Randomized Controlled Trial

Comparison of the Analgesic Efficacy of Erector Spinae Plane Block, Paravertebral Block and Quadratus Lumborum Block for Pelvi-ureteric Surgeries: A Randomized Double-Blind, Noninferiority Trial

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Background: Effective postoperative analgesia enhances the patient's comfort and facilitates early mobilization and recovery.

Objective: This study compared the analgesic efficacy of the erector spinae plane block (ESPB), thoracic paravertebral block (TPVB), and quadratus lumborum block (QLB) for pelvi-ureteric surgeries. The primary outcome measure in the study was the total morphine consumption during the first 48 hours following the operation. The secondary outcomes included the levels of postoperative pain, the time of first rescue analgesia, and the satisfaction of patients.

Study Design: Randomized double-blind noninferiority trial.

Setting: Kafr Elsheikh University Hospitals, Egypt.

Methods: This trial was performed on 90 patients between the ages of 21 and 65, men and women, who had an American Society of Anesthesiologists physical status of I or II and were undergoing elective pelvi-ureteric surgeries. Patients were assigned equally to the TPVB, QLB, and ESPB groups. Before the induction of general anesthesia, blocks were performed using 20 mL of 0.25% bupivacaine. The numeric rating scale (NRS) score was measured in the post-anesthesia care unit at one, 2, 4, 6, 8, 12, 24, 36, and 48 hours. If the NRS score was ≥ 4, the patient received 3 mg of intravenous morphine.

Results: The time of the performing block was shorter in the ESPB group than in the TPVB or QLB group ($P < 0.001$), but the TPVB and QLB groups were comparable. The intraoperative consumption of fentanyl and total consumption of morphine at 24 and then 48 hours postoperatively were comparable among the 3 groups, as were the satisfaction of the patient, NRS scores, time of first rescue analgesia, and complications ($P > 0.05$).

Limitations: A relatively small sample size, a single-center setting, and the absence of a control group.

Conclusions: In pelvi-ureteric surgeries, the ESPB, TPVB, and QLB provided comparable intraoperative and postoperative analgesia, patient satisfaction, and postoperative complications, but the ESPB was performed more quickly. Therefore, we recommend the ESPB as a routine regional anesthetic technique.

Key words: Analgesia, erector spinae plane block, paravertebral block, pelvi-ureteric surgeries, quadratus lumborum block, numeric rating scale, morphine consumption

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Renal surgeries are commonly associated with acute postoperative pain, with an incidence of about 10 to 70% (1), and relief from this pain is achieved in under 50% of patients (2). Effective postoperative analgesia facilitates early mobility and quick recovery and promotes patient comfort (3). Using ultrasonographic technologies in regional anesthesia has made nerve block use easier, resulting in the application of numerous new interfacial blocks, described as follows (4,5).

The thoracic paravertebral block (TPVB) is a peripheral nerve block that is performed by injecting local anesthetic (LA) into the paravertebral space (PVS) (6). The TPVB has been used to produce analgesia for renal surgeries (6).

Meanwhile, the quadratus lumborum block (QLB) is a fascial plane block. The nerves in the thoracolumbar region are anesthetized by injecting anesthesia next to the quadratus lumborum (QL) muscle (7). The QLB is used as a form of perioperative pain management for renal surgery (8).

Lastly, the erector spinae plane block (ESPB) is an innovative interfascial plane block known for its extensive pain relief benefits (9). Currently, the ESPB is used for managing pain after renal surgeries with minimal adverse effects (10,11).

No prior investigation has compared the ESPB, TPVB, and QLB and analgesic efficacy in the same study. This study aimed to fill this gap by comparing the effectiveness of these 3 techniques in pelvi-ureteric surgeries.

Methods

This randomized double-blind noninferiority trial was carried out on 90 patients between 21 and 65 years, men and women, who had a physical status of I or II according to the American Society of Anesthesiologists and were undergoing elective pelvi-ureteric surgeries. The research was carried out at Kafr Elsheikh University Hospitals, Egypt, from January 2023 to November 2023, after approval from the university's ethical committee (approval code: MKSU 50-12-1 2), registration on Clinicaltrials.gov (ID: NCT05713643), and the obtaining of written informed consent from all patients.

We excluded individuals with a body mass index exceeding 30 kg/m^2, contraindications to nerve blocks (such as allergies to local anesthesia, coagulation disorders, or injection site infections), chronic opioid dependence, pain that persisted for more than 3 months on medication (such as gabapentin), neuropsychiatric conditions, and anatomy (such as deformity or congenital anomalies) that would make nerve block procedures challenging.

Randomization and Blinding

Computer-generated random numbers were employed to distribute cases evenly into 3 parallel groups: ESAB, TPVB, and QLB. Another investigator, who had no extra tasks to do in the trial, opened the sealed envelope. Both outcome assessors and patients remained unaware of the group assignments. An anesthesiologist who was not involved in data collection or analysis performed the blocks before the induction of general anesthesia (GA).

Patients' histories were taken, and physical examinations and routine investigations were done. During the pre-anesthetic assessment, all patients were familiarized with the numeric rating scale (NRS), which ranged from 0-10 (0 standing for the absence of pain and 10 standing for maximum intolerable pain).

Temperature probes, noninvasive blood pressure measuring, electrocardiograms, capnography, and pulse oximetry were utilized for patient monitoring. After cannula insertion, intravenous (IV) midazolam (2 mg) was administered as a premedication to all patients.

In the holding area, patients received blocks before the induction of GA. After skin sterilization, the blocks were performed on the ipsilateral side of surgery with sterilization using 10% povidone-iodine. An ultrasound (ULSD) machine (SonoScape M22 EXP, Digital Color Doppler, Alandalus Medical) with a 5-12 MHz linear probe was used. Two percent lidocaine (3 mL) was injected subcutaneously, for which an 8-cm, 22G echogenic needle was used. Twenty mL of 0.25% bupivacaine was injected after gentle aspiration to exclude blood and air.

The Erector Spinae Plane Block Technique

Once the patient was in the sitting position, the probe was located with a longitudinal alignment 3 cm lateral to the T8 spinous process so the physician could obtain a parasagittal view. The probe's caudal end was used to introduce the needle, which was then advanced in the plane until it struck the tip of the transverse process (TP). LA was injected into the fascial plane between the erector spinae (ES) muscle and the underlying vertebra's TP. Upon injection, a cranial and caudal linear spread of LA below the muscle appeared on the screen in the ULSD, indicating a successful block (Fig. 1).

The Thoracic Paravertebral Block Technique

Once the patient was in the sitting position, the probe was aligned longitudinally, parallel to the T8 spinous process, and 3 cm laterally until the pleura, TP, and superior costotransverse ligament (SCTL) were visible. The probe was tilted laterally to enhance the visual of PVS between the pleura and SCTL. An echogenic needle was introduced from the transducer's caudal end via the in-plane technique until the SCTL was pierced. LA was injected in close proximity to the thoracic spinal nerves' ventral rami, with downward displacement of the pleura indicating a successful block (Fig. 2).

The Quadratus Lumborum Block Type III Technique

Once the patient was in the lateral position, the probe was positioned above the iliac crest in the lateral position to locate Petit's triangle. The 3 abdominal muscles were observed, including the TA and the internal and external oblique muscles. The external and internal oblique muscles followed posteriorly until bright hyperechogenic lines designated the layers of the thoracolumbar fascia. The QL muscle was observed below the latissimus dorsi muscle. The "Shamrock sign" was identified, where the TP of L4 appeared as a stem, and the psoas major (PM) muscle, QL muscle, and ES muscles resembled leaves. Using an in-plane approach, the needle was introduced in the anteromedial direction along the posterior border of the ultrasound probe. The needle was positioned between the QL and PM muscles.

Successful blocks were confirmed using the pinprick sensation test. Patients with failed blocks were excluded.

GA was induced using IV propofol (1.5-2.5 mg/kg), along with IV fentanyl (1 µg/kg). Endotracheal intubation was carried out after an IV administration of atracurium (0.5 mg/kg). Anesthesia maintenance was achieved by 1-1.5% isoflurane with 50% O_2. Additional IV atracurium (0.1 mg/kg) was given incrementally. Patients were ventilated mechanically with preserving end-tidal CO_2 levels between 35 and 40 mmHg.

In case of a rise in heart rate (HR) or mean arterial blood pressure (MAP) by more than 20% of the baseline (after ruling out causes other than pain), extra doses of IV fentanyl (1 µg/kg) were administered. The same surgical team conducted the surgeries.

At the end of the surgery, anesthesia ceased. Atropine (0.02 mg/kg) and neostigmine (0.08 mg/kg) were used to reverse any remaining neuromuscular blockade, followed by extubation. Later, the patients were moved to the post-anesthesia care unit (PACU). As routine analgesia, IV paracetamol (1 g) was given to all patients every 8 hours. NRS scores were measured in the PACU at one, 2, 4, 6, 8, 12, 24, 36 and 48 hours. If NRS scores were ≥ 4, the patients received additional doses of IV morphine (3 mg).

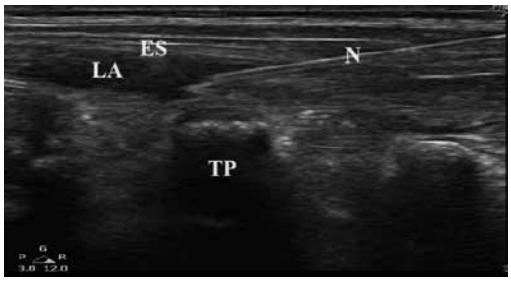


Fig. 1. *Ultrasound-guided erector spinae plane block*. N: needle, TP: transverse process, trapezius muscle, ESM: erector spinae muscles, LA: local anesthetic spread.

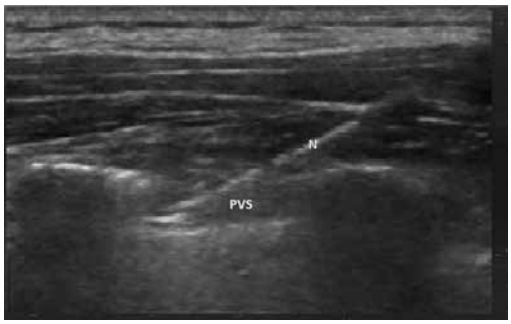


Fig. 2. *Ultrasound-guided thoracic paravertebral block*. N: needle, PVS: paravertebral space.

We documented any complications that occurred during or after the surgery, such as postoperative nausea and vomiting (PONV), bradycardia (HR > 50 beats/min), and hypotension (MAP ≤ 65 mmHg or reduction in the MAP of > 20% than the preoperative baseline value), and complications related to the block, such as hematoma, were documented. To treat bradycardia, atropine (0.01 mg/kg) was used. To treat hypotension, 5-10 mg of IV ephedrine and/or fluid boluses were administered.

Using a 5-point Likert rating system, we evaluated the level of patient satisfaction: 4 = extremely satisfied, 3 = satisfied, 2 = neither satisfied nor unsatisfied, 1 = unsatisfied, 0 = extremely dissatisfied).

Patients at high risk for DVT received preoperative heparin (40 mg LMWH once daily, starting 12-24 hours before surgery, or 5,000 units UFH 3 times daily, starting 2 hours before surgery).

The primary outcome was patients' total morphine consumption in the first 48 hours following the operation. The secondary outcomes included the levels of postoperative pain, the time of the first rescue of analgesia, and the levels of patient satisfaction.

Sample Size Calculation

Calculation of the sample size was performed using the PASS program Version 11.0 (NCSS, LLC). The following factors guided the determination of the sample size: 95% confidence limit, 80% power of the study, and a group ratio of 1:1:1. Furthermore, the common standard deviation of total morphine consumption during the first 48 hours was 1.5 mg, according to an unpublished pilot study, the noninferiority margin was set to one mg, and 2 patients were added to each group to compensate for dropouts. Thus, 30 patients were enrolled in each group.

Statistical Analysis

SPSS Version 27 (IBM Corp.) was used to perform the statistical analysis. Using histograms and the Shapiro-Wilks test, we examined the normality of the data distribution. An ANOVA (F) with a post hoc test (Tukey) was used to analyze the parametric quantitative data, which were reported as mean and SD. The Kruskal-Wallis test was used to determine the nonparametric quantitative data (and the Mann-Whitney test was used to compare group differences), which were reported as the median and interquartile range (IQR). A Bonferroni correction test was used to assess multiple comparisons. The chi-square test was used to compare group differences among qualitative variables, which were reported as frequency (%). Statistical significance was defined as a 2-tailed P value ≤ 0.05.

Results

A total of 109 individuals were evaluated for eligibility to participate in the study. Out of this number, 13 patients did not match the required criteria, while 6 patients refused to participate. The remaining patients were allocated randomly and evenly into 3 groups. Randomized patients were analyzed statistically and followed up (Fig. 3).

Demographic data and duration of surgery were comparable among the 3 groups. Table 1 baseline and intraoperative HR and MAP measurements were not significantly different among the groups (Fig. 4).

The time of the performing block was significantly shorter in the ESPB group than in the TPVB and QLB groups (P value < 0.001) and was comparable between the TPVB and QLB groups (Table 2).

Intraoperative fentanyl consumption, total morphine consumption during the first 24 and 48 hours after the operation, and the time of first rescue analgesia were not significantly different among the 3 groups (Table 2).

NRS scores among the 3 groups were not significantly different during patients' immediate admission to the PACU or at one, 2, 4, 6, 8, 12, 24, 36 or 48 hours (Table 3).

The incidences of hypotension, bradycardia, and PONV were not significantly different among the groups. No patient in any group experienced pneumothorax or hematoma. Patient satisfaction was comparable among the 3 groups (Table 4).

Discussion

Increasing clinical evidence suggests the ESPB may block sympathetic nerves and the ventral rami, providing analgesia for visceral pain, alleviating specific sympathetically mediated symptoms, and potentially inducing motor blockade (12). The ESPB targets the thoracolumbar nerves, which can provide analgesia for pelvic and lower abdominal surgeries (13).

Successful PVB commonly involves the ventral rami of the spinal nerve and the sympathetic ganglion, with observations frequently indicating epidural spread through the intervertebral foramen (14). The TPVB involves the injection of an LA agent near the PVS, proximate to the site from where spinal nerves emanate from the intervertebral foramina, which leads to the blockade of somatic and sympathetic nerves, providing analgesia to the corresponding dermatomes (15).

The QLB type III involves injecting the LA agent in the plane between the QL and the PM muscle, blocking the thoracolumbar nerves by diffusion of the LA agent anteriorly to the paravertebral area (16). We preferred QLB III over QLB I and QLB II due to the type-III block's ability to offer more extensive and prolonged analgesic effects, specifically for visceral pain that arose from the kidneys and adjacent anatomical structures. By targeting the paraspinal and anterior and lateral abdominal wall muscles as well as sympathetic fibers that innervate the abdominal viscera, QLB III has the potential to effectively alleviate both somatic and visceral pain that may be associated with renal surgeries (17). This relief may result in enhanced recovery, decreased opioid needs, and improved postoperative pain management (18). Because of the lateral injection site and distance

from neuraxial structures, QLB III is a safer alternative to QLB I and QLB II, thereby reducing the possibility of potential complications occurring during the administration of the block (19).

Our findings revealed that intraoperative and postoperative opioid consumption, time of first rescue analgesia, pain score, complications, and patient satisfaction were comparable among the ESPB, TPVB, and QLB groups.

Consistent with our results, Elewa et al (20) compared the analgesic efficacy of unilateral TPVB and unilateral ESPB using 0.25% bupivacaine (30 mL) on patients scheduled for elective breast surgery. The researchers stated that intraoperative opioid consumption, time of first rescue analgesia, total opioid consumption during the first 24 hours after the operation, and PONV were comparable between the TPVB and ESPB groups.

Also, Kang et al (21) investigated the ESPB's (at T8) and the QLB II's effectiveness in relieving pain after liver surgery. Both techniques involved a single injection of 0.375% ropivacaine (20 mL) on each side of the body. The study revealed that intraoperative opioid consumption, time of first rescue analgesia, total opioid consumption in the first 24 and 48 hours after surgery, pain score, PONV, and patient satisfaction were comparable between the QLB and ESPB groups. No complications associated with blocks were reported in either the QLB or the ESPB group. However, the time of the performing block in the ESPB group was shorter than in the QLB one but not significantly so. This variation may be related to the use of the bilateral QLB II. The QLB II targets the ventral rami of the lumbar nerves (L1-L4), which provide sensory innervation to the anterior abdominal wall, as well as the iliohypogastric, ilioinguinal, and genitofemoral nerves, which supply the skin of the lower abdomen and upper inner thigh (22).

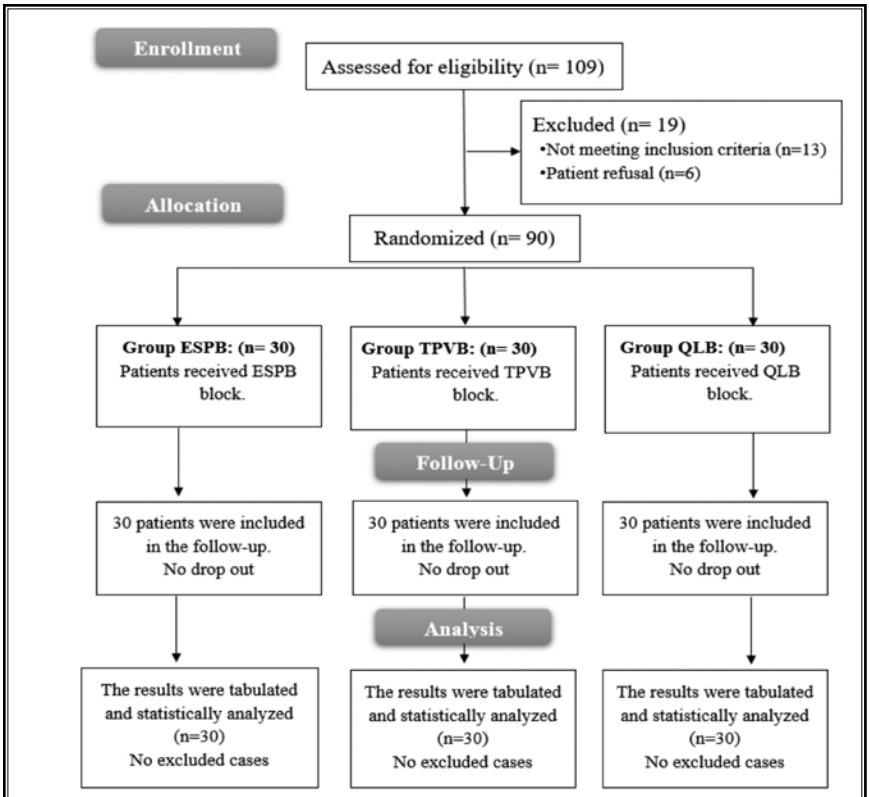
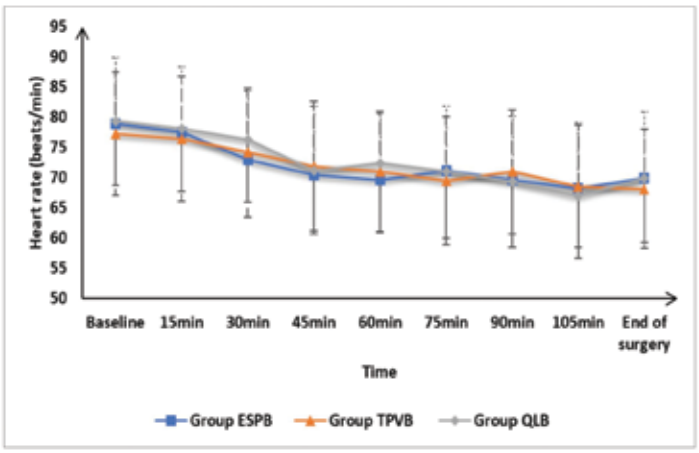


Fig. 3. *CONSORT flowchart of the enrolled patients.*

Table 1. *Demographic data and duration of surgery of the studied groups.*

		ESPB Group (n = 30)	TPVB Group (n = 30)	QLB Group (n = 30)	*P* value
Age (years)		47.8 ± 10.4	43.4 ± 9.99	46.2 ± 10.43	0.243
Gender	Male	20 (66.67%)	21 (70%)	16 (53.33%)	0.366
	Female	10 (33.33%)	9 (30%)	14 (46.67%)	
Weight (kg)		71.1 ± 8.67	69.9 ± 6.62	67.5 ± 5.51	0.144
Height (m)		1.69 ± 0.08	1.67 ± 0.07	1.64 ± 0.08	0.053
BMI (kg/m^2)		24.9 ± 3.06	25.1 ± 2.68	25.3 ± 3.02	0.875
ASA physical status	I	14 (46.67%)	11 (36.67%)	13 (43.33%)	0.727
	II	16 (53.33%)	19 (63.33%)	17 (56.67%)	
Duration of surgery (min)		136.3 ± 12.45	137.7 ± 13.44	142 ± 13.81	0.229

Data are presented as mean ± SD or frequency (%). ASA: American Society of Anesthesiologists, BMI: body mass index, ESPB: erector spinae plane block, QLB: quadratus lumborum block, TPVB: thoracic paravertebral block.



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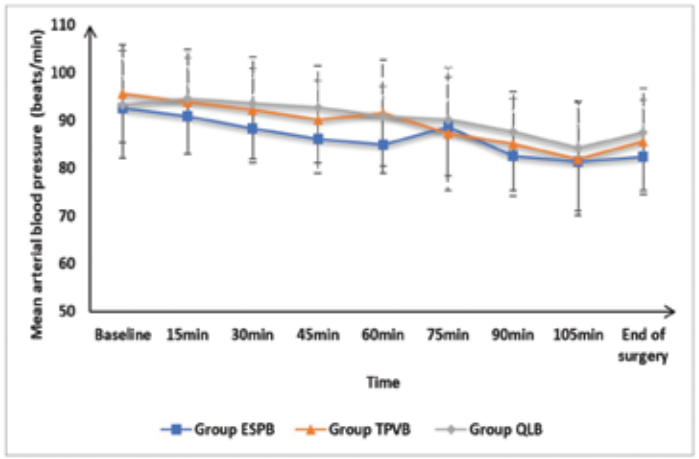

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Fig. 4. *(A) Heart rate and (B) mean arterial blood pressure changes of the studied groups.*
Data are presented as mean ± SD.

In agreement with our results, Abd Ellatif and Abdelnaby (19) compared the efficacy of the analgesia of the unilateral ESPB and QLB III after open nephrectomy using 0.25% bupivacaine (0.3–0.4 mL/kg) with a maximum volume of 30 mL. They illustrated that the time of the performing block was significantly lower in the ESPB group than in the QLB group. Intraoperative opioid consumption, pain score, time of first rescue analgesia, and total opioid consumption in the first 24 hours after surgery were comparable between the ESPB and QLB groups. No block-related complications were reported in either group.

Additionally, Aoyama et al (23) compared the effectiveness of the ESPB (T5 level) and the TPVB (T3 and T5 levels) using 0.5% ropivacaine (20 mL) at relieving pain after breast surgeries. The researchers stated that the ESPB was performed in a shorter time than was the TPVB. Intraoperative opioid consumption, pain score on movement time of first rescue analgesia, and PONV were comparable between the ESPB and TPVB groups. Again, no block-related complications were recorded in either group.

Also, El Ghamry and Amer (24) compared the effect of the ESPB to that of the TPVB performed with 0.25% bupivacaine (20 mL) in post-mastectomy acute pain control. According to this study, intraoperative opioid consumption, pain score, time of first rescue analgesia, total opioid consumption in the first 24 hours after sur-

Table 2. *Time of performing block, intraoperative fentanyl and postoperative morphine consumption, and time of first rescue analgesia of the studied groups.*

	ESPB Group (n = 30)	TPVB Group (n = 30)	QLB Group (n = 30)	*P* value	Post hoc
Time of performing block (min)	5.6 ± 1.07	9.2 ± 2.31	8.7 ± 1.64	<0.001	P1 < 0.001 P2 < 0.001 P3 = 0.558
Intraoperative fentanyl consumption (µg)	96.3 ± 38.91	105 ± 36.74	98 ± 35.76	0.633	
Total morphine consumption in first 24h postoperative (mg)	8.7 ± 2.92	8.3 ± 2.73	7.8 ± 2.84	0.520	
Total morphine consumption in first 48h postoperative (mg)	13.5 ± 2.67	13.3 ± 2.73	13.5 ± 2.98	0.965	
Time of first rescue analgesia (h)	5.4 ± 1.28	4.8 ± 0.94	5 ± 1.1	0.064	

Data are presented as mean ± SD or frequency (%). P1: *P* value between ESPB group and TPVB group, P2: P value between ESPB group and QLB group, P3: *P* value between TPVB group and QLB group, ESPB: erector spinae plane block, TPVB: thoracic paravertebral block, QLB: quadratus lumborum block.

gery, and PONV were comparable between the TPVB and ESPB groups. However, 4 (11.4%) patients in the TPVB group had pneumothorax. The difference in the instances of pneumothorax between the 2 groups was insignificant.

Similarly, Taketa et al (25) performed a comparison between the analgesic effects of the ESPB and the TPVB at the onset of video-assisted thoracic surgery (VATS). They administered 0.2% levobupivacaine (20 mL) via a catheter followed by a continuous infusion of 0.2% levobupivacaine (8 mL/hour). Taketa et al demonstrated that intraoperative opioid consumption, time of first rescue analgesia, total opioid consumption in the first 24 and 48 hours after surgery, and PONV were comparable between the TPVB and ESPB groups. However, pain scores at one, 2, and 24 hours were significantly higher in the ESPB group than in the TPVB group. The difference might have been attributable to the block performance level at T4 or T5, the differences in the type of operations and the use of continuous infusion.

Contrasting our findings, Fang et al (26) compared the effectiveness of the ESPB and TPVB performed using 0.25% bupivacaine (20 mL) at relieving pain after thoracotomy. They stated that pain scores, total opioid consumption, hypotension, bradycardia, and patient satisfaction were notably greater in the TPVB group than in the ESPB group.

Examining acute pain following VATS, Zengn et al (31) compared the efficacy of the TPVB to that of the ESPB conducted with bupivacaine (20 mL). They illustrated that total opioid consumption and pain scores at one, 2, 4, 8, and 16 hours after the procedure were notably higher in the TPVB group than in the ESPB group, contradicting the findings of the present study. The LA was injected at a level of T5, and different surgeries were involved, which might have been responsible for this difference.

Performance time and simplicity of use are vital factors in selecting among various regional blocks (27).

That the ESPB requires less technical expertise than do other blocks is one of its most obvious benefits. In line with earlier research (19,25,28), we demonstrated that the ESPB was performed faster than were the TPVB or QLB.

The following 2 factors provide an explanation for the results of the TPVB. Initially, the TPVB necessitates handling needles with greater caution and advancing them farther toward the target. Second, several level injections are advised because the TPVB limits the injectate diffusion in the craniocaudal direction (23).

For the QLB, the needle tip must technically be fully visible throughout the injection because the injection site is close to the abdominal tissues, and there is a danger of retroperitoneal hematoma (19).

Table 3. *NRS score of the studied groups*.

	ESPB Group (n = 30)	TPVB Group (n = 30)	QLB Group (n = 30)	*P* value
At PACU	0 (0 - 1)	0.5 (0 - 1)	0 (0 - 1)	0.585
1h	1 (1 - 1)	1 (1 - 2)	1 (1 - 2)	0.092
2h	2 (1 - 2)	2 (2 - 2)	2 (2 - 2)	0.119
4h	3 (3 - 4)	3 (3 - 5)	3.5 (3 - 5)	0.931
6h	3 (1 - 5)	2 (1 - 4)	2 (1 - 4)	0.199
8h	2 (2 - 2.75)	2 (2 - 2.75)	2 (2 - 3)	0.887
12h	4 (3 - 4.75)	4 (4 - 5)	4 (4 - 5)	0.356
24h	4 (3 - 5)	4.5 (3.25 - 5)	4 (3 - 5)	0.874
36h	4 (3 - 5)	5 (3.25 - 5)	4 (4 - 5)	0.239
48h	4 (3 - 5)	5 (4 - 5)	5 (4 - 5)	0.821

Data are presented as median (IQR). NRS: numerical rating scale, PACU: post-anesthesia care unit, ESPB: erector spinae plane block, TPVB: thoracic paravertebral block, QLB: quadratus lumborum block.

Table 4. *Complications and patient satisfaction of the studied groups*.

		ESPB Group (n = 30)	TPVB Group (n = 30)	QLB Group (n = 30)	*P* value
Complications	Hypotension	2 (6.67%)	5 (16.67%)	4 (13.33%)	0.484
	Bradycardia	1 (3.33%)	2 (6.67%)	4 (13.33%)	0.338
	PONV	3 (10%)	6 (20%)	4 (13.33%)	0.533
	Pneumothorax	0 (0%)	0 (0%)	0 (0%)	---
	Hematoma	0 (0%)	0 (0%)	0 (0%)	---
Patient Satisfaction	Extremely satisfied	15 (50%)	8 (26.67%)	11 (36.67%)	0.727
	Satisfied	12 (40%)	14 (46.67%)	14 (46.67%)	
	Neither satisfied nor unsatisfied	3 (10%)	6 (20%)	4 (13.33%)	
	Unsatisfied	0 (0%)	2 (6.67%)	1 (3.33%)	
	Extremely dissatisfied	0 (0%)	0 (0%)	0 (0%)	

Data are presented as frequency (%). ESPB: erector spinae plane block, TPVB: thoracic paravertebral block, QLB: quadratus lumborum block, PONV: postoperative nausea and vomiting.

Performing the ESPB is simpler, due to the presentation of visible markers on ultrasonography and an injection termination that targets bone structure rather than the PVS near the pleura and main blood vessels, reducing the opportunity for significant adverse effects (29).

Limitations

The limitations of the present trial included a relatively small sample size, a single-center setting, and the absence of a control group. Also, no long-term outcomes were observed, since the study period was limited to 48 hours, and we did not assess the pain score patients experienced during movement. Additionally, obese patients were excluded.

Conclusions

In pelvi-ureteric surgeries, the ESPB, TPVB, and QLB provided comparable intraoperative and postoperative analgesia, patient satisfaction, and postoperative complications, but the ESPB was performed most quickly. Therefore, we recommend the ESPB as a routine regional anesthetic technique.

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