The analgesic efficacy of ultrasound-guided transversus abdominis plane block for retroperitoneoscopic renal surgery: A randomized controlled study

Xue Li
peking university first hospital
Zhen-Zhen Xu
Peking University First Hospital
Xue-Ying Li
Peking University First Hospital
Ting-Ting Jiang
Peking University First Hospital
Zeng-Mao Lin (linzengmao@163.com)
https://orcid.org/0000-0001-6450-8063
Dong-Xin Wang
Peking University First Hospital

Research article

Keywords: Transversus abdominis plane block, Analgesia, Retroperitoneoscopic renal surgery, Postsurgical recovery

Posted Date: July 31st, 2019

DOI: https://doi.org/10.21203/rs.2.9718/v2

Version of Record: A version of this preprint was published on October 18th, 2019. See the published version at https://doi.org/10.1186/s12871-019-0850-3.

Abstract

Background Ultrasound-guided lateral transversus abdominis plane (TAP) block can provide definite analgesia to the anterior abdominal wall. However, whether this method is useful in renal surgery involving access through the lateral abdominal wall remains unknown. Therefore, the study aimed to evaluate the analgesic efficacy of lateral TAP block for retroperitoneoscopic partial or radical nephrectomy. Method In this prospective, randomized, double-blind, placebo-controlled trial, eligible patients were randomized into the intervention (T) or control (C) groups. After anaesthesia induction, ultrasound-guided lateral TAP block was performed preoperatively with 30 ml of 0.4% ropivacaine and an equivalent amount of normal saline in groups T and C, respectively. The primary outcomes were opioid consumption during surgery and in the first 24 h after surgery. Secondary outcomes were postsurgical pain intensity upon immediately awakening from anaesthesia and at 0.5, 1, 2, 6, 12, and 24 h after surgery as well as recovery quality variables including the incidence of postoperative nausea and vomiting (PONV), sleep quality, time to first ambulation, drainage and length of hospital stay. Results A total of 104 patients were enrolled and randomized: 53 and 51 in groups T and C, respectively. Laparoscopic surgery was converted to open surgery in one patient. Thus, he was excluded from the analysis. The median intraoperative and postoperative opioid consumption (oral morphine equivalent dose, o-MED) in the first 24 h after surgery were 105.0 and 32.5 mg in Group C, respectively, and the corresponding values in Group T were 121.0 and 39.7 mg, all of which were not significant (P = 0.284 and 0.311). Postsurgical pain intensity at all time points was comparable between the groups (all P > 0.05). Intergroup differences in the recovery quality variables were not significant (all P > 0.05). Conclusion Our findings demonstrated that preoperative lateral TAP could not decrease intraoperative or postoperative opioid consumption or pain intensity in the first 24 h after surgery, nor could it promote postoperative recovery in patients undergoing laparoscopic renal surgery through retroperitoneal access.

Background

For laparoscopic renal surgery, the retroperitoneal approach is an alternative method to the transperitoneal approach. The overall outcomes of both approaches, such as the perioperative complication rate, positive surgical margin rate and recurrence rate, are similar, while the retroperitoneoscopic approach is advantageous in terms of easier hilar control and shorter total operative time, especially in patients with a past history of intraperitoneal procedures or with a posteriorly located renal tumour [1–3]. Therefore, the retroperitoneoscopic approach is the most popular approach for radical or partial nephrectomy in Peking University First Hospital. Multimodal analgesia including nerve block is advocated to improve early recovery after renal surgery [4,5].

Transversus abdominis plane (TAP) block is an effective local regional anaesthetic technique that blocks neural afferents of the T6-L1 spinal nerve innervating the anterolateral abdominal wall [6]. Since the original report by Rafı [7], there have been a plethora of studies on this block and variations of the original approach, among which lateral TAP is the most commonly used approach in abdominal surgery, with its dermatomal blocking area covering T10 to L1 [8]. A recent systematic review demonstrated that TAP had

definite analgesic efficiency for some kinds of lower abdominal surgeries, such as gynaecological surgery, caesarean section and hernia repair surgery, but not urologic surgeries [9]. However, it was worth noting that there was high heterogeneity among the urologic studies included in this review. In addition, some studies focusing on renal surgery were missed.

To our knowledge, only three randomized controlled trials have compared the effect of lateral TAP block and placebo in laparoscopic live-donor nephrectomy [10–12]. All of them found that TAP block surely reduced postoperative pain and opioid requirements. However, this conclusion could not be extrapolated to retroperitoneal laparoscopic renal surgeries (RLRS) because the main incision was completely different from that of live donor nephrectomy.

Theoretically, the lateral TAP block dermatome can only partially cover the wound in RLRS. Thus, whether it could reduce opioid consumption or subjective pain score or ultimately promote the recovery of patients undergoing RLRS is still unknown and requires further investigation.

The primary objective of this study was to determine whether lateral TAP block could supply effective analgesia and improve recovery quality in patients undergoing RLRS.

Methods

Study design

This prospective, randomized, double-blinded study was approved by the Biomedical Research Ethics Committee of Peking University First Hospital (2017–1398). It was registered at http://www.chictr.org.cn with the following identification number: ChiCTR-INR–17013244. Written informed consent was obtained from each patient.

Participants

Potential participants were screened the day before surgery. Patients aged between 18 and 70 years and scheduled to undergo elective laparoscopic radical or partial nephrectomy were included. Patients who met any of the following criteria were excluded: (1) chronic opioid addiction and/or use of other kinds of analgesic drugs for more than 3 months; (2) inability to communicate due to severe dementia, language barrier, or end-stage disease; (3) allergic to local anaesthetics; (4) nerve block contraindication such as an infection in the puncture site or severe coagulation dysfunction; and (5) refusal to participate in the study. Patients who were eligible for this trial were taught how to evaluate pain intensity by using the numeric rating scale (NRS, an 11-point scale where 0 indicates no pain and 10 indicates the worst pain) and how to use a patient-controlled analgesia (PCA) device.

Anaesthesia management and surgical technique

All patients were treated per a standardized anaesthetic protocol. In addition to basic standard monitoring (electrocardiography, noninvasive arterial blood pressure measurement, pulse oximetry,

bispectral index (BIS), capnography), other interventions, such as central venous cannulation, invasive arterial cannulation, and/or monitoring using the Flotrac-Vigileo system, were performed according to the patients' comorbidities. Anaesthesia was induced with 0.15–0.3 μg/kg sufentanil, 1–3 mg/kg propofol, and 0.1–0.2 mg/kg etomidate. Endotracheal intubation was facilitated using 0.15 mg/kg cisatracurium or 0.6 mg/kg rocuronium bromide. Anaesthesia was maintained with propofol infusion, remifentanil infusion with intermittent sufentanil or sufentanil infusion, with or without dexmedetomidine infusion, with the aim of maintaining BIS values between 40 and 60 and mean arterial pressure and heart rate in a 10–20% interval in relation to the corresponding preoperative values. 30 min before the end of surgery, 50 mg of intravenous flurbiprofen axetil and 5 mg of tropisetron were administered to all patients. Upon emergence from anaesthesia, the patients were transferred to the post-anaesthesia care unit (PACU) followed by transfer to the ward 1 h later.

All patients were managed according to a standard postoperative pain management protocol, i.e., a PCA pump with 1.25 μg/ml sufentanil at a basal rate of 0.5 ml/h and an on-demand bolus of 4 ml every 10 min with a rigorous rescue analgesia plan. The analgesic aim was to maintain the NRS pain score below 4. In the PACU, regular pain evaluation was performed every 30 min. If the NRS score was higher than 7, a first bolus of 4 ml was administered from the pump by medical workers, and pain was evaluated 5 min later. If the score continued to remain higher than 7, 3–5 μg sufentanil was administered according to the patient's weight. If, however, the score decreased to 4 or less, no more rescue analgesics were administered. In the ward, pain evaluation was performed at 2, 6, 12, and 24 h after the surgery. In addition to these follow-ups, patients were instructed to request additional medication in case of breakthrough pain. Breakthrough pain control measures were similar to those in the PACU, except 3–5 mg morphine was administered instead of 3–5 μg sufentanil. NSAIDS or other analgesics could be used as additional drugs according to the surgeons' preference.

The retroperitoneal laparoscopic procedure was usually performed through three ports. The primary port was invariably placed through the incision made for the creation of the working space. The location of this incision was just below the tip of the 12th rib on the posterior axillary line. The secondary port was placed 2 cm above the iliac crest on the midaxillary line, while the third port was placed under the costal margin on the anterior axillary line. In radical nephrectomy, the initial incision was extended ventrally for kidney removal. The pneumoperitoneum was maintained at approximately 12–14 mmHg throughout the procedure (Figure 1).

Randomization and intervention

Stratified randomization with a block size of 4 was performed using the SAS statistical package version 9.3 (SAS Institute, Cary, NC, USA) by a biostatistician (Xiao-Lu Nie) who was blinded to the data management and statistical analyses. The stratified factor was the type of surgery, i.e., radical or partial nephrectomy. The randomization results were then sealed in sequentially numbered envelopes, transferred to a qualified anaesthesia nurse (Ting-Ting Jiang) with the Good Clinical Practice (GCP) certification and stored at the site of the investigation until the end of the study.

An investigator (Zeng-Mao Lin) screened the patients and made a recruitment plan the day before surgery. On the day of surgery, the anaesthesia nurse opened the envelopes consecutively according to the recruitment plan and prepared relevant drugs for each group and then did not participate in the rest of the trial. The study drugs were provided as clear aqueous solutions in the same 20 ml syringes. The patients were randomly assigned to two groups: Group T and Group C. Perioperative management was identical in both groups except for the drug used in the TAP block. The drug used in Group T was 30 ml of 0.4% ropivacaine, while an equivalent amount of normal saline was used in Group C. The anaesthesiologist, surgeon, attending staff in charge of the patient, investigators, and patients themselves were fully blinded to the group assignments.

Ultrasound-guided TAP block was performed by two experienced anaesthetists (Da Huang and Hao Kong) immediately after the induction of anaesthesia and approximately 15 min before skin incision. With the patient in the supine position, the US probe was placed at the midaxillary line between the lower costal margin and the iliac crest. At this point, the plane between the internal oblique and transverse abdominal muscles was identified (Figure 2A). A special needle used for nerve block (80 mm or 100 mm, Stimuplex D, Germany) was inserted using an in-plane technique in the anteroposterior direction. After aspiration, to avoid inadvertent intravascular injection and abdominal paracentesis, an injection with 2 ml of normal saline was used to ensure correct positioning of the needle. Then, the prepared drug was injected into this plane. Successful drug injection for this study was defined as the appearance of a hypoechoic ellipsoid with well-defined margins on ultrasonic imaging (Figure 2B).

Follow-up schedule and outcomes

Investigators (Xue Li, Zhen-Zhen Xu, Zeng-Mao Lin) blinded to the randomization were in charge of the perioperative data collection. Patients were followed-up at several time points in the first 24 h after surgery. In addition, the electronic medical system was reviewed to obtain necessary data.

The primary outcomes were opioid consumption (o-MED) during surgery and in the first 24 h after surgery. The secondary outcomes were as follows: (1) NRS pain scores both at rest and with coughing at the following time points: after immediately awakening from anaesthesia and at 0.5, 1, 2, 6, 12 and 24 h after the operation; (2) time to the first bolus demand in the PCA system with its required and effective bolus numbers; (3) time to the first rescue analgesic as well as its frequency and percentage in addition to the use of the PCA system; (4) the incidence of postoperative nausea and vomiting (PONV) 24 h after surgery and the percentage of antiemetic use; (5) patients' sleep quality evaluated by the NRS (an 11-point scale where 0 indicates the best sleep quality and 10 indicates the worst sleep experience) on the night of surgery; (6) time to the first ambulation after surgery; (7) drainage in the first 24 h after surgery; and (8) the length of hospital stay after surgery.

To assess the safety of the technique, complications associated with the TAP block, anaesthesia, and surgery were also recorded. These adverse events included but were not limited to the following conditions: numbness in the lower extremities, haematoma and bleeding in the needle trajectory, visceral organ injury, anaphylaxis, local anaesthetic toxicity, airway spasm, hypoxemia, cardiac arrest, new-onset

arrhythmia, persistent hypotension (systolic blood pressure reduction of more than 30% from baseline [average value in the ward] lasting for at least 15 min) and bradycardia (heart rate < 45 beats per minute or a decrease of more than 30% from baseline [average value in the ward] lasting for at least 5 min), major haemorrhage (loss of over one blood volume [70 ml/kg or >5 L in a 70-kg adult] in 24 h, loss of 50% of total blood volume in less than 3 h, or bleeding at a rate greater than 150 ml/min), conversion of laparoscopic surgery to open surgery, and re-operation after leaving the operating room.

Statistical analysis

Sample size estimation

According to previous studies [10,12, 13], the TAP block decreased opioid consumption by 13.5%–45.3% compared with the placebo within the first 24 h after surgery. We conservatively assumed that opioid consumption would be reduced by 10% in the TAP block group. We based our sample size calculation on a previous data analysis from our clinical follow-up system, which showed that the total dose of sufentanil in RLRS with no TAP block intervention was 36.5 5.4 μg. With the significance and power set at 0.05 (two-sided) and 90%, respectively, the sample size required to detect differences was 94 patients. Taking into account a drop-out rate of approximately 10%, we planned to enrol 104 patients. Sample size calculation was performed with PASS 11.0 software (Stata Corp. LP, College Station, TX).

Outcome analyses

Normally distributed continuous variables are expressed as the mean ± SD values and were compared using a two-tailed Student's t-test. Non-normally distributed continuous variables and ordinal data are expressed as medians (interquartile range) and were analysed using the Mann-Whitney U test. Categorical variables are expressed as numbers (percentages) and were compared with Chi-squared analysis or Fischer's exact test. Time-event data were analysed by the Kaplan-Meier estimator, with the difference between groups compared by the log-rank test. Two-sided P values of less than 0.05 were regarded as statistically significant. All statistical analyses were performed with the SPSS statistical package version 22.0 (SPSS Inc., Chicago, IL, USA).

Results

From January 1, 2018, to March 20, 2018, 166 patients were screened for eligibility; 130 patients met the inclusion/exclusion criteria, and 104 patients gave consent and were randomized into the study, with 53 patients in Group T and 51 in Group C. All subjects followed the study protocol, except one patient who suffered major haemorrhage and had to receive open surgery instead. Thus, he was excluded from the analysis. The results were listed as Per-Protocol analysis. The CONSORT diagram was shown in Figure 3.

There were no significant intergroup differences in the demographic or baseline characteristics except for the percentage of diabetes mellitus (Table 1). For intraoperative parameters, both groups were

comparable in terms of anaesthesia and surgical duration, the percentage of dexmedetomidine usage and its dosage, and blood loss (Table 2).

Table 1 Patients' demographic and baseline characteristics

Table 2 Intraoperative data

The median intraoperative and postoperative opioid consumption (o-MED) in the first 24 h after surgery were 105.0 and 32.5 mg in Group C, respectively, and the corresponding values in Group T were 121.0 and 39.7 mg, all of which were not significant (P = 0.284, and 0.311). The required and effective bolus numbers, as well as the time to the first bolus demand, were all comparable between the two groups (P = 0.335, 0.338 and 0.105). There was no statistically significant intergroup difference in the percentage or frequency of rescue analgesic administration in addition to the use of the PCA system (P = 0.153 and 0.306). In patients who received rescue analgesia, the time for administration of the first dose of rescue analgesia was comparable in the two groups (P = 0.845). Post-surgical pain scores at these abovementioned time points were similar at rest and with coughing in the two groups (all p > 0.05) (Table 3, at the end of this text).

Regarding the recovery quality, in the first 24 h after surgery, the incidence of PONV, percentage of antiemetic usage for therapy, subject sleep quality, time to the first ambulation, drainage, and length of postsurgical stay in the hospital were similar between the two groups (all p > 0.05) (Table 4).

Strata analysis also did not find any discrepancy in intra- and postoperative o-MED values between the two groups in either the partial or radical nephrectomy subgroups (Table 5, at the end of this text).

No complications related to the TAP block technique were observed in either group, and none of the other adverse events listed above were noted in this trial, except for a major haemorrhage (blood loss, 6500 ml) as well as persistent hypotension in one patient from Group T and emergence delirium in one patient from Group C.

Table 4 Comparisons of recovery variables

Discussion

To our knowledge, this was the first study investigating lateral TAP block efficiency in patients undergoing RLRS. Our results showed that preoperative lateral TAP block could not decrease intraoperative or postoperative opioid consumption or pain intensity in the first 24 h after surgery. Compared with the placebo control, TAP block showed no advantage in promoting postoperative recovery in these patients. Our study added new evidence to the current knowledge of analgesic measures for laparoscopic urological surgeries.

Our results conflicted with those of previous studies. Both Parikh and Guner found that lateral TAP block performed at the end of surgery significantly decreased pain score and total opioid consumption in the

first 24 h after laparoscopic donor nephrectomy [11,12]. Similarly, Hosgood also claimed that TAP block reduced the early morphine requirement (6 h after surgery) in the same population [10]. This discrepancy might be explained according to two aspects. First, the main surgical incision for kidney retrieval and trocar sites distribution were completely different from the methods of previous studies [10,11]. Second, we performed TAP block before surgery, while others performed TAP block after surgery [11,12]. Thus, when comparing results among different trials, it is crucial to take the surgical technique and the performance time of the block into consideration. Full clarification of our negative findings requires detailed interpretation of the innervation of the abdominal wall.

The anterolateral abdominal wall is mainly innervated by the anterior rami of thoracolumbar spinal nerves (T6-L1), which follow a curvilinear course from the back towards the midline of the body [6]. Generally, as they proceed, after giving off lateral cutaneous branches (LCB) near the costal angle innervating the lateral areas of the abdominal wall [14], they enter into the TAP with a varied course and finally perforate the rectus abdominis and end as the anterior cutaneous branches innervating the anterior abdomen (area from the midline to the midclavicular line) [15]. Most of the LCB arise before the main nerves enter the TAP, and only those of T11 and T12 have a short course within or through the TAP [15]. Thus, it is not surprising that lateral TAP block can reliably provide analgesia for the lower anterior abdomen but not the lateral abdomen wall. Ma further confirmed this by detecting the blocking dermatome in 19 areas of the abdominal wall after lateral TAP block [16]. For urological surgeries, the posterior TAP approach [13,17] or quadratus lumborum block [18] may be the better choice because they can block the LCB of thoracolumbar spinal nerves and provide better lateral abdominal wall analgesia.

Regarding the quality of recovery, we observed no advantages in Group T in terms of the incidence of PONV or time to first ambulation. This was consistent with the findings of other studies [10, 19]. It is likely that perioperative opioid consumption was comparable in the two groups. We found rather low sleep quality in both groups with no significant difference. We believed that not only pain intensity but also the surrounding environment in the ward affected sleep quality. Given that none of the above variables were different, it was no wonder that the length of hospital stay was similar in the two groups.

Our study has some limitations. First, we did not assess sensory dermatome blockage to confirm a successful TAP block because the block was performed after anaesthesia induction for blinding. Second, we only collected opioid consumption information at a single time point (24 h after surgery). Without data from other time points during the follow-up periods, we could not analyse the early effect of TAP block. Last, we did not use any valid questionnaire, such as QoR–40, to evaluate the recovery quality.

Conclusion

This prospective, randomized, blinded trial demonstrated that preoperative single-shot lateral TAP could not decrease intraoperative or postoperative opioid consumption or pain intensity in the first 24 h after surgery, nor could it promote postoperative recovery in patients undergoing laparoscopic renal surgery through retroperitoneal access. We do not suggest performing lateral TAP block in RLRS. Other kinds of

trunk blocks that can reliably block the lateral abdomen wall should be used and investigated in future studies.

List Of Abbreviations

ASA: America Society of Anaesthesiologists; BMI: body mass index; BIS: Bi-spectral index; COPD: chronic obstructive pulmonary disease; LDN: laparoscopic donor nephrectomy; LCB: lateral cutaneous branches; NYHA: New York Heart Association; NSAIDS: non-steroidal anti-inflammatory drugs; NRS: numeric rating scale; o-MED: oral morphine equivalent dose; PONV: postoperative nausea and vomiting; PCA: patient-controlled analgesia; PACU: post-anaesthesia care unit; RLRS: retroperitoneal laparoscopic renal surgeries; TAP: transversus abdominis plane.

Declarations

Ethics approval and consent to participate

The research protocol was approved by the Biomedical Research Ethics Committee of Peking University First Hospital (Number: 2017–1398), and all the patients signed written informed consent voluntarily.

Consent for publication

Not applicable.

Availability of data and materials

The dataset supporting the conclusions of this article is included within the article and its additional files.

Competing interests

The authors declare that they have no competing interests.

Funding

No funding.

Authors' contributions

Xue Li: Study design, data collection and analysis, manuscript drafting.

Zhen-Zhen Xu: Data collection.

Xue-Ying Li: Sample size calculation.

Ting-Ting Jiang: Randomization implementation and drug preparation.

Zeng-Mao Lin: Study design, data collection, manuscript revision.

Dong-Xin Wang: Manuscript revision.

Acknowledgements

We thank Xiao-Lu Nie a great deal for performing the randomization sequence and making the covering envelopes. Furthermore, we appreciate the efforts of Da Huang and Hao Kong for performing the TAP block. We also acknowledge the Department of Anesthesiology team and the Department of Urological Surgery team in Peking University First Hospital for supporting the research.

References

1. Liatsikos E, Kallidonis P, Do M, Dietel A, Al-Aown A, Constantinidis C, Stolzenburg JU. Laparoscopic radical and partial nephrectomy: technical issues and outcome. Word J Urol 2013, 31(4):785-791.
2. Ren T, Liu Y, Zhao X, Ni S, Zhang C, Guo C, Ren M: Transperitoneal approach versus retroperitoneal approach: a meta-analysis of laparoscopic partial nephrectomy for renal cell carcinoma. Plos One 2014, 9(3):e91978.
3. Fan X, Xu K, Lin T, Liu H, Yin Z, Dong W, Huang H, Huang J: Comparison of transperitoneal and retroperitoneal laparoscopic nephrectomy for renal cell carcinoma: a systematic review and meta-analysis. Bju Int 2013, 111(4):611-621.
4. Tan M, Law LS, Gan TJ. Optimizing pain management to facilitate enhanced recovery after surgery pathways. Can J Anaesth 2015, 62(2):203-218.
5. Nasrallah G, Souki FG: Peri-anesthetic management of laparoscopic kidney Surgery. Curr Urol Rep 2018, 19(1):1.
6. Tsai HC, Yoshida T, Chuang TY, Yang SF, Chang CC, Yao HY, Tai YT, Lin JA, Chen KY. Transversus abdominis plane block: an updated review of anatomy and techniques. Biomed Res Int 2017, 2017:8284363.
7. Rafi AN. Abdominal field block via the lumbar triangle revisited. Anaesthesia 2012, 67(12):1399-1401.
8. Tran TM, Ivanusic JJ, Hebbard P, Barrington MJ. Determination of spread of injectate after ultrasound-guided transversus abdominis plane block: a cadaveric study. Br J Anaesth 2009, 102(1):123-127.
9. Brogi E, Kazan R, Cyr S, Giunta F, Hemmerling TM: Transversus abdominal plane block for postoperative analgesia: a systematic review and meta-analysis of randomized-controlled trials. Can J Anaesth 2016, 63(10):1184-1196.
10. Hosgood SA, Thiyagarajan UM, Nicholson HF, Jeyapalan I, Nicholson ML. Randomized clinical trial of transversus abdominis plane block versus placebo control in live-donor nephrectomy. Transplantation 2012, 94(5):520-525.

11. Parikh BK, Waghmare VT, Shah VR, Mehta T, Butala BP, Parikh GP, Vora KS. The analgesic efficacy of ultrasound-guided transversus abdominis plane block for retroperitoneoscopic donor nephrectomy: A randomized controlled study. Saudi J Anaesth 2013, 7(1):43-47.
12. Guner CM, Goz R, Berber I, Kaspar C, Cakir U. Ultrasound/ laparoscopic camera-guided transversus abdominis plane block for renal transplant donors: a randomized controlled trial. Ann Transplant 2015, 20:418-423.
13. Aniskevich S, Taner CB, Perry DK, Robards CB, Porter SB, Thomas CS, Logvinov II, Clendenen SR. Ultrasound-guided transversus abdominis plane blocks for patients undergoing laparoscopic hand-assisted nephrectomy: a randomized, placebo-controlled trial. Local Reg Anesth 2014, 7:11-16.
14. Sakamoto H, Akita K, Sato T. An anatomical analysis of the relationships between the intercostal nerves and the thoracic and abdominal muscles in man. I. Ramification of the intercostal nerves. Acta Anat (Basel) 1996, 156(2):132-142.
15. Hebbard PD, Barrington MJ, Vasey C. Ultrasound-guided continuous oblique subcostal transversus abdominis plane blockade: description of anatomy and clinical technique. Reg Anesth Pain Med 2010, 35(5):436-441.
16. Ma J, Pan Y, Yang J, Xie Z, Li J: Efficacy of mid·axillary approach to transversus abdominis plane block in each abdominal and back region. Chin J Anesthesiol 2016, 10(01):1247-1249 (in chinese).
17. Qu G, Cui XL, Liu HJ, Ji ZG, Huang YG. Ultrasound-guided Transversus Abdominis Plane Block Improves Postoperative Analgesia and Early Recovery in Patients Undergoing Retroperitoneoscopic Urologic Surgeries: A Randomized Controlled Double-blinded Trial big up tri, open. Chin Med Sci J 2016, 31(3):137-141.
18. Elsharkawy H, Ahuja S, DeGrande S, Maheshwari K, Chan V: Subcostal approach to anterior quadratus lumborum block for pain control following open urological procedures. Journal of Anesthesia 2019, 33(1):148-154.
19. Ma N, Duncan JK, Scarfe AJ, Schuhmann S, Cameron AL: Clinical safety and effectiveness of transversus abdominis plane (TAP) block in post-operative analgesia: a systematic review and meta-analysis. J Anesth 2017, 31(3):432-452

Tables

Table1 Patients' demographic and baseline characteristics

	Group C (n=51)	Group T (n=52)	P value
Age, year	51.1±11.1	51.9±10.3	0.717
BMI, kg/ m^2	24.8±3.3	24.8±3.8	0.929
Male	31 (60.8%)	32 (61.5%)	0.937
Type of surgery			0.927
Radical nephrectomy	24 (47.1%)	24 (46.2%)	
Partial nephrectomy	27 (52.9%)	28 (53.8%)	
ASA class			
□	27 (52.9%)	24 (46.2%)	0.421
□	24 (47.1%)	27 (51.9%)	
□	0 (0.0%)	1 (1.9%)	
NYHA class			0.495
□	51 (100%)	50 (96.2%)	
□	0 (0.0%)	2 (3.8%)	
Comorbidities			
Stoke	2 (3.9%)	4 (7.7%)	0.692
Hypertension	19 (37.3%)	16 (30.8%)	0.487
Coronary artery disease	1 (2.0%)	3 (5.8%)	0.624
Diabetes Mellitus	3 (5.9%)	10 (19.2%)	0.041
Asthema and/ or COPD	2 (3.9%)	0 (0.0%)	0.243
History of abdomen and back surgery	14 (27.5%)	10 (19.2%)	0.324
Preoperative opioid usage	0 (0.0%)	0 (0.0%)	>0.999

Data are presented as mean ± standard deviation or number (%);

BMI: body mass index; ASA: America Society of Anaesthesiologists; NYHA: New York Heart Association; COPD: chronic obstructive pulmonary disease.

Table2 Intraoperative data

	Group C (n=51)	Group T (n=52)	P value
Duration of anaesthesia, min	144.0 (122.0, 168.0)	140.0 (126.0, 165.0)	0.805
Duration of surgery, min	78.0 (59.0, 112.0)	79.0 (64.0, 102.3)	0.934
Percentage of using Dex.	20 (39.2%)	13 (25.0%)	0.122
Dose of Dex., μg	30.0 (22.5, 39.0)	30.0 (22.2, 50.0)	0.785
Blood loss, ml	50.0 (50.0, 50.0)	50.0 (50.0, 50.0)	0.387

Data are presented as median (interquartile range) or number (%)

Dex.: Dexmedetomidine;

Table3 Effectiveness outcomes

	Group C (n=51)	Group T (n=52)	Estimated effects (95% CI) [a]	P value
Opioids used during surgery				
Dose of Suf., mg	20.0 (15.0, 38.2)	22.5 (20.0, 30.0)	0.0 (-5.0, 5.0)	0.685
Dose of Ref., μg	600.0 (501.5, 793.5) (n=33)	607.0 (428.0, 818.0) (n=39)	0.0 (-120.0, 119.0)	0.977
Total o-MED, mg	105.0 (54.0, 149.0)	121.0 (62.7, 177.3)	-13.1 (-40.1, 10.8)	0.284
o-MED per kilogram, mg/kg	1.73 (0.86, 2.32)	1.77 (0.90, 2.60)	-0.2 (-0.5, 0.2)	0.326
Data from the PCA system in the first 24 h after surgery				
Total dose of suf., mg	32.5 (23.3, 65.0)	39.7 (24.1, 79.7)	-3.5 (-14.4, 3.9)	0.311
Total o-MED, mg	32.5 (23.3, 65.0)	39.7 (24.1, 79.7)	-3.5 (-14.4, 3.9)	0.311
o-MED per kilogram, mg/kg	0.48 (0.35, 0.94)	0.56 (0.37, 1.17)	-0.1 (-0.2, 0.1)	0.252
Required bolus numbers	4 (1, 10)	6 (1, 15)	-1 (-4, 1)	0.335
Effective bolus numbers	3 (1, 10)	5 (1, 12)	-3 (-1, 1)	0.338
Time to first bolus demand, hour[b]	1.7 (0.4, 3.0)	6.0 (2.8, 9.2)	1.5 (0.9, 2.3)	0.105
Data in addition to the PCA system in the first 24 h after surgery				
Percentage of those needing rescue analgesics	12 (23.5%)	19 (36.5%)	0.5 (0.2, 1.3)	0.153
Time to first rescue analgesics required, hour[b]	21.0 (14.4, 27.6)	25.0 (19.3, 30.7)	1.1 (0.5, 2.2)	0.845
Frequency of rescue analgesics required	2 (1, 3)	1 (1, 4)	0 (0, 1)	0.306
NRS pain score after surgery, at rest[c]				
Immediately after anaesthesia recovery	0 (0, 2) (n=49)	0 (0, 1) (n=52)	0 (0, 0)	0.725
0.5 h post-surgery	1 (0, 3) (n=50)	1 (0, 2) (n=52)	0 (0, 0)	0.818
1 h post-surgery	2 (0, 3) (n=50)	1 (0, 3) (n=52)	0 (0, 1)	0.703
2 h post-surgery	2 (1, 3) (n=50)	2 (1, 3) (n=52)	0 (0, 1)	0.310
6 h post-surgery	3 (1, 3)	2 (1, 3)	0 (0, 1)	0.361
12 h post-surgery	3 (2, 4)	3 (1, 4)	0 (-1, 1)	0.700
24 h post-surgery	2 (2, 3)	2 (1, 3)	0 (0, 1)	0.467
NRS pain score after surgery, with coughing[c]				
Immediately after anaesthesia recovery	0 (0, 3) (n=49)	1 (0, 2) (n=52)	0 (0, 0)	0.812
0.5 h post-surgery	2 (0, 4) (n=50)	2 (0, 3) (n=52)	0 (-1, 1)	0.859
1 h post-surgery	2 (1, 4)	2 (1, 4)	0 (-1, 1)	0.589

	(n=50)	(n=52)		
2 h post-surgery	3 (2, 5)	3 (2, 4)	0 (0, 1)	0.210
	(n=50)	(n=52)		
6 h post-surgery	4 (2, 5)	3 (2, 5)	0 (-1, 1)	0.444
12 h post-surgery	4 (2, 6)	4 (2, 6)	0 (-1, 1)	0.622
24 h post-surgery	4 (3, 5)	3 (2, 5)	0 (0, 1)	0.411

Data are presented as median (interquartile range) or number of patient (%), unless otherwise indicated.

[a]Calculated as Group C minus or Group T. The results are presented as odds ratios (95% CI), median differences (95% CI) or hazard ratios (95% CI).

Suf.: sufentanil; Ref.: remifentanil; o-MED: oral morphine equivalent dose; PCA: patient controlled analgesia; NRS: numeric rating scale.

[b]Data were analysed by Kaplan-Meier analysis and compared by log-rank test; the results are presented as the median (95% confidence interval).

[c] In Group C, the NRS score could not be evaluated during the first 2 hours after surgery in one patient who was transferred to the ICU unexpectedly, resulting from the request of the surgeon for unknown reasons. Furthermore, the NRS score could not be evaluated immediately after surgery in one patient due to the emergence of delirium.

Table4 Comparisons of recovery variables

	Group C (n=51)	Group T (n=52)	P value
Incidence of PONV	15 (29.4%)	17 (32.7%)	0.719
Percentage of using antiemetics	10 (19.6%)	8 (15.4%)	0.573
Subject sleep quality, NRS score	5 (2, 7)	4 (2, 7)	0.717
Time to first ambulation, hour[a]	19.5 (17.8, 21.2)	20.0 (18.2, 21.8)	0.314
Drainage, ml	30.0 (0.0, 55.0)	35.0 (0.0, 90.0)	0.248
Length of hospital stay after surgery, day[a]	4.0 (3.7, 4.3)	4.0 (3.6, 4.4)	0.754

Data are presented as median (interquartile range) or number (%), unless otherwise indicated.

PONV: postoperative nausea and vomiting; NRS: numeric rating scale.

Except for the length of hospital stay, all items listed in this table referred to data in the first 24 hours after surgery.

[a]Data were analysed by Kaplan-Meier analysis and compared by log-rank test; the results are presented as median (95% confidence interval).

Table5 Strata analysis about primary outcomes

	Laparoscopic partial nephrectomy				Laparoscopic radical nephrectomy			
	Group C (n=27)	Group T (n=28)	Estimated effects (95% CI) [a]	P value	Group C (n=24)	Group T (n=24)	Estimated effects (95% CI) [a]	P value
Total intra-OP MED, mg	123.8 (42.0, 149.0)	114.2 (57.0, 181.5)	-13.1 (-50.0, 31.8)	0.485	90.0 (57.6, 158.2)	122.2 (80.7, 161.6)	-16.5 (-56.2, 20.5)	0.370
Total post-OP MED, mg	30.4 (22.1, 59.4)	53.1 (25.2,78.2)	-9.2 (-30.0, 0.8)	0.070	43.6 (24.7, 74.8)	31.9 (23.8, 83.4)	2.6 (-13.1, 18.1)	0.773

Data are presented as median (interquartile range), unless otherwise indicated.

[a]Calculated as Group C minus or Group T. The results are presented as median difference (95% CI).

Intra-OP: intraoperative; post-OP: postoperative.

Figures

Figure 1

The three trocar sites in retroperitoneoscopic renal surgery

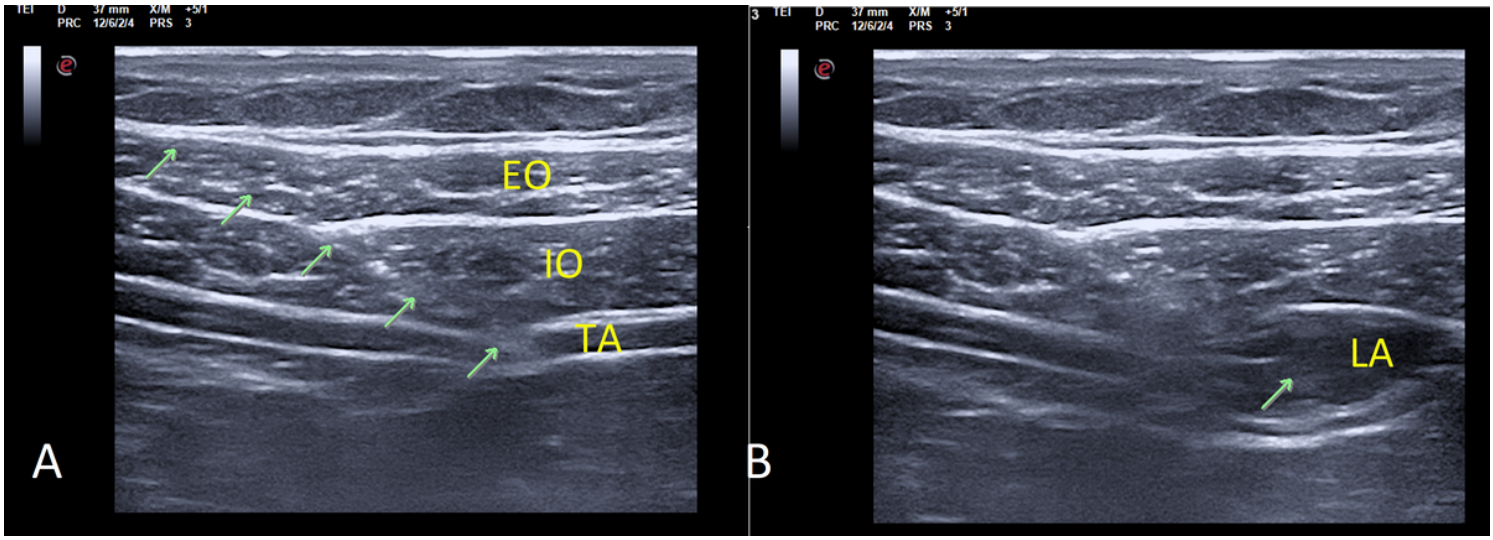

Figure 2

Sonography of the lateral TAP block. A: ultrasound anatomical structure B: spread of local anaesthetic. The green arrow indicates the needle trajectory; EO, external oblique; IO, internal oblique; TA, transversus abdominis; LA, local anaesthetic.

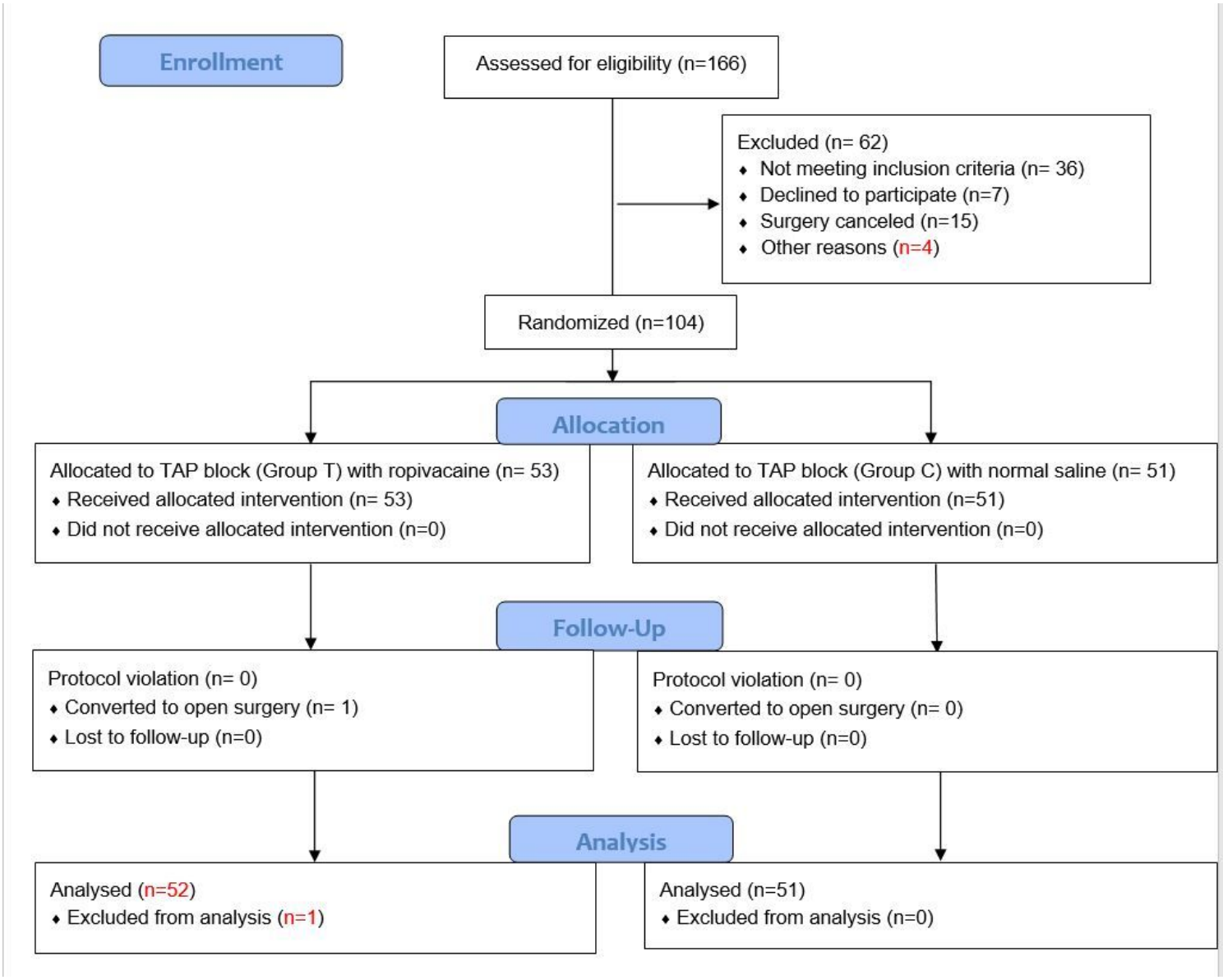

Figure 3

Flow diagram of the study

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- supplement1.docx
- supplement2.xlsx