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## Original Article

# Analgesic Efficacy of Quadratus Lumborum Block Against Erector Spinae Plane Block in Laparoscopic Sleeve Gastrectomy: A Prospective Randomized Study

Adel Ali Hassan Abdelhamid <sup>\*1</sup>; Mohammad Elhossieny Mohammad Salama <sup>2</sup>; Hani Gharib Ali <sup>3</sup>;  
 Hatem Mahmoud Elkenany <sup>4</sup>; Ahmed Mehrez Gad <sup>5</sup>; Tamer Ahmed Abdelmonem Abdelsalam <sup>3</sup>

<sup>1</sup> Department of Anesthesia, Intensive Care, and Pain Management, Faculty of Medicine, Port Said University, Port Said, Egypt.

<sup>2</sup> Department of Anesthesia and Intensive Care, Faculty of Medicine, Suez Canal University, Ismailia, Egypt.

<sup>3</sup> Department of Anesthesia, Intensive Care, and Pain Management, Faculty of Medicine, Mansoura University, Mansoura, Egypt.

<sup>4</sup> Department of Anesthesia and Critical Care, Faculty of Medicine, Al-Azhar University, Cairo, Egypt.

<sup>5</sup> Department of General, gastrointestinal and Hepatobiliary Surgery Faculty of Medicine, Delta University for Science and Technology, Gamasa, Egypt.

## ABSTRACT

### Article information

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### \*Corresponding author

Email: adel.hassan@med.psu.edu.eg

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**Background:** Laparoscopic sleeve gastrectomy is a very frequent surgical procedure with notable postoperative pain and discomfort. Both QLB and ESPB techniques have somatic and visceral analgesia. These interventions could be integrated into a multimodal analgesia strategy in sleeve gastrectomy surgeries.

**Objective:** This study aimed to assess the postoperative analgesic efficacy of quadratus Lumborum block against erector spinae plane block in sleeve gastrectomy operations.

**Patients and Methods:** This randomized prospective experiment had 92 people who were randomly assigned to have elective sleeve gastrectomy. They were randomly assigned to two groups of equivalent sizes [46 patients in each]. The initial group received QLB. The second group received ESPB.

**Results:** The findings revealed no statistically significant difference in postoperative morphine consumption over a 24-hour period between the two groups [5.35 ± 2.19 mg in QLB versus 5.48 ± 2.17 mg in ESPB, p = 0.775], as well as in postoperative VAS scores and the timing of the initial request for rescue analgesia. Both techniques alleviated the stress response during trocar insertion and abdominal insufflation.

**Conclusion:** The Quadratus Lumborum block [QLB] and Erector Spinae Plane block [ESPB] can be employed to reduce postoperative pain in sleeve gastrectomy surgeries, as they efficiently address both somatic and visceral pain components.

**Keywords:** Quadratus Lumborum Block; Erector Spinae Plane Block; Sleeve Gastrectomy.



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## INTRODUCTION

The global prevalence of morbid obesity is rising, resulting in an increasing number of people undergoing various elective and emergency surgeries. Morbid obesity is a chronic systemic disorder that reduces quality of life and life expectancy while simultaneously increasing perioperative morbidity and mortality rates in patients [1].

Opioid analgesics are the most commonly administered medications intravenously after bariatric surgery. However, their detrimental consequences are exacerbated in obese persons, encompassing postoperative nausea and vomiting [PONV] and respiratory problems [2].

Bariatric surgery frequently entails considerable postoperative pain that can be challenging to manage [3].

Bariatric surgeries entail comprehensive pain consisting of three specific clinical components: somatic pain at the incisional sites, visceral discomfort deep inside the abdomen, and shoulder pain from carbon dioxide insufflation-related peritoneal stretching and diaphragmatic irritation [4].

Inadequate management of this persistent pain may prolong healing, need hospitalization, and hence elevate healthcare expenses [5].

During the execution of an erector spinae plane block [ESPB], cranio-caudal dispersion is achieved by injecting a local anesthetic into the fascial plane just beneath the erector spinae muscle [6] which induces blockade on both the somatic and visceral levels, potentially providing effective analgesia post-abdominal surgery [7,8].

When performed bilaterally, it can be as effective as thoracic epidural analgesia, providing adequate postoperative analgesia when supplied at the T7 level for abdominal procedures [9].

In recent years, the quadratus lumborum block [QLB] has emerged as a prevalent regional nerve block treatment. It is often utilized alongside general anesthesia during abdominal surgery [10].

Previous study has shown that the application of QLB in abdominal surgery can result in decreased opioid usage and analgesia lasting up to 24 hours [11]. The local anesthetic delivered via the posterior QLB can more efficiently infiltrate the thoracic paravertebral space or the thoracolumbar plane, offering somatic and visceral analgesia that surpasses that of the TAP block [12].

The posterior QLB provides extensive sensory-level analgesia, potentially extending from T7 to L1 [13].

This research aimed to assess the effectiveness of ultrasound-guided posterior quadratus lumborum block and erector spinae plane block in providing postoperative analgesia during laparoscopic bariatric surgeries.

The research posited that the posterior QLB would be comparable to the ESPB, given that both demonstrate somatic and visceral analgesic effects.

## PATIENTS AND METHODS

This double-blind randomized clinical trial was conducted in the surgical department of Egyptian Liver Hospital from February 27, 2024, to February 2, 2025, after authorization from the Institutional Review Board at Egyptian Liver Hospital [ELH-IRB], ethical committee number

[CT2023-014], receiving explicit written consent from all patients who participated in the study. The trial is registered on clinicaltrials.gov [ID: NCT06050044].

**Inclusion criteria:** Participants were classified according to ASA I–III classification, aged 18 to 60 years, of both sexes, and planned to undergo general anesthesia for a laparoscopic sleeve gastrectomy.

**Exclusion criteria:** The patient exhibited chronic pain and a body mass index over 50 kg/m<sup>2</sup>, drug addiction, local skin infections at the block site, bleeding or coagulation abnormalities, patient refusal, and a history of known hypersensitivity to the study medications were among the exclusion criteria.

### Randomization and Blindness:

Concealing the assignment was 92 patients participated in this randomized double-blind trial; using sealed envelope and computer-generated randomization, they were split evenly into two groups of 46 each. The first group had a Quadratus lumborum Block [QLB], while the second group received Erector spinae plane block [ESPB]. The anesthesiologist opened the envelopes immediately prior to the injection, while the surgeons, patients, and the research data collector assessing patients postoperatively remained unaware of the group assignment.

### Procedure:

All patients underwent a thorough medical history evaluation, physical examination, and baseline laboratory assessments, which included complete blood count, international normalized ratio, liver function tests, and renal function tests and an electrocardiogram as part of the preoperative evaluation procedure. All patients received instructions on utilizing the visual analogue scale [VAS] the day prior to the surgery.

The VAS is a scale that extends from 0 [indicating no discomfort] to 10 [representing the outmost agony]. In the operating room, after establishing a peripheral intravenous line and implementing standard monitoring techniques such as noninvasive blood pressure measurement, pulse oximetry, and electrocardiography, patients received either ultrasound-guided bilateral ESPB or QLB according to their designated group. All blocks were administered by an anesthesiologist who had no further participation in the trial.

### Technique of posterior quadratus lumborum block [QL 2 block]:

The patient was positioned laterally, and the curvilinear ultrasound probe [3-5 MHz] was aligned in the transverse plane over the flank region, superior to the iliac crest.

The muscular layers of the abdominal wall were delineated. The transducer was subsequently repositioned posteriorly to evaluate the aponeurosis of the transversus abdominis muscle until the quadratus lumborum muscle was visualized.

A 22-gauge block needle was positioned in-plane toward the posterior region of the quadratus lumborum muscle. A 2-ml test dose of normal saline was delivered to verify proper placement.

Subsequently, 20 cc of isobaric bupivacaine 0.375% was injected posterior to the quadratus lumborum muscle. The same process was implemented on both sides [14]. **Figure [1]**



Figure [1]: Arrow indicates the injection site for the posterior quadratus lumborum block [QL 2 block]; QL: quadratus lumborum muscle

### **Technique of erector spinae plane block:**

The patient was placed in a lateral posture within an aseptic setting. The high-frequency linear ultrasound probe [6-13 MHz] was placed on the spinous process at the T7 level along the parasagittal plane and thereafter moved 2.5–3 cm laterally to assess the transverse process and erector spinae muscle.

The in-plane technique was utilized; a 22-G needle was oriented craniocaudally until it contacted the T7 transverse process, with the needle tip placed within the fascial plane beneath the erector spinae muscle.

The accurate site was validated by administering 2 mL of saline, resulting in the elevation of the erector spinae muscle from the transverse process without muscular distension, and by monitoring the craniocaudal dispersion of the injectate. Subsequently, 20 mL of isobaric bupivacaine at a concentration of 0.375% was administered into the erector spinae plane. The same process was implemented on both sides <sup>[6]</sup> [Figure 2]

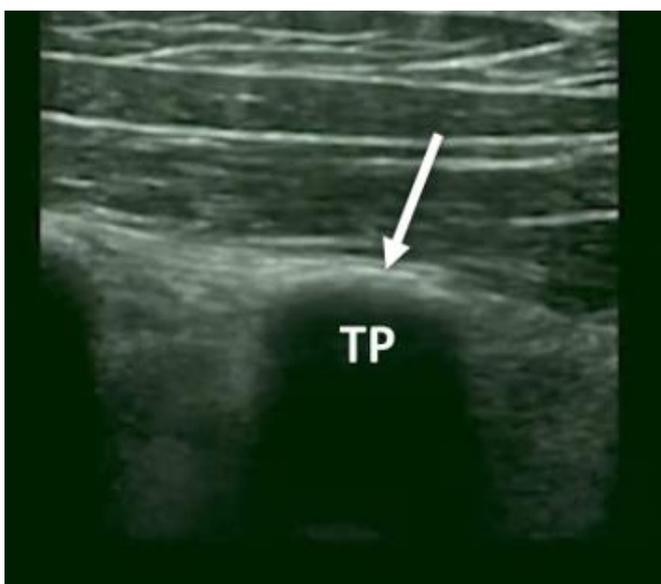


Figure [2]: Arrow indicates the injection site for the erector spinae plane block [TP: transverse process].

The efficacy of the block was evaluated through pinprick assessment utilizing a blunt needle, ensuring minimal skin deformation, to

detect sensory alterations from T4 to L2 in comparison to C3-4 dermatomes.

The blockade was deemed successful if sensory changes were observed from T6-7 to T10-11 dermatomes.

The initiation of general anesthesia began with intravenous administration of propofol at a dose of 2 mg/kg, fentanyl at 1 microgram/kg, and atracurium besylate at 0.5 mg/kg to facilitate intubation. Patients had mechanical breathing to maintain end-tidal CO<sub>2</sub> at approximately 35 mmHg. Anesthesia was maintained with 1% isoflurane, a mixture of 60% air and oxygen, and an additional dosage of atracurium.

The intravenous fluids were administered based on body weight and intraoperative fluid loss.

Following the commencement of general anesthesia, a Paracetamol infusion [15 mg/kg] and a 30 mg ampoule of ketorolac were administered intravenously to all groups, subsequently repeated every 8 hours.

Heart rate and mean arterial blood pressure were recorded during trocar insertion and abdomen insufflation to assess stress levels.

If there was no increase in both parameters more than 20%, no analgesia was given and considered as a successful indicator to attenuate stress response. All patients were extubated post-surgery following neuromuscular reversal and the duration of the operation was documented.

Postoperatively, morphine boluses [2 mg] were administered if the VAS exceeded 3, with the possibility of repetition after 30 minutes until the VAS was  $\leq 3$ , and the administered dose was documented. VAS scores were assessed at 1, 6, 12, 24 hours postoperatively. The demographic data, including age, sex, and BMI, were recorded. Time of first request to postoperative analgesia was registered.

The primary outcome was the assessment of opioid requirements within 24 hours postoperatively, the secondary outcome encompassed the assessment of stress associated with trocar insertion and insufflation, as well as the postoperative visual analogue scale [VAS], and the timing of the first request for postoperative analgesia.

### **Sample size:**

Sample size calculation was based on difference in mean difference of total analgesic dose between erector spinae and quadratus lumborum arms retrieved from previous research <sup>[15]</sup>. With G power software version 3.1.9.7, sample size was computed with effect size of 0.593, 2-tailed test,  $\alpha$  error = 0.05, and power = 80.0%, resulting in 46 in each group.

### **Statistical analysis:**

The statistical analysis was carried out using IBM SPSS v27 [Armonk, NY, USA]. The Shapiro-Wilk test and histograms were used to determine the normality of the data distribution. The unpaired Student's t-test was used to evaluate the quantitative parametric data between the two groups, presented as mean and standard deviation, while the paired t-test was utilized inside each group. The Mann-Whitney test evaluated quantitative nonparametric data, It was articulated as the median and interquartile range. The Chi-square test was employed to examine the qualitative data presented as counts and percentages. A two-tailed P value less than 0.05 was deemed significant.

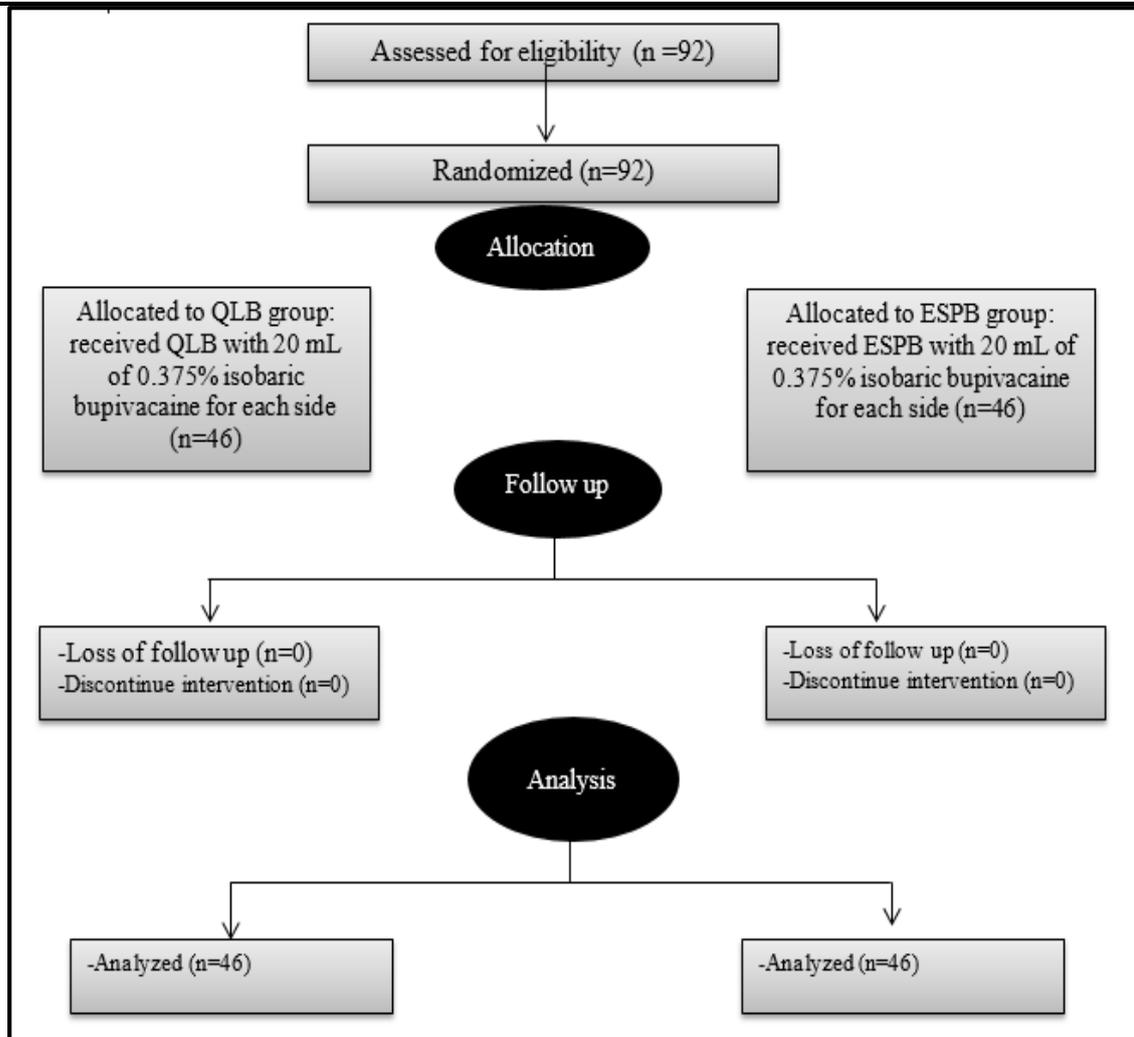


Figure [3]: CONSORT [Consolidated Standards of Reporting Trials] 2010 flow diagram of the consecutive steps of the study.

**ESULTS**

There were 92 participants in this prospective, randomized, double-blind trial ranging in age from 18 to 60 years, who were scheduled for elective sleeve gastrectomy under general anesthesia [Figure 3]. No statistically significant difference was observed in the patients' demographics or the duration of operation between the two groups [table 1].

The use of morphine over a 24-hour period was statistically comparable amongst the groups. [5.35 ± 2.19 mg in QLB vs. 5.48 ± 2.17

mg in ESPB, p = 0.775]. No significant difference in the time to the first analgesic request [4.25 ± 0.94 hours for QLB vs. 4.26 ± 0.96 hours for ESPB, p = 0.956] [table 2]. In relation to the postoperative VAS data [table 2], There was no substantial difference between the two groups.

There was significant increase in heart rate and blood pressure at time of trocar insertion and abdominal insufflation when compared with basal data in both groups, but they were not increased more than 20% of basal numbers, so no analgesia was needed. No significant difference was seen between the two groups concerning heart rate and blood pressure at baseline readings or at the time of trocar implantation and insufflation.

Table [1]: Demographic information and surgical duration in studied group

		Group 1 [n=46]	Group 2 [n=46]	P value
Age [years]		42.67 ± 7.47	43.78 ± 7.32	0.474
BMI [kg/m <sup>2</sup> ]		41.22 ± 3.41	41.61 ± 4.17	0.629
Sex	M	13 [65.52%]	12 [60.71%]	0.815
	F	33 [34.48%]	34 [39.29%]	
Duration of surgery [min]		107.07 ± 15.11	106.19 ± 14.07	0.776

BMI= body mass index; Data is presented as mean ± SD and compared between groups by t test. Sex is presented as number and % and compared between groups using Chi-Square test.

**Table [2]:** analgesic pattern in both groups

	Group 1 [n=46]	Group 2 [n=46]	P value
<b>Time to first analgesic request [hour]</b>	4.25± 0.94	4.26± 0.96	0.9560
<b>VAS at 1h</b>	1 [1-2]	1 [0-2]	0.0646
<b>VAS at 6h</b>	4 [3 - 5]	4 [3 - 5]	0.8490
<b>VAS at 12h</b>	4 [3 - 5]	4 [3 - 5]	0.2260
<b>VAS at 24h</b>	4 [3 - 5]	3 [3 - 5]	0.3840
<b>postoperative morphine consumption [mg]</b>	5.35 ± 2.19	5.48 ± 2.17	0.7750

Data are presented as mean ± SD or median [interquartile range]

**Table [3]:** Hemodynamics in studied groups

	Group 1 [n=46]	Group 2 [n=46]	P <sup>##</sup> value
<b>HR1</b>	84.52±10.58	85.71±10.14	0.582
<b>HR2</b>	91.93±9.66	91.21±9.93	0.726
<b>P#</b>	< <b>0.0001*</b>	< <b>0.0001*</b>	
<b>MAP1</b>	94.59±6.14	95.69±5.12	0.349
<b>MAP2</b>	100.34±6.02	100.17±5.28	0.883
<b>P#</b>	< <b>0.0001*</b>	< <b>0.0001*</b>	

HR1= baseline, HR2= insufflation. MAP1= baseline, MAP2= at insufflation; P<sup>##</sup> value represents the comparison between both groups using unpaired t test; P# value represents comparison between insufflation value and baseline value within each group using paired t test. \* Indicates significant P# <0.05.

## DISCUSSION

In profoundly obese patients, laparoscopic sleeve gastrectomy and laparoscopic gastric bypass surgeries have been shown to be more effective than alternative therapies [16]. The insufficient handling of acute postoperative pain burdens the healthcare system, requiring measures to improve patients' postoperative pain experience. The integration of regional blocks into general anaesthesia exhibited enhanced pain management and less opioid consumption compared to conventional approaches [17]. This study assessed the analgesic efficacy of the Quadratus Lumborum Block [QLB] and Erector Spinae Plane Block [ESPB] in bariatric procedures, concentrating on postoperative opioid usage, pain levels, and their impact on stress response in relation to hemodynamic parameters. Both QLB and ESPB offered effective postoperative analgesia, yielding equivalent results for the initial analgesic request, visual analog scale [VAS] ratings, and morphine consumption.

The study demonstrated that morphine usage over a 24-hour period was statistically comparable between the groups [5.35 ± 2.19 mg in QLB versus 5.48 ± 2.17 mg in ESPB, p = 0.775]. This suggests that both blocks substantially decrease postoperative opioid needs, potentially alleviating opioid-related side effects and affirming the adaptability of both blocks in postoperative pain management. Blanco et al. shown that QLB markedly diminished opioid usage following the cesarean section in comparison to standard care, underscoring its strong opioid-sparing properties [7]. **Forero and coworkers** reported that ESPB effectively reduced opioid use in thoracic operations, resulting in significant opioid sparing postoperatively [6]. The similarity in results aligns with the hypothesis that both techniques offer somatic and visceral analgesia.

Both groups demonstrated steady hemodynamic parameters [heart rate and mean arterial pressure] throughout trocar implantation and insufflation. This highlights their efficacy in mitigating stress responses.

This aligns with a study by **Chin et al.**, which indicated that ESPB stabilized hemodynamics during laparoscopic procedures owing to its visceral and somatic analgesic properties [10]. Furthermore, the findings of **Murouchi et al.** indicated that QLB exhibited hemodynamic stability, accompanied by decreased stress responses after abdominal procedures [18].

The time for the first analgesic request was 4.25 ± 0.94 hours for QLB compared to 4.26 ± 0.96 hours for ESPB. The present study indicates comparable analgesic duration for both blocks; however, prior research suggests minor discrepancies in block length attributable to factors such as the kind of surgery, dosage of local anesthetic, and injection procedures. Murouchi et al. discovered that QLB lengthened the interval to the initial analgesic request to 6–8 hours' post-laparoscopic surgery, indicating protracted analgesia [18]. Chin et al. shown that ESPB delivered prolonged analgesia [6–9 hours] in bariatric procedures, which is somewhat longer than the findings of the current investigation [10].

Our study demonstrated that both blocks provided equivalent pain management, with no significant changes in VAS scores at 1, 6, 12, and 24 hours postoperatively. This corresponds with the research of numerous studies that have examined the analgesic efficacy of two nerve block procedures in adult patients undergoing laparoscopic nephrectomy, hepatectomy and hysterectomy, with both techniques providing effective analgesia [19-21].

Conversely, Ueshima et al. discovered that ESPB offered superior pain alleviation compared to QLB for certain thoracic procedures, perhaps attributable to enhanced distribution to the paravertebral region [14].

The QLB facilitates somatic and visceral analgesia by enabling the local anesthetic to disseminate from the thoracolumbar fascia to the thoracic paravertebral region. This mechanism induces somatic analgesia via dorsal rami innervation of the abdominal wall, encompassing

dermatomes from T7 to L1, and visceral analgesia by influencing the sympathetic chain situated in the thoracic paravertebral region, which regulates visceral sensation [12, 14]. The ESPB induces analgesia by the diffusion of local anesthetic into the paravertebral and epidural regions, impacting the ventral rami, dorsal rami, and rami communicantes [sympathetic fibers]. This resulted in analgesia for both somatic [trocar locations] and visceral [intra-abdominal] pain [6,7].

**Limitation:** This research was performed at a single center with a defined demography, which may affect its generalizability; therefore, future research with bigger sample sizes and diverse surgical populations is advised to enhance block selection for scenarios.

**Recommendations:** The selection between QLB and ESPB may hinge on specific patient characteristics and the proficiency of the clinician. QLB's anatomical methodology may provide supplementary advantages in instances necessitating thoracolumbar analgesia. In contrast, ESPB may be simpler to execute, with a reduced risk of problems owing to its superficial characteristics.

**Conclusion:** The Quadratus Lumborum block [QLB] and Erector Spinae Plane block [ESPB] techniques can be utilized for the management of postoperative pain in abdominal surgeries, effectively addressing both somatic and visceral pain components.

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**Conflict of interest:** The authors have declared that they have no conflicts of interest.

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