. Then, the quadratus lumborum muscle was visualized slightly cephalad to the iliac crest after setting a 2 to 5 MHz low-frequency curved linear transducer (Sono-site EDGE Portable Ultrasound System) to an imaging depth between 6.6 and 9.2 cm (Fig. 1).

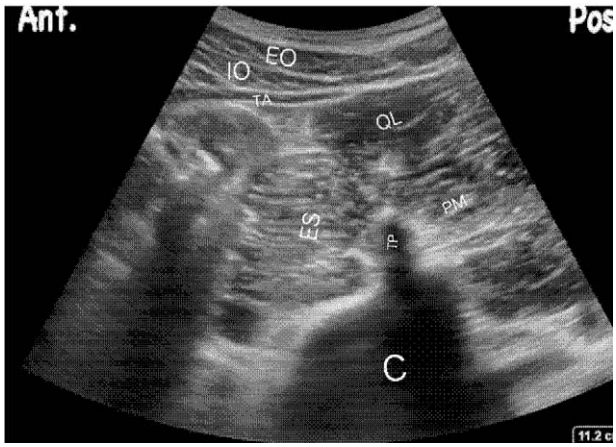

Figure 1. Ultrasound guided imaging demonstrating relevant QLB anatomy. The anesthesiologist performing the QLB procedures obtained similar images. C = centrum, PM = psoas muscle, QLM = quadratus lumborum, TP = transverse process.

The probe was moved to visualize the "shamrock sign," where the erector spine and psoas muscles become visible. These images show the recognizable pattern of a three-leaf shamrock as described in the Shamrock Block technique. The quadratus lumborum attaches to the transverse process. The anesthesiologist used a real-time ultrasound-guided in-plane technology to insert the puncture needle (100-mm 20-G) from the dorsal lateral to the ventral side of the quadratus lumborum (needle tip in the lumbar interfacial triangle behind the muscle), tested for withdrawal without blood, and then injected 2 to 4 mL of saline solution in the confirmed location. The anesthesiologist injected each muscle side with 20 mL 0.25% ropivacaine and confirmed the puncture and drug dissemination in real-time under ultrasound guidance. Twenty minutes later, we used alcohol to test the blocking range in the T7-L1 regions. The patients in the control group underwent the same cleaning with sterilized wipes for puncture preparation, and the anesthesiologist used a 20-G needle tail to simulate puncture and injection at the anatomical block location.

All patients underwent endotracheal intubation, and the anesthesiologist induced general anesthesia with intravenous fentanyl (3–4 μg/kg), propofol (2–3 mg/kg), and cisatracurium (0.1–0.2 mg/kg). During the surgery, anesthesia was maintained

Table 1

ERAS protocol.

	Control group (n = 31)	QLB group (n = 31)
Operative day −1 Bowel preparation	Compound polyethylene glycol (2 bags)	Compound polyethylene glycol (2 bags)
Preoperative	Quit smoking and drinking	Quit smoking and drinking
	Preoperative education	Preoperative education
	Informed consent	Informed consent
	Glucose load (2 h before)	Glucose load (2 h before)
	Antibiotic prophylaxis	Antibiotic prophylaxis
	Thrombus prophylaxis	Thrombus prophylaxis
Anesthetic protocol	General anesthesia without block	General anesthesia plus ultra-sound guided quadratus lumborum block
Intraoperative	Prevention of hypothermia	Prevention of hypothermia
Operative day +1 Analgesia	Regular 50 mg flurbiprofen axitil when VAS > 4;PCIA	Regular 50 mg flurbiprofen axitil when VAS > 4;PCIA
Activities of daily living	Encourage walking	Encourage walking
Postoperative IV fluids	Liberal protocol	Liberal protocol

with a mixture of 60% oxygen and air with a 0.8 to 1 minimum alveolar anesthetic concentration of sevoflurane, as well as a maintenance dose of 0.05 to 0.2 μg/kg/min of remifentanil. Intraoperative intermittent addition of cisatracurium was used to maintain a deep curarization for the full duration of surgery. The mechanical ventilation settings were: VT 7 mL/kg, $P_{ET}CO_2$ 35–50 mm Hg, and BIS 40–60. Thirty minutes before the end of the surgery, all patients received 50 mg flurbiprofen axitil.

All patients underwent the same surgical procedure. An experienced surgeon performed all the TURPs. All the data were prospectively recorded in a dedicated database.

To observe the influence of the QLB on the management of postoperative pain after the patients had been brought to the recovery room, we connected a sufentanil (patient-controlled analgesia) PCA pump to each patient, and programmed it to deliver a 2 μg intravenous bolus on demand, with a lockout interval of 10 minutes and no background infusion. In addition, each patient received a regular postoperative analgesic regimen consisting of 50 mg flurbiprofen axitil when VAS > 4.

For our primary endpoint, we measured the consumption analgesic pump during 0 to 24 hours, and for our second endpoints we recorded the first pressing time of analgesic pump during 0 to 24 hours, postoperative pain scores using the VAS method recorded at 1, 4, 8, 12, and 24 hours after surgery (at rest and when coughing), length of hospital stay, remedial analgesia requirements, and complications (recurrence of postoperative nausea, vomiting, dizziness, and flatulence).

3.1. Statistical analysis

We did not find any previous studies comparing QLB pain scores after TURP. We performed a pilot study with a small number of patients in each group. We calculated the data from 10 patients, in whom the consumption analgesic pump during 0 to 24 hours postoperation. The average consumption in the control group is 30 μg, while in the QLB group was 10 μg. As this would be a 25% absolute reduction in the QLB group compared with the A group. We elected 31 patients per group into the study based on a calculation of type I error associated with this test for null hypothesis was 0.05 and a power of 0.8, to minimize any effect of data loss.

We performed all statistical analyses using the statistical package SPSS (ver. 19, SPSS Inc), and defined the level of significance at $P = .05$. We assessed data for normality based on the results of the Shapiro–Wilk test. For variables with a normal distribution, we presented the measurement data as means ± standard deviations, and used a parametric t test. For non-normally distributed variables, we used the non-parametric

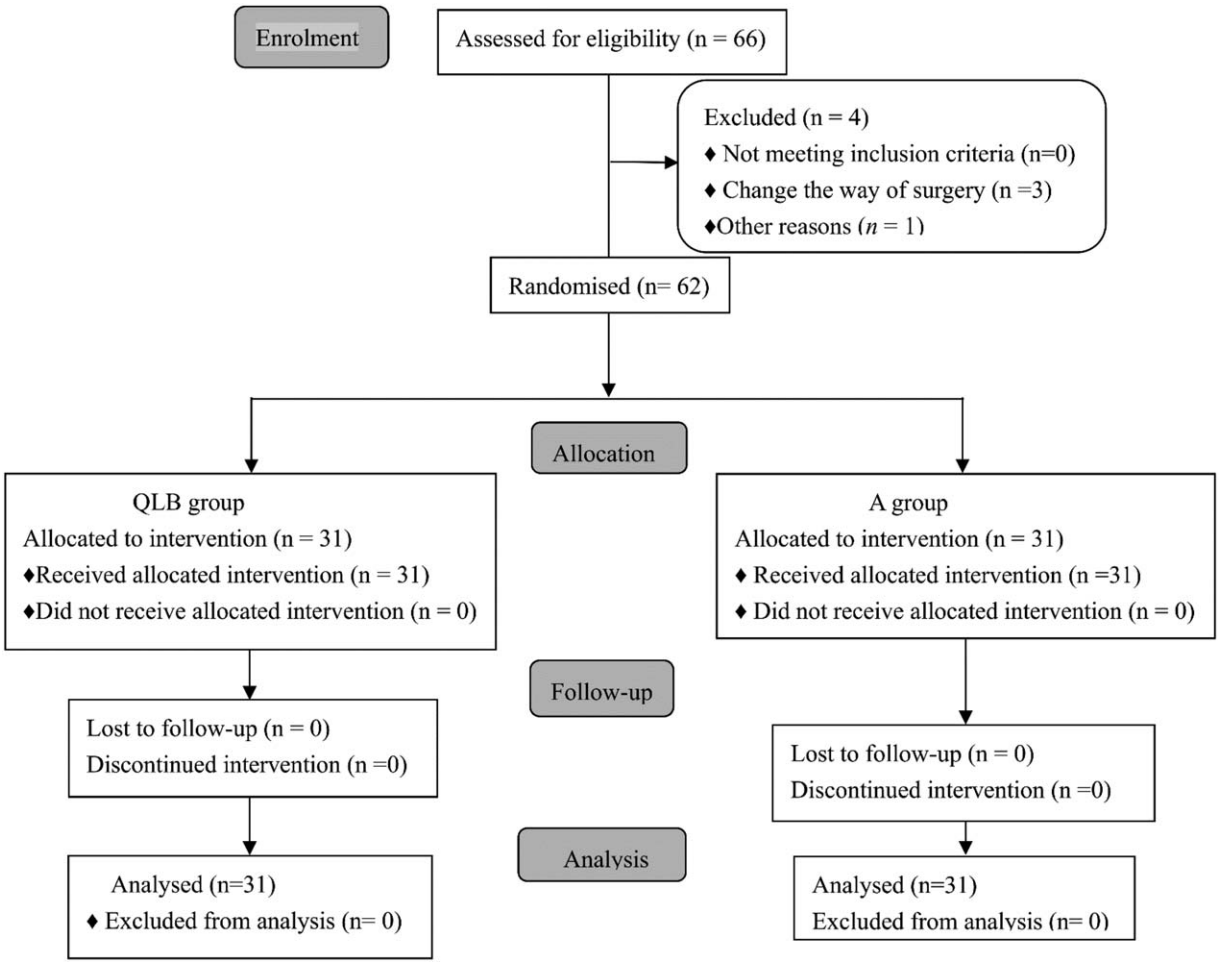

Figure 2. Patients' flow diagram. QLB indicates quadratus lumborum block.

Table 2

Patient characteristics.

	Control (n = 31)	QLB (n = 31) *P*
Age, years, median (range)	71 (50–85)	71 (50–84) .842
BMI, kg/m 2, median (range)	23.6 ± 3	23.6 ± 2.3 .970
ASAI/II/III	2/29 /0	3/28/0 .641

Mann–Whitney *U* test. We used the Chi-Squared test to compare differences between the obtained variables in the 2 independent groups. We determined statistical differences using Student *t* test or one-way analysis of variance with post hoc test. A *P* value $<.05$ ($P < .05$) in a two-tailed test was considered statistically significant.

4. Results

We enrolled 64 patients in the study; 2 were excluded, one of them because they had undergone another operation, and the other one because they did not meet the inclusion criteria. After the exclusions, we placed 31 patients into the QLB group and 31 into the control group (Fig. 2). We found no differences in baseline patient characteristics (Table 2), clinical variables, or surgical procedures between the 2 groups. Compared with group A, the consumption, the first pressing time of analgesic pump during 0 to 24 hours after surgery in group QLB were significantly less than those in group A ($P < .05$). Moreover, Patients in the QLB group showed lower VAS scores at 1, 4, 8, 12, and 24 hours postoperation, at rest and when coughing (Fig. 3). This group presented a shorter length of hospital stay ($P = .023$). One remedial analgesia had to be used in a patient in the control group. Six patients presented dizziness, and 4 abdominal distention in the control group, while 1 presented dizziness and 1 abdominal distention in the QLB group. We found similar postoperative nausea and vomiting rates in both groups (Table 3). However, the QLB group had lower mean ΔSBP (systolic pressure), ΔDBP (diastolic blood pressure), ΔHR (heart rate), and ΔMAP (mean arterial pressure) between the time of skin incision and 5 minutes after that (Fig. 4).

Twenty minutes later, we used alcohol to test the blocking range in the T7-L1 regions.

12 hours later, we used alcohol to test the blocking range in the T7-L1 regions.

Table 3

Postoperative outcomes.

	Control (31)	QLB (31) *P* value
Operation time	86.7 ± 41.3	84.6 ± 59.3 .872
sufentanil consumption	32.66 ± 7.2	10 ± 3.8 .06*
Time to first press (h)	2.8 ± 0.98	10.56 ± 6.02 .001*
Nausea (n) %	1 (3.2%)	1 (3.2%) 1
Vomiting (n) %	1 (3.2%)	1 (3.2%) 1
Abdominal distension (n) %	4 (12.9%)	1 (3.2%) 0.162
Dizziness (n) %	6 (19.4%)	1 (3.2%) .045
Remedial analgesia (n) %	11 (35.2%)	1 (3.2%) .001

5. Discussion

We designed this study to assess the analgesic efficacy of QLB in patients who had received PCA for postoperative pain relief after TURP.

Why are we not choosing intraspinal anesthesia because more and more people like to choose general anesthesia.

The pain of the TURP was mild to moderate, triggered by prostatic afferent nerves via spinal reflexes. Then, the astrocytes in the lumbosacral spinal cord were activated. The nerve impulses were transmitted through ilioinguinal and the genitofemoral nerves, and the sympathetic nerve terminal released norepinephrine, prostaglandins, calcitonin gene-related peptide and substance P. These substances leaded to bladder and urethral dysfunction, as well as abnormal contraction in the perineum, pelvis, and sacrum muscles. Eventually, it resulted in the persistent pain and referred pain in the specific region outside the prostatic.

We found that, for patients in the QLB group, compared with group A, a reduction in 24 hours PCA consumption and time to first pump dose. The VAS scores were lower than those in the control group at every assessed time point.

To our knowledge, this is the first double-blind randomized prospective study of QLB for TURP. In addition, the QLB group had a shorter length of hospital stay and fewer complications.

QLB has been widely used in the clinical practice. We base this observation on our experience during the training and competency assessment of the anesthesiologists at our institution, who perform this block. We chose to perform posterior QLB, as this type of block is safer than a TPVB due to its more superficial

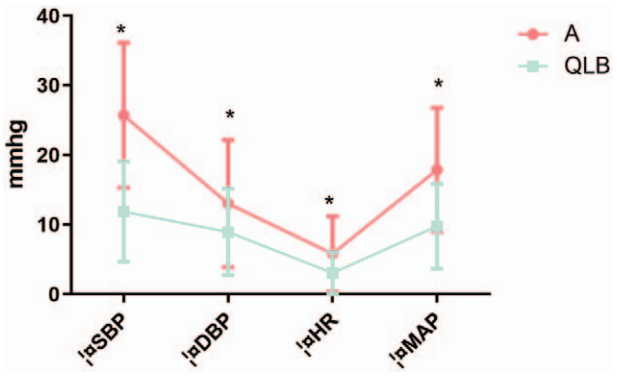

Figure 3. Visual analogue scale for pain (A) at rest and (B) coughing in patients receiving quadratus lumborum block with lopivacaine or none.

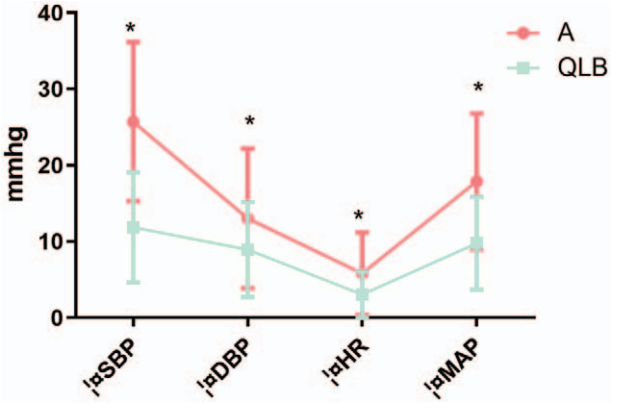

Figure 4. ΔSBP, ΔDBP, ΔHR, ΔMAP means the changes in the 2 time-points of immediately at the time of skin incision and 5 minutes after skin incision.

location, the longer distance to the intra-abdominal viscera, and the presence of adjacent muscle.

We performed QLB before the surgery with the patients in the lateral position and under the effects of sedation, the block before the operation to use ultrasonographic anatomical guidance. Also, combined anesthesia can reduce the amount of anesthetic drugs needed (especially reducing the need for opioids) during the operation. Opioid-sparing strategies after surgery can reduce the nausea, vomiting, and constipation.

Hansen et al studied the transmuscular QLB for postoperative pain relief in a randomized controlled trial and showed less opioid consumption in 24-hour.[6] In a postoperative pain after cesarean delivery in a randomized controlled trial, Blanco et al observed that the analgesic effect lasted for 18 to 24 hours and was still present 48 hours postoperatively, otherwise, the consumption of morphine reduced.[7] Yun et al used QLBs and studied analgesic effects and chronological ropivacaine concentrations after laparoscopic operations.[4] They found that the QLB resulted in a lower risk of systemic toxicity, in a more widespread sensory block, and in longer-lasting analgesia than the TPVB. In our study, we generated an analgesia block plane from the T7 to the L1 spaces, as described by Spence et al.[8] The VAS scores in the QLB group at 24 hours after surgery were lower than those in the control group, which means the analgesia lasted for at least 24 hours, in agreement with findings by Wikner et al.[9]

We did not directly compare QLB with other, though we still not sure the true mechanism of action of the QLB, but the efficacy of the QLB for postoperative analgesia has been demonstrated for cesarean sections,[6] gynecological laparoscopic procedures,[10] hip arthroplasty,[11] and abdominal operations.[12]

Moreover, we found that the hemodynamics in the QLB group were more stable than those in the control group between the time of skin incision and 5 minutes after it (The measured time points were all before the pendulum position). We postulate that the QLB may suppress stress reactions. However, this needs to be demonstrated in future randomized studies.

5.1. Limitations

We are aware of our study's limitations. First, whether there is potential to use a higher concentration such as 0.375% ropivacaine with a volume increased to the maximum safe dose, then has a more optimistic outcome. Second, this study included only a 24-hour follow-up survey, and the duration of the QLB analgesia could not be investigated. Furthermore, it might also lead to different results, because of the vary ways of block to be used in QLB block.

6. Conclusions

In all, QLB seems to be an optimal regional analgesic technique for patients undergoing TURP as an additional analgesic method for managing postoperative pain using non-narcotic analgesics. The role of QLB in the visceral pain surgery requires further study.

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Author contributions

Conceptualization: Chunxia Fei.
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Project administration: haiyan wang.
Writing – original draft: haiyan wang.
Writing – review & editing: Wei Deng.

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