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RESEARCH ARTICLE
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COMPARISON OF ULTRASOUND-GUIDED: LUMBAR ERECTOR SPINAE PLANE BLOCK VERSUS QUADRATUS LUMBORUM BLOCK FOR POST-OPERATIVE ANALGESIA IN LOWER ABDOMINAL SURGERIES: RANDOMIZED CONTROLLED TRAIL

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ABSTRACT

Background: Abdominal surgery is one of the most common surgical procedures and the associated postoperative pain is a common medical problem. The health and outcome of patients after abdominal surgeries can be detrimentally affected by the consequences of postoperative pain, such as respiratory complications, thromboembolism and increased duration of post-operative stay. Multimodal analgesic regimen is essential to control this postoperative pain and discomfort.

Aim: This study aimed to evaluate and compare the analgesic effect of ultrasound-guided erector spinae plane block (ESPB) vs ultrasound-guided quadratus lumborum Block (QLB) in patients having lower abdominal surgery at Suez Canal university hospitals.

Patients and Methods: This randomized, double blinded prospective study was conducted on patients undergoing lower abdominal surgeries at Suez Canal University Hospital. Seventy patients were allocated into two equal groups, group I received ultrasound- guided erector spinae plane block with 20 ml of bupivacaine 0.25% and group II received ultrasound- guided quadratus lumborum block with 20 ml of bupivacaine 0.25%. Each participant was subjected to clinical evaluation including medical history, physical examination and essential laboratory investigations.

Results: Our results showed that there was no statistically significant difference between the two groups regarding the total morphine consumption during the first 24 hours. As regards to time of the 1st request of analgesia, the results showed that there was no statistically significant difference between the 2 groups, too. The results showed that there was no significant difference between the two groups regarding VAS postoperative at rest at 60 min 12, 24 hours postoperative. Also, there was no significant difference between the two groups regarding VAS postoperative at patient movement.

Conclusion: The effect of ultrasound guided QLB and ESPB in patients undergoing lower abdominal surgeries were found to be similar in regards to postoperative pain and opioid requirement. Ultrasound-guided lumbar erector spinae plane block has advantages in terms of greater technical

simplicity and shorter time to complete the block. Quadratus lumborum block has the advantage of better and prolonged analgesia than ESPB, however, the difference was not significant. Both techniques may be thus considered as viable and effective techniques for post operative analgesia in lower abdominal surgeries.

Key words: ESPB, QLB, Post-Operative Analgesia, VAS.

Introduction

One of the most frequent surgical procedures is abdominal surgery, and postoperative discomfort is a regular issue. Patients who have abdominal surgery often experience considerable postoperative pain, which not only slows their pace of recovery but also triggers a number of pathophysiological responses. Therefore, having a safe and efficient pain management paradigm is crucial for perioperative patients (1).

Even while traditional postoperative analgesic techniques may effectively reduce postoperative pain, there is a known risk of adverse consequences when using them. Nerve blocks have recently emerged as the crucial component of multimodal analgesic regimens due to the increase in improved postoperative recovery (2).

The use of anticoagulants, which have unpredictable effects on blood coagulation and jeopardize the safety of neuraxial procedures, limits the use of epidural analgesia, despite the fact that it produces excellent analgesic results in large open abdominal operations (3).

According to clinical recommendations, nerve blocks are a better option for reducing pain after abdominal procedures than central neuraxial blocks because of their superior benefit/risk ratio (RR) (4). Interest in regional anesthetic, and specifically interfacial plane blocks, has skyrocketed in the last ten years (5).

It's intriguing to consider offering total anesthesia for thoracic and abdominal procedures without the use of neuraxial methods or opioids. Nerve and interfacial blocks were landmark procedures until a few years ago, but the regular installation of ultrasound machines specifically designed for anesthesiology in operating rooms encouraged their advancement. Ultrasound guided regional anesthesia techniques have changed from being the exclusive domain of consolidated clinical practices, Many interfacial blocks are currently employed to provide thoracic (e.g., pectoral nerves block, serratus block) and/or abdominal (e.g., transversus abdominis plane block, rectus sheath block, quadratus lumborum block) analgesia (6).

Since then, the block has reportedly been utilized effectively in a wide range of operations, such as lumbar fusions, percutaneous nephrolithotomies, ventral hernia repairs, and thoracotomies (7).

Aim

This study aimed to evaluate and compare the analgesic effect of ultrasound-guided erector spinae plane block (ESPB) vs ultrasound-guided quadratus lumborum Block (QLB) in patients having lower abdominal surgery at Suez Canal university hospitals.

Patients and Methods

This randomized, prospective, double-blinded trial was done on patients undergoing lower abdominal surgeries at Suez Canal University Hospital, in a prospective, double-blinded clinical trial. After obtaining approval by the Hospital Ethics Committee, and written informed patient consent with an explanation regarding the purpose, methods, effects and complications, patients were allocated into two equal groups:

❖ Group I: included 35 patients with Ultrasound guided ESP block at L1 vertebral level was performed post induction using 0.5 ml/kg 0.25% bupivacaine to the patients in ESPB group.

❖ Group II: included 35 patients with ultrasound guided QLB block was performed post induction using 0.5 ml/kg 0.25% bupivacaine to the patients in QLB group .

Patients undergoing lower abdominal surgeries adults (18 to 60 years old of both sexes), who were ASA I-II (American Society of Anesthesiologists physical status Grade I and II) with lower abdominal operations e.g., (inguinal hernia, hydrocele, varicocele, ovarian cyst) were included in the study. While patients with coagulopathy, infection at the site of the block, neurological diseases or any systemic diseases causing neurological abnormalities, known sensitivity to study drugs or uncooperative and mentally retarded patients were excluded from the study.

Seventy patients were assigned randomly to either erector spinae plane block group or quadratus lumborum block group with 1:1 allocation ratio based on a computer-generated randomization list. Group assignment was concealed in opaque numbered sealed envelopes that were opened only after enrollment by the operating anesthesiologist on day of surgery. Another anesthesiologist assessed postoperative analgesia and total morphine consumption using PCA.

All patients were subjected to full history taking, full examinations, laboratory investigations as (CBC, PT, INR, PTT, RBS) and chest x ray.

Patient received general anesthesia then the technique was done using ultrasound machine. After completion of the technique, surgery was started. 18-gauge venous cannula was inserted and ringer lactate solution was started to be infused. All patients were premedicated with intravenous (0.05mg/kg) midazolam before induction. In the operation room, all patients were monitored continuously by electrocardiogram, noninvasive blood pressure, peripheral oxygen saturation and end tidal carbon dioxide using (Nihon kohden, Japan) monitor throughout the surgical procedure.

Induction was achieved using IV propofol (2-3mg/kg), Atracurium besylate (0.5mg/kg) and fentanyl (1-2μg/kg) was used to facilitate insertion of appropriate size of the endotracheal tube. Mechanical ventilation was adjusted to maintain end- tidal CO2 between 35-40 mmHg. Anesthesia was maintained by inhalational isoflurane.

First group received ultrasound- guided erector spinae plane block. All patients were placed in lateral position with the side to be blocked uppermost and a high-frequency linear 2-6 MHz ultrasound transducer was placed in a longitudinal orientation 3 cm lateral to the upper lumber spinous processes. Three muscles were identified superficial to the hyperechoic transverse process shadow as follows: trapezius, rhomboid major, and erector spinae. The area was prepared and draped in a sterile fashion, and lidocaine infiltrated subcutaneously at the point of anticipated needle entry. A sterile needle was introduced and advanced towards the corresponding transverse process. Hydro-dissection was ensured that the proper plane is located. Once the erector spinae musculature is separated, 20 mL of 0.25% bupivacaine was injected there. Close monitoring of the vital signs was done at regular intervals till end of the procedure.

Second group received ultrasound- guided quadratus lumborum block. The patients were placed in lateral position with the side to be blocked uppermost and slightly flexed in the hip and knee joint. After skin and transducer preparation, a linear 2-6 MHz transducer was placed transverse over the flank in the posterior axillary line immediately cranial to the iliac crest. The transducer was then moved slightly posterior and angled caudad until the QL muscle was visualized at the level of the L4 transverse process. The psoas major muscle (PM) was also identified anteriorly and the paraspinal muscle (erector spinae) posteriorly. The so-called "Shamrock" sign was identified; the L4 transverse process being the stem and the 3 muscles (QL, PM and ESM) being the 3 clovers. Hemodynamics (blood pressure and heart rate) were monitored intraoperative at regular intervals (15, 30, 60, 75 and 90 min.) and were documented.

In both groups, an intravenous bolus dose of fentanyl (0.5 μg/kg/dose) was given every 30 min. for rapid control of pain if needed based on a rise in hemodynamics 20% from the basal blood pressure and heart rate. Neuromuscular blockade was reversed with 0.04 mg / kg of neostigmine and 0.02 mg / kg of atropine and patients were extubated and transferred to the recovery room. No peritoneal (puff or injection) or surgical site anesthesia was performed.

Postoperatively, on 1st request of analgesia, a postoperative analgesic regimen, consisting of intravenous patient-controlled morphine analgesia (bolus 1 mg, 10-min lockout, maximum dose 6 mg / h), was used in both groups. The presence and severity of pain, nausea, and sedation was assessed

systematically by the investigator. These assessments were performed in the PACU and at 60 minutes, 12h and 24 h postoperatively.

Statistical analysis

Data of the patients was collected and tabulated. 2- Data entry and analysis were done using a standard statistical program SPSS version 15 (SPSS Inc., Chicago, IL, USA) for windows program by aid of the following statistical tests; Quantitative data were expressed as means and standard deviation (SD). Qualitative data were expressed as numbers and percentages (%). ANOVA (2 ways) test was used for continuous variables. Chi-square for discrete variables. Differences were statistically significant if P value ≤ 0.05. Presentation of the statistical outcomes in form of tables was performed using the "Microsoft Office 2016" program.

Results

Table 1 showed that there was no significant difference between the two groups regarding the demographic data.

Table 1: Comparison between the two studied groups according to demographic data

	ESP block group (n = 35)		**QLB block group (n = 35)**		**p**
	No.	**%**	**No.**	**%**	
Sex					
Male	19	54.3	18	51.4	0.811 NS
Female	16	45.7	17	48.6	
Age (years) SD ± Mean	45.89 ± 10.32		49.17 ± 8.94		0.758 NS
Weight (kg) SD ± Mean	81.54 ± 6.42		84.11 ± 7.57		0.130 NS

SD: Standard deviation p: p value for comparing between the two studied groups NS Statistically not significant at p ≥0.05

Figure 1 showed that there was no significant difference between the two groups regarding the total morphine consumption during the first 24 hours.

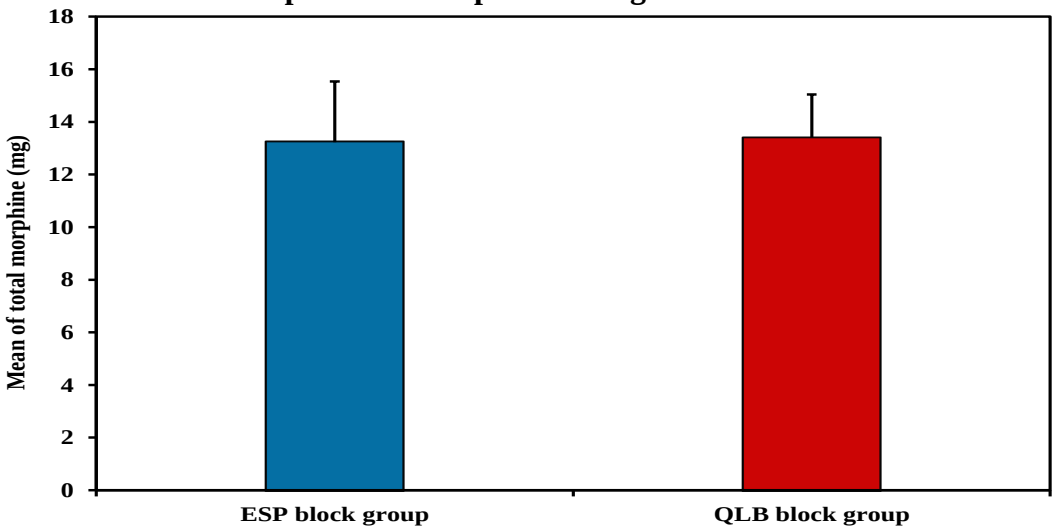

Figure 1: Comparison between the two studied groups according to total morphine consumption during the first 24 hours post operative

Figure 2 showed that there was no significant difference between the two groups regarding time of the 1st request of analgesia.

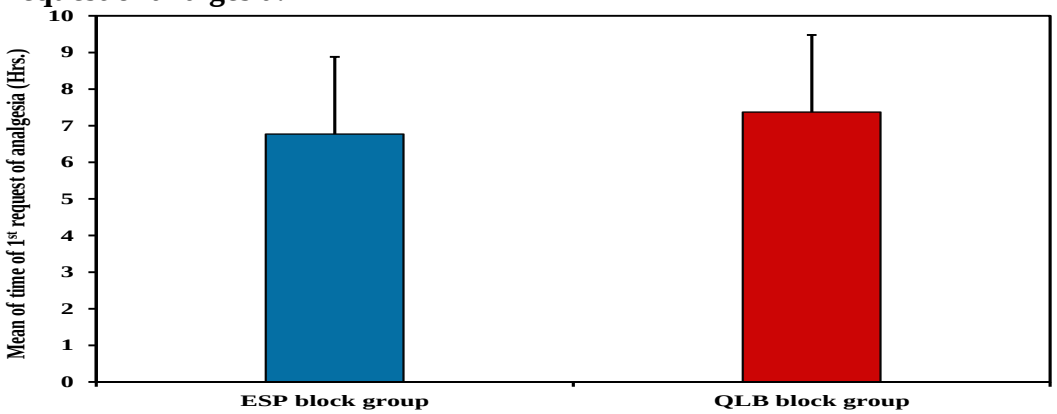

Figure 2: Comparison between the two studied groups according to 1st request of analgesia

Figure 3 showed that there was no significant difference between the two groups regarding VAS postoperative at rest at 60 min 12, 24 hours postoperative.

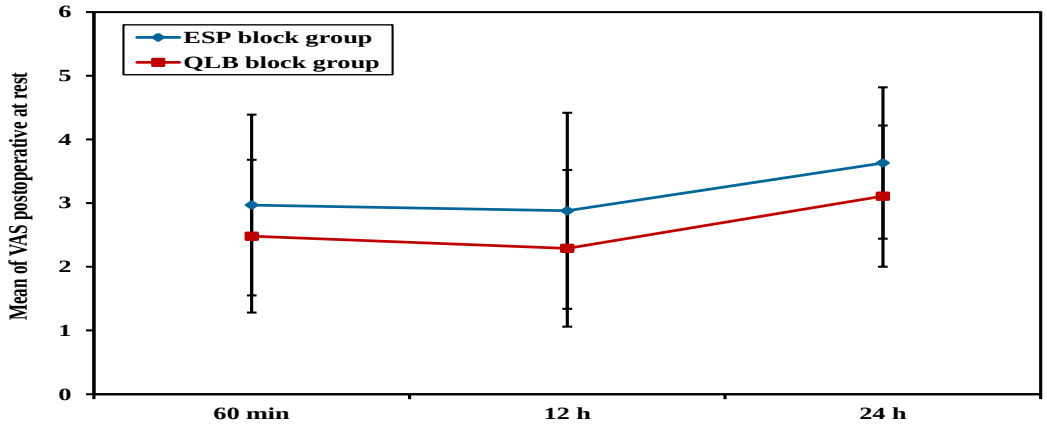

Figure 3: Comparison between the two studied groups according to VAS post operative at rest

Figure 4 showed that there was no significant difference between the two groups regarding VAS postoperative at patient movement.

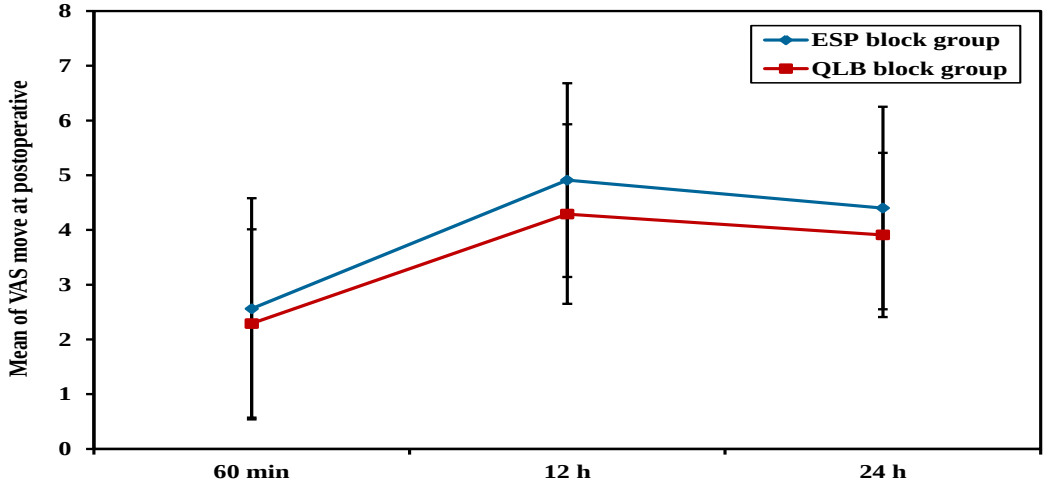

Figure 4: Comparison between the two studied groups according to VAS post operative at patient movement.

Table 2 showed that there was no significant difference between the two groups regarding the duration of surgery.

Table 2: Comparison between the two studied groups according to duration of surgery

	ESP block group (n = 35)	**QLB block group (n = 35)**	**P**
Duration of surgery (hr.)			
SD ± Mean	1.76 ± 2.04	2.0 ± 2.77	0.178 NS

SD: Standard deviation p: p value for comparing between the two studied groups NS Statistically not significant at p ≥0.05

Table 3 showed that there was no significant difference between the two groups regarding procedure time and difficulty.

Table 3: Comparison between the two studied groups according to technique time and difficulty

	ESP block group (n = 35)	**QLB block group (n = 35)**	**P**
Technique time (min)			
SD ± Mean	9.83 ± 3.59	11.02 ± 2.54	0.079 NS
Technique difficulty Number (percentage)			
Easy	24 (68.6%)	22 (62.9%)	0.056 NS
Rather difficult	11 (20.0%)	13 (37.1%)	
Difficult	0 (0.0%)	0 (0.0%)	

SD: Standard deviation p: p value for comparing between the two studied groups NS Statistically not significant at p ≥0.05

Figure 5 showed that there was no significant difference between the two groups regarding heart rate.

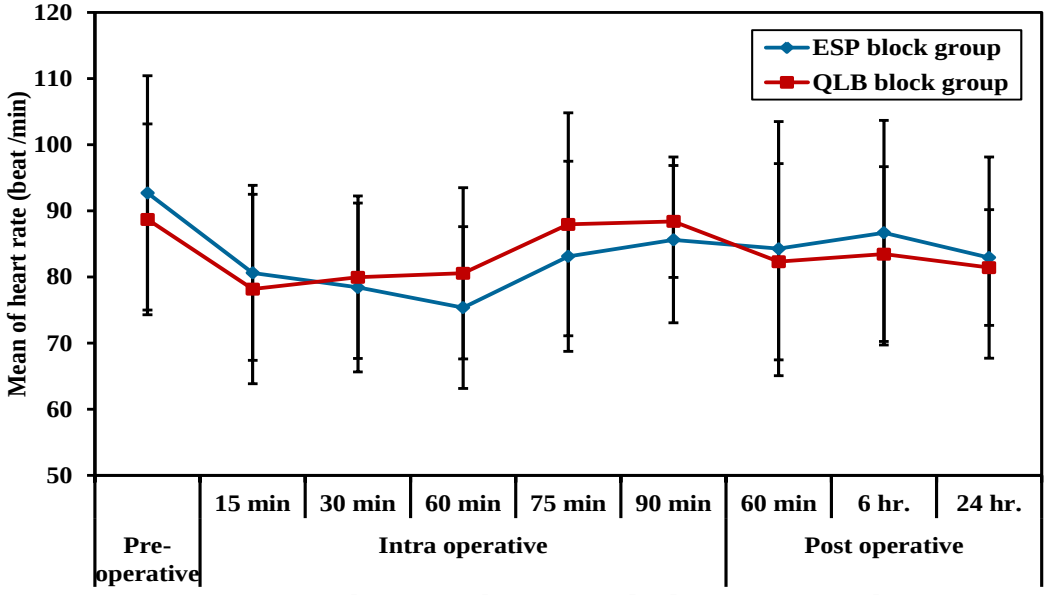

Figure 5: Comparison between the two studied groups according to HR

Figure 6 showed that there was no significant difference between the two groups regarding the systolic blood pressure readings.

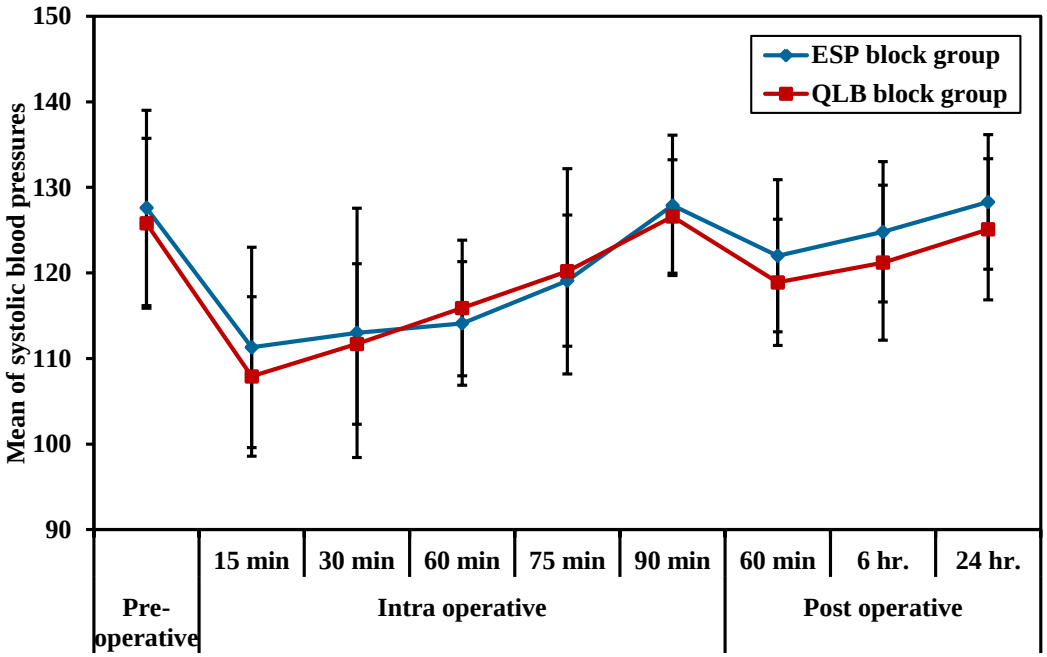

Figure 6: Comparison between the two studied groups according to systolic blood pressures

Figure 7 showed that there was no significant difference between the two groups regarding the diastolic blood pressure.

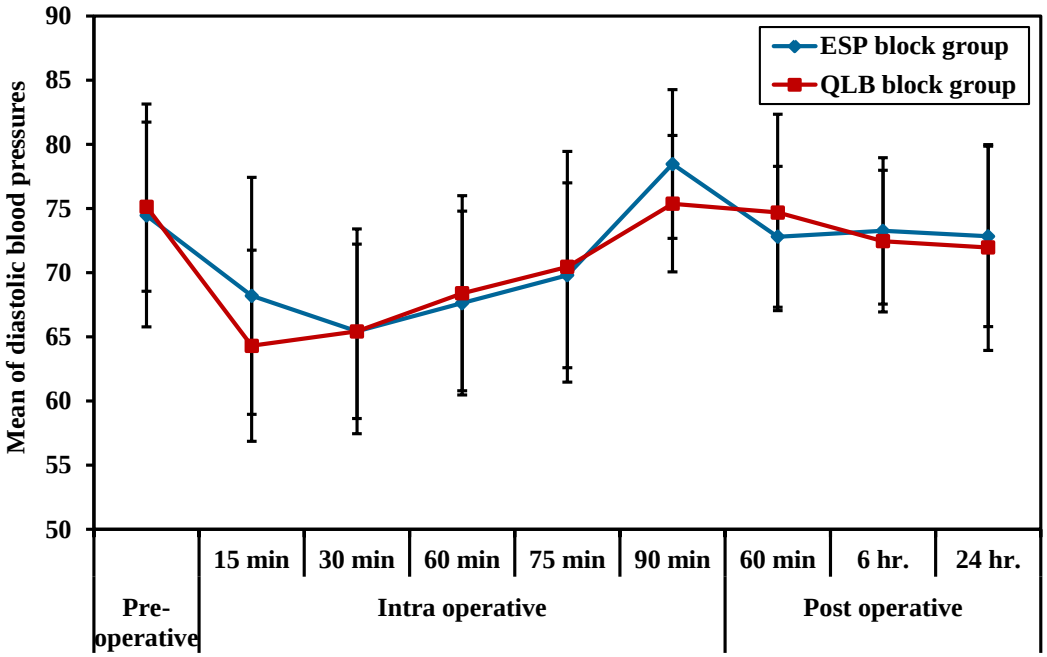

Figure 7: Comparison between the two studied groups according to diastolic blood pressures

Figure 8 showed that there was no significant difference between the two groups regarding mean blood pressure.

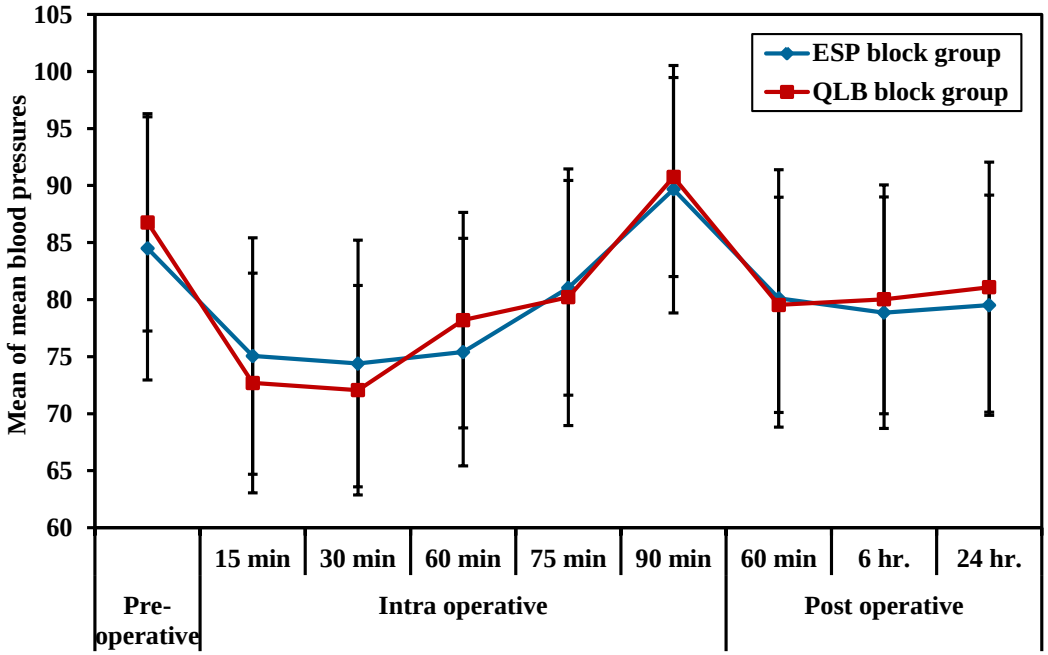

Figure 8: Comparison between the two studied groups according to mean blood pressures

Figure 9 showed that there was no significant difference between the two groups regarding the respiratory rate readings.

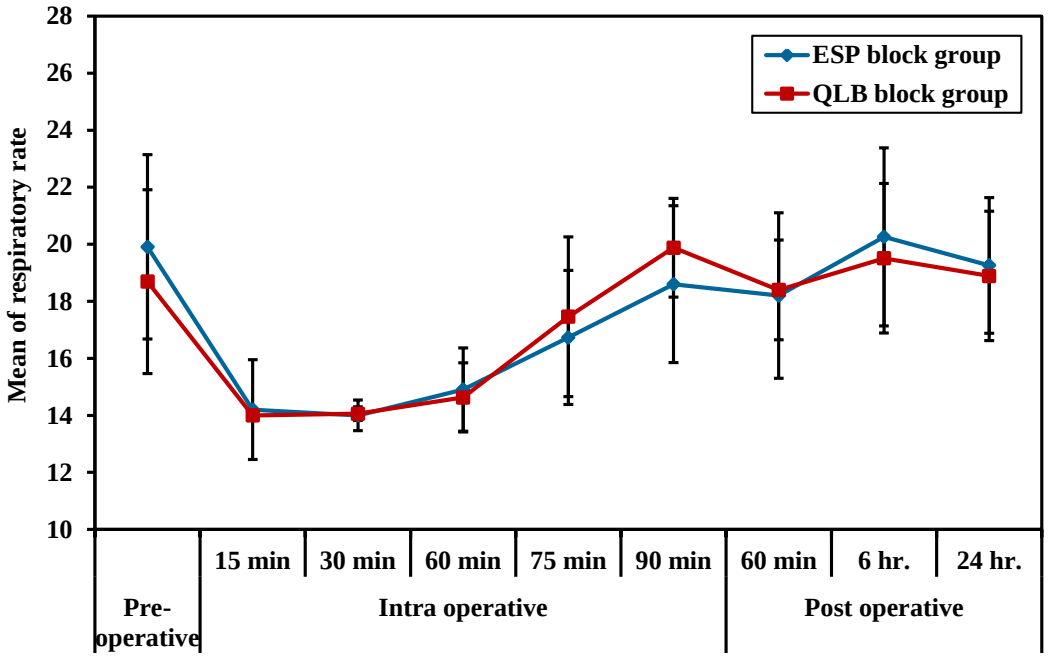

Figure 9: Comparison between the two studied groups according to respiratory rate

Table 4 showed that there was no significant difference between the two groups regarding side effects of both procedures.

Table 4: Comparison between the two studied groups according to side effects

	ESP block group (n = 35)		QLB block group (n = 35)		p
	No.	%	No.	%	
Side effects					
No	33	94.2	33	94.2	
Post operative nausea and vomiting	2	5.8	2	5.8	0.764 NS

SD: Standard deviation p: p value for comparing between the two studied groups NS Statistically not significant at p ≥0.05

Discussion

One of the most frequent surgical procedures is abdominal surgery, and one of the most frequent issues with these surgeries is postoperative discomfort. Patients who have abdominal surgery often experience considerable postoperative pain, which not only slows their pace of recovery but also triggers a number of pathophysiological responses (1).

For patients undergoing lower abdomen surgery at Suez Canal University Hospitals, we examined the analgesic effects of ultrasound-guided erector spinae plane block and ultrasound-guided quadratus lumborum block. Seventy patients were divided into two equal groups at random. The first group received ultrasound-guided ESP block at the L1 vertebral level, which was administered to the ESPB group using 0.5 ml/kg 0.25% bupivacaine. The second group received ultrasound-guided QLB block. Age, sex, weight, method time and complexity, and surgical length were all matched between the two groups. Both the total amount of morphine used and the initial request for analgesia during the first 24 hours after surgery did not significantly vary between the two groups in our research.

Furthermore, 60 patients scheduled for LSCS under spinal anesthesia were randomly assigned to two equal groups: group E (n = 30) and group Q (n = 30) in Bakshi et al.(8), a randomized and double-blind trial. Following surgery, each parturient received either TESPB (group E) or US-guided bilateral TQLB (group Q), with 4 mg of dexamethasone and 20 ml of 0.375% ropivacaine administered to each side. Comparing the two caesarean section blocks, it was discovered that group E's initial rescue analgesia duration mean ± SD was 11.90 ± 2.49 hours, whereas group Q's was 12.56 ± 3.38 hours (P = 0.19). Tramadol was used as a rescue analgesic in 50 (75 50) mg for the erector spinae block group and 50 (50 25) mg for the quadratus lumborum group (P = 0.48), respectively.

Additionally, Kang et al. (9) randomized eighty-eight patients who were scheduled for laparoscopic liver resection to receive either bilateral single injection of posterior QL block (QL group; 20 mL of 0.375% ropivacaine for each side, totaling 150 mg of ropivacaine) or bilateral single injection of ESP block at T8 (ESP group). This was done in addition to intravenous (IV) fentanyl patient-controlled analgesia and multimodal analgesia. Cumulative opioid use during the first 24 hours, measured in IV morphine equivalents, was the main result. Time to first flatus, pain ratings, Quality of Recovery-15 scores, and serial plasma ropivacaine concentrations were secondary objectives. When comparing the analgesic effectiveness of posterior quadratus lumborum block with erector spinae plane block in laparoscopic liver resection, it was discovered that there was no discernible difference in the two groups' overall morphine intake.

Furthermore, Abd Ellatif and Abdelnaby (10) compared the use of ultrasound-guided erector spinae plane block versus quadratus lumborum block for postoperative analgesia in patients undergoing open nephrectomy. In their study, 75 patients scheduled for open nephrectomy were randomly assigned to three equal groups of 25 each; the control group underwent general anesthesia, while the QLB and ESPB groups received unilateral (QLB or ESPB) and 0.3–0.4 ml/kg of bupivacaine 0.25%. They

discovered that the first time to rescue analgesic, the total amount of morphine consumed, and the length of hospital stay were all statistically significant ($p < 0.001$) in the control group, with no significant difference between these two interventional groups.

Additionally, 80 patients (ASA I–II) scheduled for laparoscopic cholecystectomy participated in a randomized, prospective, comparative, double-blind trial conducted by Aygun et al. (11). Two equal groups of patients (ESB and QLB-II) were assigned. QLB-II and ESPB were carried out under ultrasound supervision. During the first 24 hours after surgery, mean opioid intake and Numerical Rating Scores were recorded. There was no discernible difference in the total amount of morphine used by the two groups when comparing the two blocks in laparoscopic cholecystectomy.

In our research, we measured VAS postoperatively while patients were at rest and when they were asked to move. We discovered that there was no significant difference between the two groups in terms of VAS postoperative at rest after 60, 12, and 24 hours as well as in terms of VAS postoperative at patient movement.

In a similar vein, Abd Ellatif and Abdelnaby (10) discovered that there was no discernible difference in VAS between the QLB and ESPB groups at rest or during movement across all time assessments. Nonetheless, there was a statistically significant difference between the interventional groups and the control group [65].

Furthermore, Aksu et al. (12) discovered that there was no discernible difference in the groups' FLACC (Face, Legs, Activity, Cry, and CONSOL ability) ratings over any given period of time.

The two groups in our research did not significantly vary in terms of mean arterial blood pressure, systolic and diastolic blood pressure, heart rate, or respiratory rate.

Likewise, Abd Ellatif and Abdelnaby (10) found that the MAP was similar at baseline, immediately after induction, and 20 minutes after induction, with no significant difference between the groups under study. Later, at 40 minutes, 1 hour, and 2 hours, the MAP was statistically significantly lower in the QLB and ESPB groups than in the control group, which had higher pressure. At the conclusion of surgery, no significant difference in MAP was observed between the two interventional groups at different timings.

Regarding the adverse consequences of both operations, there was no discernible difference between the two groups in our research.

In accordance, Bakshi et al. (8) found no discernible difference between the two groups. Furthermore, Abd Ellatif and Abdelnaby (10) discovered that no issues pertaining to the methods were noted .

Additionally, Aksu et al. (12) discovered that no patient had any issues during the intraoperative or postoperative periods, including hypotension, arrhythmia, or allergic response. Following surgery, no block-related issues or adverse consequences were noted [67].

Conclusion

These findings suggest that the effects of ultrasound-guided QLB and ESPB on postoperative pain and opioid need were comparable in individuals following lower abdominal operations. The benefits of an ultrasound-guided lumbar erector spinae plane block include a reduced block completion time and increased technical simplicity. Although quadratus lumborum block provides greater and longer-lasting analgesia than ESPB, the difference was not statistically significant. Thus, both approaches might be regarded as practical and efficient methods for lower abdominal surgery post-operative analgesia.

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