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Ultrasound Guided Parascapular Sub-Iliocostalis Plane Block versus Thoracic Epidural for Postoperative Analgesia in Thoracotomy Operations

Ahmed Said Elnoury*, Esaam Makram Fotouh,
Ahmed Mostafa Abdelhamid and Asmaa Fath Elbab Abdelfatah
Anesthesiology and Intensive Care Department, Faculty of Medicine, Benha, University
*** Corresponding author:** Name: Ahmed Said Elnoury, Email: Dr.ahmed.elnori@gmail.com, Phone: +201007938237

ABSTRACT

Background: Post-thoracotomy pain syndrome (PTPS) is a significant clinical problem affecting patient recovery and quality of life. Effective postoperative pain management is crucial in reducing the incidence of PTPS. Both parascapular sub-iliocostalis plane (PSIP) block and thoracic epidural analgesia (TEA) are employed to manage post-thoracotomy pain, but their efficacy and safety profiles need thorough comparative analysis.

Objective: In order to reduce the occurrence of PTPS, compare the safety and efficacy of ultrasound-guided PSIP block to TEA for postoperative analgesia in patients following elective thoracotomy.

Patients and methods: This randomised, single-blind clinical study was undertaken at Benha University Hospital. A randomised comparison was conducted between two groups of 52 adult patients undergoing elective thoracotomy: one group received PSIP block, and the other group received TEA. The incidence of adverse effects, visual analogue scale (VAS) pain scores, morphine use, and hemodynamic parameters were evaluated for both groups.

Results: The study enrolled 52 patients with no significant differences in demographic characteristics between the groups ($p>0.05$). The TEA group demonstrated significantly lower morphine consumption in the first 48 hours postoperatively ($p<0.001$), indicating superior analgesic efficacy. However, patients in the TEA group experienced higher incidences of hypotension ($p<0.001$) and did not differ significantly in pain scores across most time points ($p>0.05$). The PSIP group had a shorter ICU stay (mean 1.31 days versus 2.00 days, $p<0.001$).

Conclusion: While TEA provides superior analgesia reflected in lower morphine consumption, PSIP block is associated with fewer hemodynamic complications and shorter ICU stays, suggesting an advantageous profile for enhancing recovery after thoracotomy.

Keywords: Thoracotomy; Post-thoracotomy pain syndrome; Ultrasound-guided analgesia; Parascapular sub-iliocostalis plane block; Thoracic epidural analgesia.

INTRODUCTION

Thoracotomy procedures entail incisions made in the intercostal space. One of the most severe forms of postoperative pain, post-thoracotomy pain is caused by disruptions to the costovertebral joint, intercostal nerve, and pleura. These injuries occur during the operation [1]. Physical inactivity and difficulty breathing might be impeded by inadequate pain management, which can raise the risk of developing lung infections and collapse. It has been observed that the incidence of pulmonary problems ranges from 15 to 32.5 % [2]. In addition to prolonging hospitalisation, acute discomfort increases postoperative morbidity. Untreated, it may result in the development of persistent pain that endures for several months. PTPS, or post-thoracotomy pain, impacts an estimated 25–47% of patients in the post-thoracotomy period. Over 25% of these individuals have moderate-to-severe pain, especially after physical exertion, and the majority endure sleep disturbances, difficulties in performing everyday tasks, and compromised quality of life as a whole [3].

In order to reduce problems following thoracotomy, thoracic epidural blockade (TEB) with local anaesthetic and opioid medications has been largely considered as the analgesic gold standard. A reduced risk of lung collapse, pneumonia, and discomfort, as well as improved ventilatory mechanics, gas exchange, and early extubation, can occur from the analgesic effects of an epidural [3]. Nevertheless, proficient medical personnel are necessary to perform the insertion, removal, and administration of the continuous infusion of bupivacaine and opioid. Epidural insertion carries the following risks: unintentional dural puncture, unintentional high block, toxicity of the local anaesthetic, and total spinal anaesthesia (inadvertent spinal injection of a high epidural dose of local anaesthetic leading to depression of the cervical spinal cord and brainstem). Abscess, nerve damage, and epidural hematoma are uncommon yet severe consequences [4]. A thoracic epidural inhibits nerves bilaterally, and hypotension can arise from vasodilation and heart depression caused by sympathetic nerve block. It has been stated that failure rates range between 14 and 30 percent and are susceptible to the practitioner's abilities[4]. Patients who are contraindicated for epidurals include those who have a history of spinal surgery, local infection, blood clotting issues, or are currently undergoing anticoagulant and antiplatelet therapy [5].

In recent times, the utilisation of myofascial plane blocks, including the erector spinae plane block and serratus plane blocks, to administer postoperative analgesia during thoracotomies has generated considerable interest [5]. In theory, the ESP block may offer favourable analgesic properties at the thoracic level. However, it is important to note that it can also induce various adverse effects, especially when performed bilaterally. These include central

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sympathetic blockade, chest wall weakness, and an increased risk of falls during ambulation due to the potential for thoracic ESP block to migrate towards the paravertebral space (PVS) via the costotransverse foramina [6].

Recently described, continuous bilateral parascapular sub-iliocostalis plane (PSIP) block provides a safer profile for posterior rib fractures and thoracic spine surgery [6]. The local anaesthetic (LA) predominantly diffuses medially during the PSIP block due to the impediment posed by the iliocostalis muscle (ILCM) costal insertions, which restrict the LA's lateral dispersion and impede the dispersion of the rhomboid intercostal block [7]. Potentially, the effectiveness of the PSIP block could be contingent upon various methods of action: (1) The erector spinae muscle (ESM) exerts a direct influence via craniocaudal myofascial spread; (2) The proximal intercostal nerves are reached via deep layer spread; (3) The posterior and ventral spinal nerves are blocked via midline further medial spread through deeper layers; (4) The posterior spinal nerves are reached more reliably than with the rhomboid intercostal/sub-serratus [RISS] block; and (5) The sub-serratus (SS) plane is utilised for lateral spread in the sub-serratus (SS) plane to (TEA) [7].

In an effort to reduce the occurrence of PTPS, this study compared the safety and efficacy of ultrasound-guided PSIP block against TEA for postoperative analgesia in patients following elective thoracotomy.

METHODOLOGY

Design and population:

The research was designed as a randomized, prospective, interventional clinical trial and carried out at Benha University Hospital from April 2022 to April 2024. The participants in the study were adult patients aged 18 to 70 years scheduled for thoracotomy. The study had two parallel arms: one group received a parascapular sub- iliocostalis plane block, while the other group received a thoracic epidural catheter. The trial was single-blinded; the outcomes assessor was aware of the group assignment, but the practitioners and patients were not.

Eligibility for the study was limited to adults and older adults over 18 years of age, excluding healthy volunteers. Patients were included based on their American Society of Anesthesiologists Physical Status I, II, and III if scheduled for elective thoracotomy procedures such as lung resection, decortication, minimal invasive atrial septal defect repair, rib fracture fixation, and bilateral hydatid cyst repair.

Exclusion criteria were age below 18, obesity with a BMI exceeding 40 kg/m^2, coagulopathy, unwillingness to provide written consent, pregnancy, and a history of relevant medication allergy are all undesirable conditions.

Randomization and blindness:

Randomization was conducted using a computer-generated sequence number kept in sealed envelopes that were only opened in the operation room on the day of surgery. Depending on the envelope, patients received either a PSIP block or a thoracic epidural. The observing anesthesiologist in the postoperative period was blinded to group assignments.

Preoperative preparation:

A comprehensive history was obtained, physical examinations were performed, and investigations were conducted in accordance with the local protocol. These investigations encompassed the following: hepatic function tests, electrocardiogram (ECG), total blood count, blood sugar levels, serum urea and creatinine, coagulation profile (ABG), and, if necessary, respiratory function tests. Patients were informed of the pain rating on the visual analogue scale (VAS) **(Figure 1)** [8], varying between 0 (painless) to 10 cm (worst imaginable pain). After fasting for six hours, patients were taken to the operation theatre.

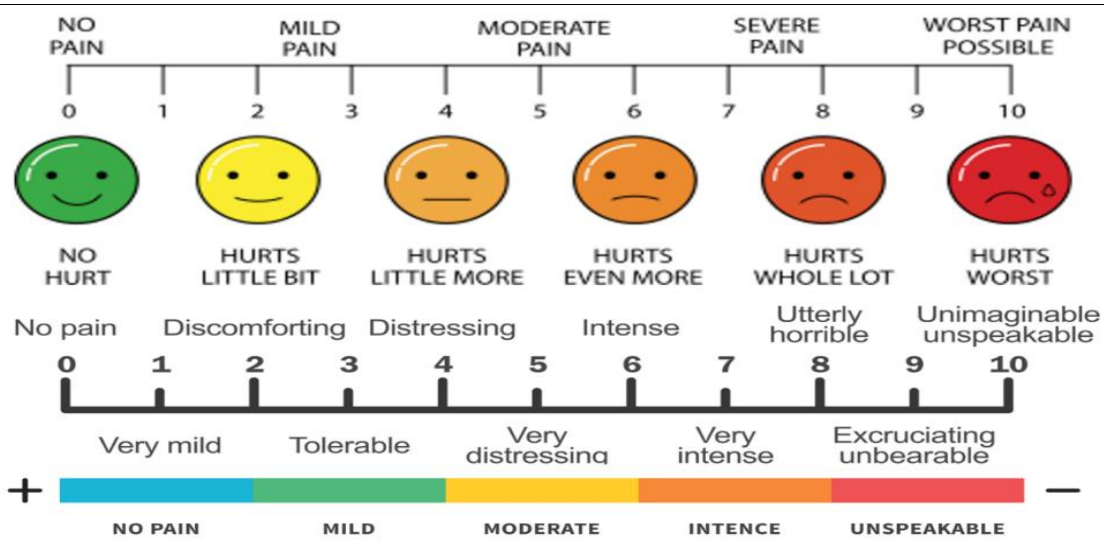

Figure 1: Visual analogue scale [8]

In the preoperative room, patients were placed in a semi-sitting position (30 to 45 degrees). Procedures included the insertion of a wide-bore IV line (14-16 gauges), administration of light premedication with midazolam (0.01-0.02 mg/kg), and oxygen supplementation (2-3 L/min via nasal cannula) to prevent hypoxemia after pre-medication. A pulse oximeter and non-invasive blood pressure cuff were connected to the patient. An arterial line was inserted based on the surgical and patient conditions, typically choosing the radial artery after performing Allen's test to assess the adequacy of collateral circulation and the absence of proximal obstructions. Throughout the procedure, various monitoring techniques were implemented, including invasive and non-invasive blood pressure monitoring, a 5-lead electrocardiogram, and arterial line-connected pressure-tubing-transducer systems flushed with heparinized saline for the latter (0.5-1 unit of heparin per ml of saline). The patient's finger was adorned with a pulse oximeter in order to measure oxygen saturation continually.

For group A:

While seated with her arms draped over her body, the patient underwent the PSIP block. A high frequency linear ultrasound probe was positioned in a parasagittal plane, at the level of the scapula spine edge, 2 cm from the medial scapular border, while maintaining strict aseptic conditions (fourth rib level). An examination of the trapezius, rhomboid major, iliocostalis, and intercostal muscles was conducted, encompassing both the superficial and deep layers of muscle tissue. By employing an in-plane method, a sonovisible 100 mm 18 G needle (Contiplex S ultra; B. Braun, Melsungen, Germany) was inserted in the vicinity of the fourth rib with a cranial to caudal orientation. The needle was then advanced in the iliocostal-intercostal myofascial plane. Following the confirmation of the needle's position with a 2 ml saline solution, a catheter was inserted 6 cm beyond the needle tip and tunnelled beneath the skin. 15 ml of 0.25 percent bupivacaine was injected at the conclusion of the procedure. Then, a perioperative elastomeric infusion of 0.125 percent bupivacaine was begun at a rate of 5 ml/h via the PSIP catheter and maintained for a duration of 48 hours.

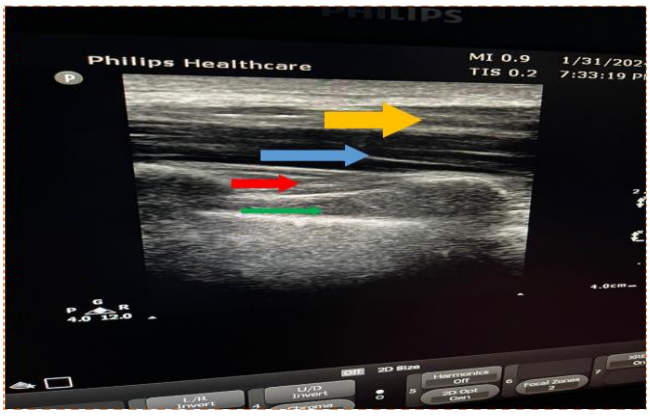

Figure 2: US of PSIP block yellow arrow for trapezius MS, blue arrow for rhomboid MS, red arrow for iliocostalis MS and green arrow for intercostal MS.

For group B:

Thoracic epidural (TEA): a thoracic epidural catheter is placed 3–4 cm into the T6/T7 gap using the loss of resistance to air approach in the preoperative holding area soon prior to surgery. To preclude the requirement for intravascular and intrathecal catheter placement, a test dose of 3 ml of preservative-free lidocaine containing 1.5 % epinephrine was delivered via catheter or needle-to-needle. A loading dosage of 15 ml of bupivacaine at a concentration of 0.25 % was systematically injected into the thoracic epidural catheter at the conclusion of the surgery, while blood pressure and heart rate were continuously monitored during the injection process. A 0.125 % bupivacaine infusion at a rate of 5 ml/h was then initiated and maintained for 48 hours postoperatively.

Every patient was pre-oxygenated with 100% O_2 for three minutes. Induce muscle relaxation anaesthesia with fentanyl 1.0 µg/kg, propofol 1.5-2 mg/kg, and atracurium 0.5 mg/kg. Controlled ventilation with oxygen and air (50:50) was utilised to maintain anaesthesia with an $EtCO_2$ target of 35–40 mmHg, isoflurane at a minimum alveolar concentration (MAC) of 1:1.5, and fentanyl at a rate of 0.5µg/kg was administered intraoperatively whenever the heart rate or NIBP recorded an increase of over 20 percent from the basal values. The discontinuation of anaesthesia and tracheal extubation occurred when the patient met the necessary conditions for extubation.

Postoperative care

Patients had a two-hour transfer to the post-anesthetic care unit (PACU) following the emergence of anaesthesia. Those patients who meet the discharge criteria as determined by a modified Aldrete score greater than nine were released from the PACU. The patients were administered analgesics in accordance with the local institutional policy. Paracetamol 1 gm IV infusion for 8 hours and ketorolac 30 mg IM for 12 hours constituted two components of the multimodal anaesthetic regimen intended to reduce postoperative pain. If the visual analogue pain scale (VAS) was greater than 4, postoperative rescue analgesia with intravenous morphine according to a titration protocol (3 mg morphine sulphate IV as a bolus dose that could be repeated every 5 minutes with a maximum dose of 15 mg per 4 hours or 45 mg per 24 hours) was administered.

The morphine titration protocol was terminated in the following circumstances: oxygen saturation below 95%, respiratory rate below 10 bpm, sedation as measured by the Ramsay sedation scale >2, acute adverse effects including severe pruritus (including pruritus, marked pruritus, excessive vomiting, and hypotension with a systolic blood pressure of 20% or

higher than baseline values), or when sufficient analgesia was achieved.

Outcome measures:

The major outcome measured by the VAS score is a horizontal 10 cm line, where a value of zero on the left side signifies no pain and 10 cm on the right side represents the most excruciating agony possible. Every 6 hours, when the patient was conscious enough to describe discomfort when at rest, deep breathing, and coughing, the VAS was assessed. Following the procedure, on a pain scale ranging from zero (indicating no pain) to ten (indicating terrible pain), all patients were administered normal paracetamol and morphine as rescue analgesia, as aforementioned, to maintain VAS scores below 3.

Hemodynamic parameters: postoperative heart rate and MAP measured at 0 minutes, 15 minutes, 30 minutes, 1 hour, and then every 2 hours for 48 hours; IV ephedrine 5-25 mg was used to treat hypotension. Consumption of pain rescue analgesics within the initial 48 hours, nausea, vomiting, urinary retention, pruritus, hypotension, and bradycardia were complications. The length of the patient's hospital stay from the initial day following the procedure to their discharge, including the duration of their time in the intensive care unit, was documented. Demographic information including age, weight, height, BMI, and operation time were also gathered.

Ethical considerations:

The study was done after being accepted by the Research Ethics Committee, Benha University (Approval number: MD.15-4-2022). All patients provided written informed consents prior to their enrolment. The consent form explicitly outlined their agreement to participate in the study and for the publication of data, ensuring protection of their confidentiality and privacy. This research was conducted in adherence to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for human subjects.

Statistical analysis

A comparison was made between the outcomes of the two groups utilizing version 20 of the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA). Mean and standard deviation were utilized to compare differences between groups of normally distributed parametric numerical data using Student's t-tests. For non-parametric data, U-test was employed to determine differences between groups. Categorical data were presented in the form of numbers and percentages, and Chi-Square test and Fisher exact test were employed to compare the groups. The results were deemed significant when p-value was < 0.05 and CI was set at 95%.

RESULTS

Demographic characteristics of the enrolled participants

With respect to the age, weight, and ASA status of the patients who were included, this research found no statistically significant differences between the two groups **(Table 1)**.

Table 1: Demographic characteristics of the studied groups

		Group I	Group II	*p*-value
Age (yrs.)		39.85±15.040	39.08±13.419	0.847
Weight (kg)		87.2308±12.14021	85.6923±7.86267	0.590
Sex	♂	18(69.23%)	10(38.46%)	0.091
	♀	8(30.77%)	16(61.54%)	
ASA	**I**	10(38.46%)	14(53.85%)	0.708
	II	14(53.85%)	12(46.15%)	
	III	2(7.69%)	0	

ASA: American Society of Anesthesiologists Classification.

Surgery type

A comparison of the two groups with respect to the type of operation revealed no statistically significant distinctions **(Table 2)**.

Table 2: Indication of surgery in both groups

		Group I	Group II
Diagnosis	**Lung resection**	16 (61.53%)	12 (46.15%)
	Decortication	8 (30.77%)	4 (15.38%)
	ASD repair	2 (7.69%)	0
	Diaphragmatic hernia repair	0	2 (7.69%)
	Bilateral lung hydatid cyst	0	2 (7.69%)
	Mediastinal mass resection	0	4 (15.38%)
	Rib fixation	0	2 (7.69%)

ASD: Atrial Septal Defect.

Pain rescue analgesia

By computing the cumulative morphine usage in milligrammes over the initial forty-eight hours following the procedure, we discovered a statistically significant disparity in favour of the thoracic epidural group, as illustrated in **Table 3** and **Figure 3.**

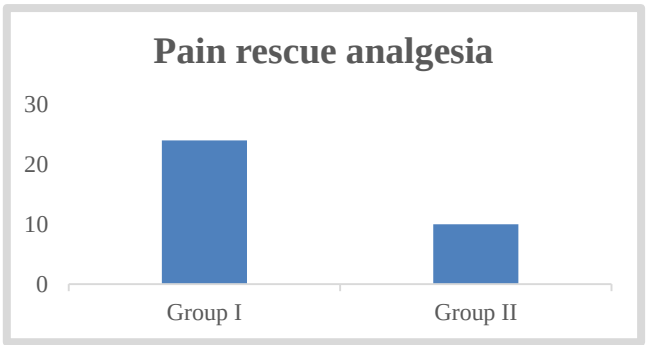

Figure 3: Pain rescue analgesia in the studied groups.

Hospital stay and ICU stay duration:

A comparison of two groups in terms of ICU length in days revealed substantial and statistically significant differences in favour of PSIP group **(Table 3; Figures 4 and 5)**.

Table 3: Comparison between both groups regarding hospital and ICU stay and supplementation of pain rescue analgesia

	Group I	Group II	
Hospital stays duration (Day)	4.54±1.174	4.23±0.710	0.258
ICU duration (Day)	1.31±0.618	2.00±0.693	<0.001*
Pain rescue analgesia	24 (92.31%)	10 (38.46%)	<0.001*

ICU: intensive care unit, *: Significant

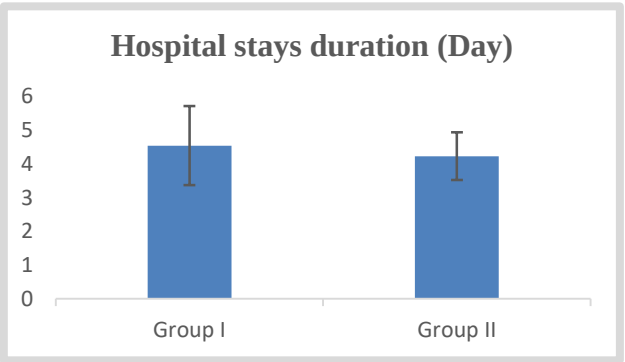

Figure 4: Hospital stay duration in the studied groups.

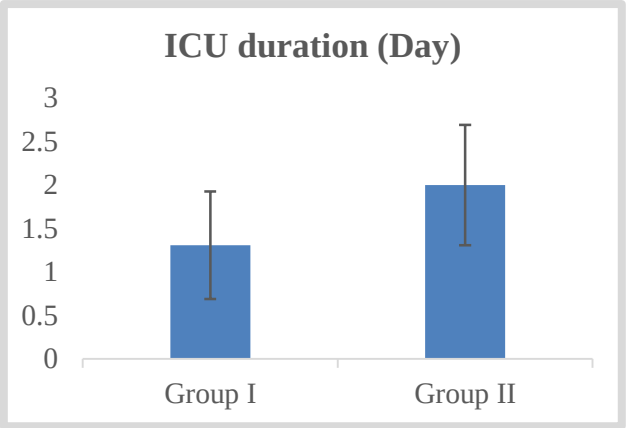

Figure 5: ICU stay duration in the studied groups

VAS score

We found no statistically significant differences between the two groups based on the VAS scores obtained (VAS) in both groups during the 48-hour postoperative period, which was monitored at zero time (on arrival to the ICU) and then every 6 hours. The epidural group exhibited a slight decrease in VAS. **Table 4 and Figure 6)**.

Table 4: VAS differences between both groups

	Group I	Group II	*p*-value
VAS 0	2.88±0.431	2.69±0.617	0.19
VAS 6 hrs.	2.65±0.689	2.35±0.846	0.15
VAS 12 hrs.	2.53±0.859	2.54±0.905	1
VAS 18 hrs.	2.61±0.697	2.462±0.989	0.51
VAS 24 hrs.	2.57±0.757	2.23±0.908	0.14
VAS 30 hrs.	2.19±0.694	2.15±0.881	0.86
VAS 36 hrs.	2.15±0.784	2±0.848	0.5
VAS 42 hrs.	2.31±0.736	1.92±0.891	0.95
VAS 48 hrs.	2.19±0.694	1.88±0.711	0.12

VAS: Visual Analogue Scale.

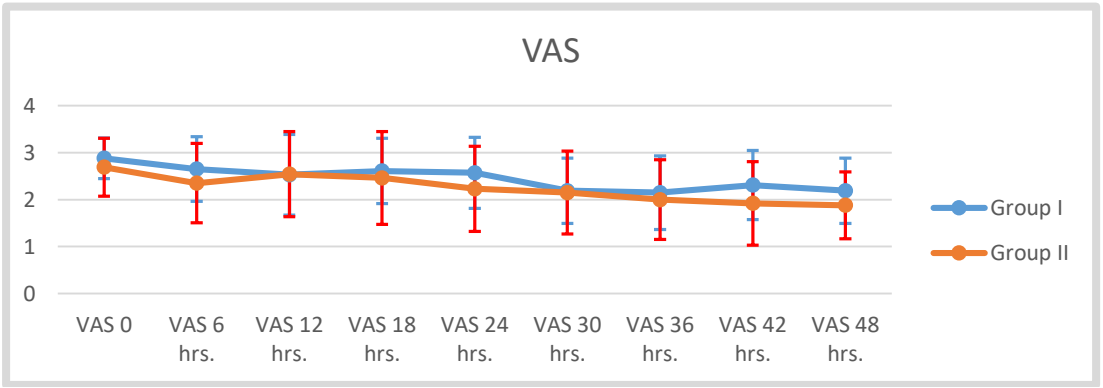

Figure 6: VAS differences between both groups.

Side effects of opioid usage and block technique

The PSIP group exhibited a substantial rise in the incidence of adverse effects associated with opioid use, according to the findings of this study. Four patients in the PSIP group had nausea, whereas no patients in the thoracic epidural block group reported such symptoms. Hypotension, defined as a systolic pressure below 90 mmHg, was documented in 14 patients receiving thoracic epidurals and in no patients receiving PSIP **(Table 5)**.

Table 5: Side effects of opioids and hypotension in the studied groups

		Group I	Group II
Complications	**No**	22 (84.62%)	12 (46.15%)
	Nasua and vomiting	4 (15.38%)	0
	Hypotension	0	14(53.85%)

In relation to the occurrence of hemodynamic alterations caused by the block, a notable distinction existed between the two cohorts regarding MAP **(Table 6 and Figure 7)**.

Table 6: Comparison of MAP values between the studied groups

	Group I	Group II	*p*-value
MAP 0	97.08±14.802	88.69±9.494	0.019*
MAP 30 min	96.31±13.353	85.92±11.045	0.004*
MAP 2 hrs.	94.69±12.161	82.46±11.486	<0.001*
MAP 4 hrs.	93.38±10.782	82.08±10.334	<0.001*
MAP 6 hrs.	90.46±9.403	80.23±12.206	0.001*
MAP 8 hrs.	90.62±9.604	81.31±8.712	0.001*
MAP 10 hrs.	93.15±7.007	79.62±6.992	<0.001*
MAP 12 hrs.	91.45±6.370	80.46±1.44	<0.001*
MAP 14 hrs.	91.62±8.015	82.46±7.966	<0.001*
MAP 16 hrs.	91.85±5.626	82.69±8.730	<0.001*
MAP 18 hrs.	91.69±5.643	83.15±6.025	<0.001*
MAP 20 hrs.	91.08±4.890	81.15±7.406	<0.001*
MAP 22 hrs.	92.77±4.493	82.77±7.570	<0.001*
MAP 24 hrs.	89.85±6.195	83.15±6.727	<0.001*
MAP 28 hrs.	92.08±5.844	84.46±5.132	<0.001*
MAP 32 hrs.	91.77±3.881	85.69±7.304	<0.001*
MAP 36 hrs.	92.46±6.819	83.38±6.530	<0.001*
MAP 40 hrs.	93.38±6.306	85.46±6.866	<0.001*
MAP 44 hrs.	90.77±6.147	87.31±5.548	0.038*
MAP 48 hrs.	91.15±3.813	86.85±2.767	<0.001*

MAP: Mean arterial pressure, *: Significant.

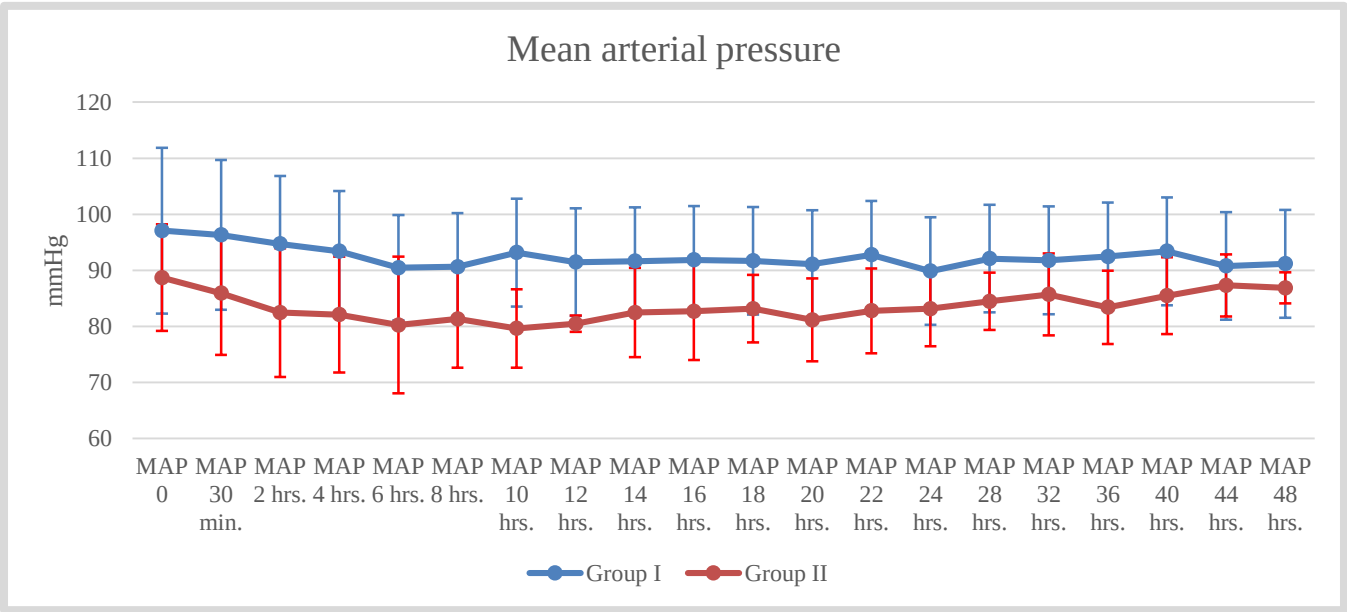

Figure 7: Comparison of MAP values between the studied groups

As regarding heart rate there were generally insignificant difference in both groups **(Table 7** and **Figure 8)**.

Table 7: Comparison of Heart rate values between the studied groups

	Group I	Group II	*p*-value
HR 0	84.69±13.117	78.54±13.306	0.099
HR 30 min.	83.85±11.291	75.23±13.706	0.017*
HR 2 hrs.	81.08±9.247	76.77±9.717	0.108
HR 4 hrs.	80.31±9.452	76.54±8.696	0.141
HR 6 hrs.	75.69±9.570	73.85±9.490	0.488
HR 8 hrs.	76.15±9.649	74.69±8.885	0.572
HR 10 hrs.	76.15±10.851	72.77±7.506	0.197
HR 12 hrs.	73.77±9.210	71.08±9.883	0.314
HR 14 hrs.	74.54±9.188	79.92±9.099	0.039*
HR 16 hrs.	72.08±8.270	74.38±6.888	0.280
HR 18 hrs.	73.38±5.900	72.92±6.151	0.784
HR 20 hrs.	74.46±5.132	73.31±6.137	0.466
HR 22 hrs.	73.62±5.940	72.15±5.808	0.374
HR 24 hrs.	72.92±6.046	69.69±6.602	0.072
HR 28 hrs.	72.69±4.371	69.46±5.995	0.031*
HR 32 hrs.	71.08±5.477	70.85±5.555	0.881
HR 36 hrs.	73.15±7.309	69.38±4.759	0.032*
HR 40 hrs.	74.23±5.294	71.46±3.992	0.038*
HR 44 hrs.	74.31±6.479	72.08±6.493	0.221
HR 48 hrs.	72.38±7.060	69.38±4.708	0.077

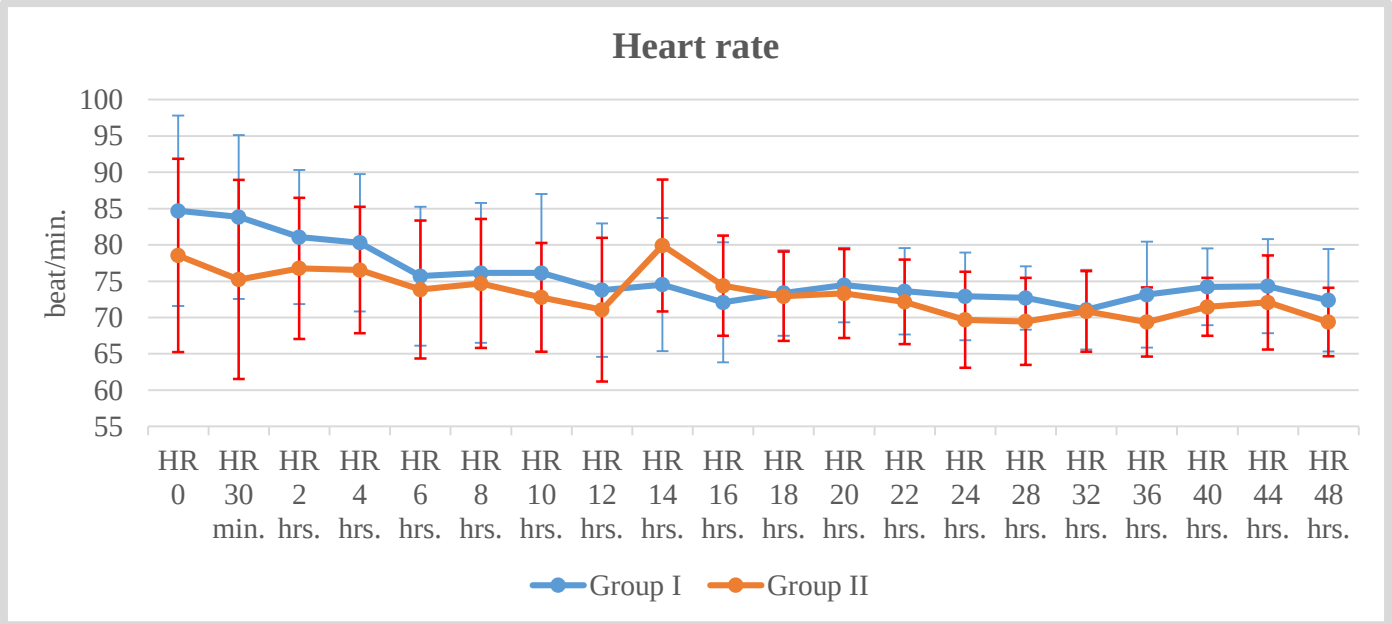

Figure 8: Heart rate.

DISCUSSION

The current work compared TEA as the gold standard thoracic analgesic approach with an innovative, effective, locoregional, thoracic analgesic procedure "PSIP" in controlling acute post thoracotomy pain. It showed that VAS values at both rest and movement were of near results in both groups with slight preference toward thoracic epidural group.

For a long time, TEA was considered the gold standard for thoracotomy pain. Yet, TEA problems like a technical failure are high (30%), sympathectomy-associated hemodynamic liability, opioid-induced nausea, vomiting, pruritis, urinary retention, and respiratory depression, and besides risks of epidural hematoma or abscesses are also recorded.

Severe postoperative pain continues to be a prevalent, yet underappreciated concern. Notwithstanding recent advancements in pain management, a considerable number of individuals continue to endure postoperative pain that ranges from moderate to severe, according to lengthy investigations. There is a correlation between severe pain and the following adverse outcomes: lower patient satisfaction, delayed postoperative ambulation, persistent postoperative pain, an elevated risk of pulmonary and cardiac problems, and increased morbidity and death. Consequently, identifying surgical procedures that induce extreme pain and the most effective analgesic methods for these procedures is critical. In this surgical group, acute pain treatment following thoracotomy and prevention of persistent post-thoracotomy pain syndrome (PTPS) continue to be important obstacles. Although initial thoracotomy pain that is treated adequately frequently fades, a considerable proportion of patients develop post-traumatic pain syndrome (PTPS), with as many as 65% feeling discomfort and 10% enduring terrible, life-altering pain [9].

Traditional regional anaesthesia techniques, including thoracic paravertebral blockade and thoracic epidural analgesia, are frequently employed and regarded as the method of choice for analgesia owing to their efficacy. However, these methods are not without their drawbacks, including hemodynamic complications, the risk of bleeding and hematoma formation, and the complexity of the block [10].

In contrast, the PSIP block concentrates on a myofascial plane situated in the space between the intercostal muscle and the erector spine muscles (Iliocostalis). The needle maintains a safe distance from the neuroaxis, major blood arteries, distinct plexi or nerves, and does not penetrate the paravertebral region [6].

The necessity to identify a safer and more straightforward alternative to PVB blocks stems from the potential for complications, including pneumothorax and other neurological side effects, that PVB blocks entail, as well as the heightened expertise required to learn and execute. Depending on the level of the injection site, ultrasound-guided PSIP block is a myofascial plane block that delivers analgesia for thoracic segmental innervation [6].

In theory, ESP blocks may offer favourable analgesic properties at the thoracic level. However, when implemented bilaterally, these blocks may also induce a number of undesirable side effects, including central sympathetic blockade, chest wall weakness, and an increased risk of falling while walking. This is due to the fact that thoracic ESP blocks can easily spread to the paravertebral space (PVS) via the costotransverse foramina [11]. After an ESP block, circumferential epidural dissemination of LA has been reported, which can exacerbate cardiac status in high-risk patients [12].

The potential efficacy of the PSIP block could be influenced by many mechanisms of action. (1) Localised effect at the site of the fracture via craniocaudal myofascial spread beneath the erector spine muscle (ESM); (2) Propagation to deep layers via tissue disruption induced by trauma, resulting in the involvement of the proximal intercostal nerves; (3) Medial spread inferior to the ESM, extending to the posterior spinal nerves; and (4) Lateral spread in the sub-serratus (SS) plane, supplying the lateral cutaneous branches of the intercostal nerves—all while minimising substantial adverse hemodynamic impacts [7].

Due to its lateral injection site, the PSIP block may induce fewer epidural-like effects than the ESP block. This reduces the likelihood of major epidural/paravertebral spread or bilateral block. Conversely, intracranial pressure may be affected by epidural distribution of LA epidurally, accidental dural puncture, or direct epidural injection when an ESP or PVB are utilised [11].

In our study we found that thoracic epidural is still considered as the gold standard analgesic for thoracotomy operations but in comparison with it, PSIP is considered a good modality for pain control for thoracotomy operations, beside regarding complications due to sympathectomy associated with epidural injection were NIL in PSIP block group and also less duration of ICU stays. Also, the use of pain rescue analgesia like ketolac, paracetamol and morphine were significant in the PSIP group, but complications after injection like hypotension and prolonged ICU stay were significant in thoracic epidural group. Alternative regional anaesthetics, such as PSIP, ought to be contemplated when a thoracic epidural is contraindicated, in order to implement an efficacious pain management approach.

There are some drawbacks to this study. Initially, the sample size was limited to a small number of patients, thereby compromising the statistical precision. Secondly, this research was conducted at a single institute and lacked randomization. Also, available studies for using parascapular sub-iliocostalis plane block for postoperative analgesia were limited.

CONCLUSIONS

PSIP is considered as a good modality for postoperative analgesia in thoracotomy operation comparable to thoracic epidural, which is considered the gold standard for pain management especially in bilateral thoracotomy operations (in case of bilateral hydatid cysts for bilateral thoracotomies), as thoracic epidural has a single puncture and less risk for infection, less failure rate, decreasing risk of local anesthetic systemic toxicity (single site injection). in the other hand, due to sympathetic block associated with epidural injection hypotension was significant in this group so, some patients cannot withstand this hemodynamic instability (ischemic heart disease). So, the use of parascapular sub-iliocostalis block as a new approach for analgesia for thoracotomies achieved patient satisfaction regarding pain severity and also was not associated with hemodynamic instability compared with epidural.

RECOMMENDATIONS

We recommend the use of PSIP block for thoracotomy surgery, as it can be performed simply and quickly with easily identified ultrasound landmarks especially in patients with contraindications for epidural insertion or cannot withstand hemodynamic instability associated with epidural dosage. We recommend further randomized controlled trials on a large number of patients and comparing variable interfacial plane blocks for thoracotomy surgery with each other in the future.

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REFERENCES

1. **Batchelor T, Rasburn N, Abdelnour-Berchtold E *et al.* (2019)**: Guidelines for enhanced recovery after lung surgery: recommendations of the Enhanced Recovery After Surgery (ERAS®) Society and the European Society of Thoracic Surgeons (ESTS). Eur J Cardiothorac Surg., 55:91-115.
2. **Yeung J, Gates S, Naidu B *et al.* (2016)**: Paravertebral block versus thoracic epidural for patients undergoing thoracotomy. Cochrane Database Syst Rev., 2:Cd009121.
3. **Zengin M, Alagoz A (2021)**: Comparison of thoracic epidural analgesia and thoracic paravertebral block applications in the treatment of acute pain after thoracotomy in geriatric patients. Cureus, 13:e18982.
4. **Sztain J, Gabriel R, Said E (2019)**: Thoracic epidurals are associated with decreased opioid consumption compared to surgical infiltration of liposomal bupivacaine following video-assisted thoracoscopic surgery for lobectomy: A Retrospective Cohort Analysis. J Cardiothorac Vasc Anesth., 33:694-8.
5. **Finnerty D, McMahon A, McNamara J *et al.* (2020)**: Comparing erector spinae plane block with serratus anterior plane block for minimally invasive thoracic surgery: a randomised clinical trial. Br J Anaesth., 125:802-10.
6. **Almeida C (2021)**: Parascapular sub-iliocostalis plane block: Comparative description of a novel technique for posterior rib fractures. Pain Pract., 21:708-14.
7. **Almeida C, Vieira L, Alves B *et al.* (2023)**: The ultimate technique for posterior rib fractures: the parascapular sub-iliocostalis plane block - A series of cases. Revista Española de Anestesiología y Reanimación (English Edition), 70:477-82.
8. **Delgado DA, Lambert BS, Boutris N *et al.* (2018)**: Validation of digital visual analog scale pain scoring with a traditional paper-based visual analog scale in adults. J Am Acad Orthop Surg Glob Res Rev., 2:e088.
9. **Gupta R, Van de Ven T, Pyati S (2020)**: Post-thoracotomy pain: Current strategies for prevention and treatment. Drugs, 80:1677-84.
10. **Kietaibl S, Ferrandis R, Godier A *et al.* (2022)**: Regional anaesthesia in patients on antithrombotic drugs: Joint ESAIC/ESRA guidelines. Eur J Anaesthesiol., 39:100-32.
11. **Almeida C, Oliveira A, Cunha P (2019)**: Continuous bilateral erector of spine plane block at T8 for extensive lumbar spine fusion surgery: Case report. Pain Pract., 19:536-40.
12. **Tulgar S, Selvi O, Ahiskalioglu A *et al.* (2019)**: Can unilateral erector spinae plane block result in bilateral sensory blockade? Can J Anaesth., 66:1001-2.