

# Analgesia and Safety of Perioperative Bilateral Erector Spinae Infusion versus Thoracic Epidural Infusion in Upper Abdominal Oncological Surgeries: A Randomized Clinical Trial

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## Abstract

**Objective:** Erector spinae plane block is a novel regional anaesthetic intervention that is said to have an effective analgesic profile in the upper abdominal region. We compared its analgesic efficacy with thoracic epidural block for upper abdominal cancer surgeries. **Methods:** This prospective study included 60 patients, 18 to 65 years old with ASA class II who underwent gastrectomy and Whipple's procedures under general anesthesia. Patients were assigned into two groups: **Thoracic epidural group**, with injection of 0.1 ml/kg of bupivacaine 0.25% in epidural catheter followed by 0.1 ml/kg/h of 0.125% bupivacaine infusion for 48 hrs., and **Erector spinae group**, with insertion of bilateral erector spinae catheters to inject 0.1 ml/kg of bupivacaine 0.25% followed by bilateral infusion of 0.1 ml/kg/h of bupivacaine 0.125% for 48 hrs. The primary endpoint was postoperative VAS scores at rest and movement. Secondary endpoint included postoperative total opioid consumption, 1<sup>st</sup> request for analgesia, hemodynamic changes and satisfaction scores. **Results:** Pain scores and needed rescue analgesia in both groups were comparable. However, 1<sup>st</sup> request for opioid was significantly longer in TEPI compared to ESI group. Hemodynamics were significantly lower in TEPI group with no differences in the incidence of postoperative complications except for hypotension. Patient satisfaction scores were arbitrarily higher in ESI group without significance. **Conclusion:** Erector spinae infusion is a highly promising regional technique with comparable effects to thoracic epidural blockade in

reducing pain and opioid needs while causing minimal hemodynamic consequences.

## Keywords

Erector Spinae, Abdominal Cancer Surgeries, Thoracic Epidural

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## 1. Introduction

Following abdominal surgery, pain is usually somatic or visceral. Somatic pain from the anterior abdominal wall accounts for 70% - 75% of the pain and often lasts 72 hours following open surgery. Visceral pain lasts 24 - 36 hours and is intense yet transient. Optimal management of pain following surgery is imperative. Opioids are still the go-to medication for treating visceral pain, but they are inefficient against somatic discomfort. So, enhanced recovery after abdominal surgery is acknowledged to be contingent upon optimal dynamic analgesia [1].

Inadequate pain relief following surgery can increase mortality and morbidity [2]; therefore, providing enough analgesia can minimize morbidity, hospital time, and healthcare costs [3]. When opioids are taken exclusively to treat pain, they might produce nausea, vomiting, pruritus, and respiratory depression [4]. Therefore, regional techniques, such as Thoracic Epidural Analgesia (TEA), can enhance postoperative pain management and results through mitigating opioids. However, high volumes of LA may be administered via thoracic epidural catheter to relieve lumbar pain, which increases the risk of hemodynamic fluctuations and has been linked to urine retention, lower limb weakness, potential spinal cord injury, difficulty breathing, dural puncture, and headache after a dural puncture [5].

Several strategies have been attempted to substitute the pain-relieving effects of TEA. They are trans-muscular quadratus lumborum (TQL) block, rectus sheath analgesia (RS), transversus abdominis plane block (TAP), and wound infusion analgesia (WI) [6] [7]. Yet, all of these approaches have limitations that keep them from becoming the preferred analgesic technique for all open abdominal procedures [8].

Forero *et al.* (2016) first reported the erector spinae plane block (ESPB) as a therapy for thoracic neuropathic pain [9]. It is an avascular plane block. Thus, it seems to be safe in patients with coagulopathies [10], and has fewer procedural difficulties than epidural or paravertebral blocks because the injection site is isolated from the nerve tissues and pleura [11] [12]. This block reduces LA absorption, lowering plasma drug volume and slowly increasing it, extending LA's duration of action [13] [14]. With distinct needle insertion and LA injection endpoints and sonographic landmarks, it is easy to conduct [15].

ESPB has been used with great success in both thoracic and abdominal procedures, offering somatic and visceral analgesia [15] [16]. It can produce sensory blockade in the distribution area between T2-T4 and L1-L2 [16]. It is seen to be

theoretically easier, even if it can provide a block similar to the paravertebral block, providing that the needle is positioned away from the pleura, with a lower chance of pneumothorax [13].

Our study aimed to assess the perioperative efficacy of erector spinae infusion analgesia vs thoracic epidural infusion analgesia in major upper abdominal cancer procedures.

## 2. Materials and Methods

This randomized, double-blinded, controlled study was conducted at South Egypt Cancer Institute, Assiut University, Assiut, Egypt, on 60 patients with upper abdominal cancers, mostly gastric and pancreatic, aged 18 - 65, ASA class II, BMI 20 - 40 kg/m<sup>2</sup>, and scheduled for open gastrectomy or Whipple's surgeries under general anesthesia from February 2021 to November 2023. This study was registered at [clinicaltrials.gov](https://clinicaltrials.gov/ct2/show/NCT04776109) under unique NCT Number NCT04776109 in February 2021 (<https://clinicaltrials.gov/ct2/show/NCT04776109>). After institutional review board approval (IRB No: 521), patients supplied informed written consent and enrollment started on 25 February 2021.

However, patients with ASA physical status > II, who refused consent, body mass index > 40 kg/m<sup>2</sup>, local infection near injection sites, coagulopathy, previous abdominal surgeries, hypersensitivity to used drugs, chronic opioid use, and pregnant women were excluded from our study. Using a computer-generated database with random numbers in a 1:1 ratio, patients were randomly assigned to two groups, each represented by an inaccessible, secured envelope: Group I (n = 30) received continuous thoracic epidural infusion [TEPI] at T7-8 level, and Group II (n = 30) received US-guided continuous bilateral erector spinae infusions [ESI] at T8 level. A history, physical examination, and standard laboratory tests were performed on each patient.

In the operating room, standard ASA monitoring probes were attached, IV 18G cannulas were inserted, and 10 - 15 ml/kg of lactated Ringer solution was infused. Then, depending on the group, catheters were inserted aseptically as follows:

**Group I [TEPI]:** After skin sterilization, the patient was seated and an epidural needle was installed at T7-8 utilizing a paramedian approach and catheter was introduced. An aspiration test and a 2 ml test dose of lidocaine 2% with adrenaline at 1:200,000 confirmed catheter placement. Before skin incision, the catheter received a 0.1 ml/kg bolus of bupivacaine 0.25%, and an intraoperative and postoperative 0.1 ml/kg/h infusion was continued for 48 hrs.

**Group II [ESI]:** After seating and sterilizing the skin, T8 was measured by counting down from the lower scapula or ultrasonography. The back muscles were then identified using a linear high frequency ultrasound transducer (Sono Site MW, Bothell, WA, USA), positioned in a parasagittal longitudinal orientation 2 cm lateral to the midline. Transverse processes with shimmering pleura are landmarks. Then, muscles appear as the erector-spinae below, the trapezius above, and rhomboid major in the middle. Afterward, 2 - 3 ml of 2% lidocaine was injected.

A 16-G, 8-cm Tuohy needle (Portex; Smiths Medical International Ltd, Kent, UK) was placed in plane with the ultrasound beam and aimed toward the transverse process as it passed beneath the erector spinae muscle's anterior fascia. Injectate spread beneath the ES muscle and raised the transverse process. As indicated in **Pictures 1-3**, a catheter (Portex; Smiths Medical International Ltd.) was placed beneath the ES muscle and attached. This was repeated on the other side. Each catheter received a 0.1 ml/kg bolus of bupivacaine 0.25% before skin incision followed by an intra- and post-operative infusion of 0.1 ml/kg/h bupivacaine 0.125% continuously for 48 hrs.



**Picture 1.** U.S. view (1) of a catheter inserted in erector spinae space after injection of LA to open the space.



**Picture 2.** U.S. view (2) of a catheter inserted in erector spinae space after injection of LA to open the space.



**Picture 3.** View of bilateral erector spinae catheters inserted at T8 level.

### 3. General Anesthesia

Anesthesia induction was done using intravenous propofol (2 mg/kg) and fentanyl (2 µg/kg) after a 5-minute pre-oxygenation period, followed by tracheal intubation after neuro-muscular inhibition with rocuronium 0.6 mg/kg. It was maintained with sevoflurane 1 - 1.5 MAC and rocuronium 0.15 mg/kg muscle relaxant. Mechanical ventilation maintained the end-tidal CO<sub>2</sub> at 35 - 40 mmHg. Inspired oxygen fraction (FIO<sub>2</sub>) was 0.5 for oxygen-air combinations. We injected 0.1 ml/kg of bupivacaine 0.25% into epidural or erector spinae catheters before skin incision, depending on patient group. Sugammadex 2 mg/kg was given to patients to antagonize neuromuscular blockade after surgery, and they were extubated if they met extubation criteria. When MBP is below 20% of baseline, we used IV fluids and vasopressor according to body weight. Bradycardia—a heart rate below 60 beats per minute—was treated with atropine 0.01 mg/kg.

All patients with VAS scores > 3 received IV morphine at 1 mg/ml via PCA for 48 hours after surgery. A 15-minute lockout gap and no background infusion were used to administer 3 ml of morphine per press on demand.

This study's primary outcome was 48-hour postoperative VAS scores at rest and movement, and secondary outcomes involved total morphine consumption, first request of analgesia, intra and postoperative hemodynamic variables (mean BP, heart rate), patient satisfaction with 48-hour postoperative analgesia, and side effects (hypotension, bradycardia, itching, postoperative nausea and vomiting (PONV), back pain, pneumothorax, vascular injury, neural injury, and hematoma).

Study data were taken intraoperatively. Heart rate and mean blood pressure

were recorded every 5-minute and at 30-minute intervals, then postoperative monitoring of vital signs (HR, non-invasive MBP), VAS scores (pain intensity at rest and during movement for the first 48 hours post-surgery), first request for rescue analgesia (IV morphine), number of morphine doses needed and total morphine consumption and side effects continued at PACU and our ICU for 48 hours and documented. Patient satisfaction was measured using [Likert's scale] (1 = poor. 2 = fair. 3 = good. 4 = very good). PONV was assessed using 3 points scale (1 = mild, 2 = moderate, 3 = severe) and patient received 4 mg of ondansetron once needed.

#### 4. Statistical Analysis

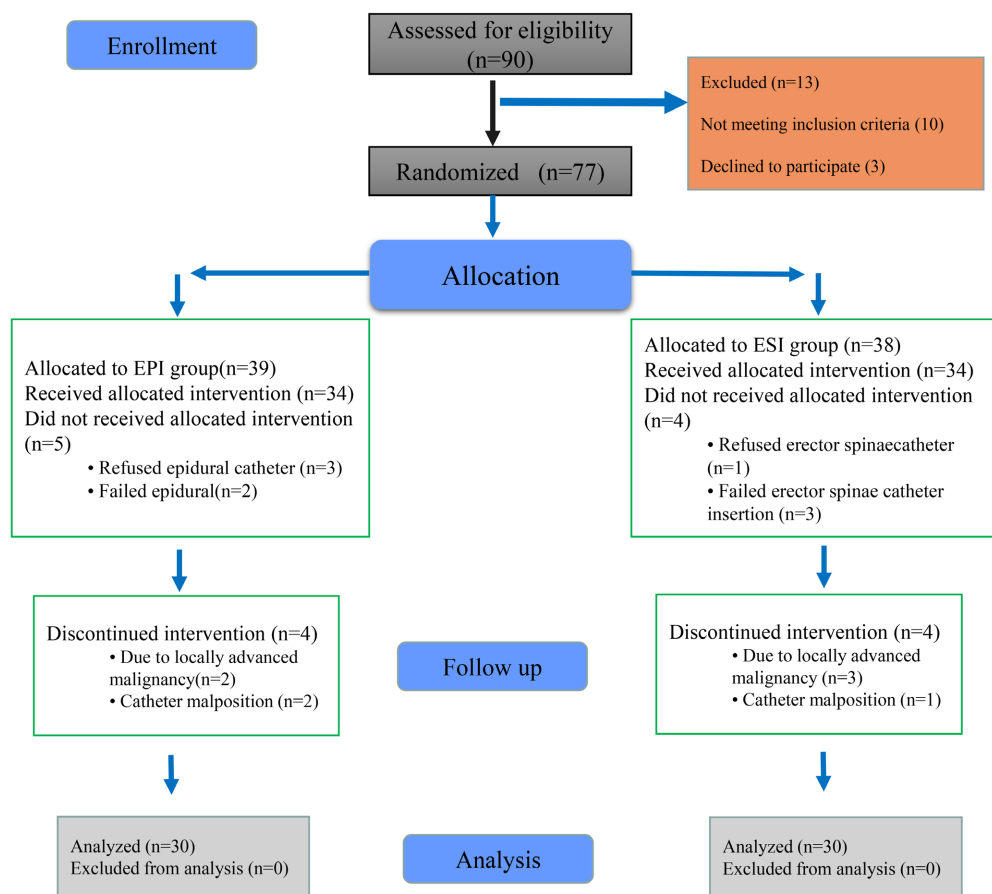
Data was analyzed using SPSS® 26.0 for Windows. Frequency and percentage were utilized for qualitative data, while mean  $\pm$  SD was used for quantitative data after Shapiro-Wilk test for normality. Chi-square/Fisher Exact was used to compare the proportions of the TE catheter and the ES catheter. To compare group's mean differences, the Independent Sample T test was utilized. ANOVA using one-way repeated measures compares each group's mean difference over time. Multiple two-way measurements ANOVA was used to compare temporal effects for ES and TE catheters. Significance was determined by a P value below 0.05.

#### 5. Results

Seventy-seven of ninety patients scheduled for major upper abdominal cancer surgeries, mostly gastrectomy and Whipple's surgeries, were eligible and enrolled in the study. Thirteen patients were excluded; three declined to participate, and ten did not meet the inclusion criteria. Then, 39 cases were randomly assigned to TEPI and 38 to ESI. After allocation, nine cases were eliminated from the TEPI group: two with locally advanced cancer, three refused the epidural catheter, two experienced failure of insertion, and the remaining two discontinued the intervention with subcutaneous epidural catheter migration. While in ESI group, eight cases were excluded; four did not receive the allocated intervention because one declined the erector spinae catheter, and three had catheter insertion failure. The other four discontinued the intervention: one due to catheter malposition and three due to locally advanced cancer. Sixty patients (30 per group) were left for analysis. (**Figure 1**)

Participants' demographics were not statistically different across groups. Most patients were in the ASA class II classification. Also, there was no significant difference between both groups regarding time of anesthesia (including analgesic block time) and surgery ( $P = 0.067$  &  $0.057$ ) respectively. (**Table 1**)

Perioperative hemodynamics showed that TEPI group, compared to ESI group, exhibited a higher statistically significant drop in mean BP from preoperative loading dose injection and throughout the surgical period till 48 postoperative hrs. ( $P$ -value  $< 0.001$ ) with significant changes in mean BP within groups overall operative time ( $P$  value  $< 0.001$ ,  $0.036$ ) respectively. (**Figure 2**)

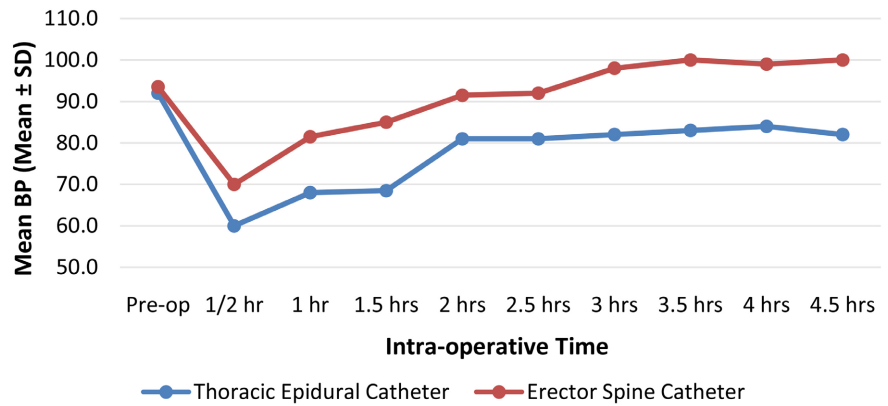


**Figure 1.** CONSORT flow chart of the participants.

**Table 1.** Clinical data of patients in the studied groups.

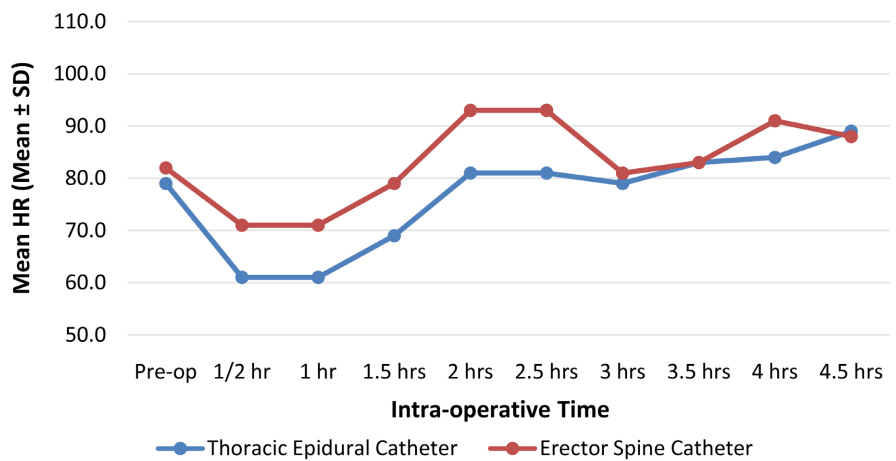
Variables	TEPI (n = 30)	ESI (n = 30)	P-value
<b>Age (years)</b>			
▪ Mean ± SD	57.37 ± 3.94	56.67 ± 4.75	0.537 <sup>a</sup>
<b>Gender</b>			
▪ Male	15 (50.0%)	19 (63.3%)	0.297 <sup>#</sup>
▪ Female	15 (50.0%)	11 (36.7%)	
<b>ASA class</b>			
▪ II	11 (36.6%)	12 (40%)	0.492 <sup>#</sup>
▪ III	19 (63.3%)	18 (60%)	
<b>BMI (Mean ± SD)</b>	24.86 ± 5.71	25.48 ± 3.78	0.619 <sup>a</sup>
<b>Time of Anesthesia (hours)</b>			
Median (Range)	3.30 (2.30 - 5.00)	3.73 (2.30 - 5.00)	0.067
<b>Time of Surgery (hours)</b>			
Median (Range)	3.00 (2.00 - 4.45)	3.08 (2.00 - 4.45)	0.057

Data were expressed as mean ± SD, frequency (%) or Median (Range); <sup>a</sup>Independent Sample T-test was used to compare mean difference between groups; <sup>#</sup>Chi-square/Fisher exact test was used to compare the proportion difference between groups.



**Figure 2.** Showing intraoperative MBP of studied groups.

Intraoperative HR in TEPI Group patients was statistically significantly lower than that of ESI Group for 2.5 hours after block injection, with a P value < 0.001. However, there were no significant differences in heart rates at baseline, 3-, 3.5-, 4-, and 4.5-intraoperative hours (P values = 0.060, 0.639, 0.918, 0.150, and 0.550 respectively). Also, HR was not statistically different between groups up to 48 hrs. postoperatively, P level > 0.05, and neither group's HR changed significantly from preoperative to 48 hours postoperatively (P = 0.058). (**Figure 3**)



**Figure 3.** Showing intraoperative HR of studied groups.

The main endpoint, postoperative pain scores (VAS), showed no statistically significant differences at rest between both groups from preoperative to 48 hrs. postoperatively (P value > 0.05). (**Figure 4**) Also, both groups had similar vas scores at movement from preoperative to 48 hours postoperatively (P value = 0.364). (**Figure 5**)

After surgery, the TEPI group had a lower mean total morphine consumption compared to the ESI group ( $5.63 \pm 2.50$  mg vs  $6.55 \pm 1.81$  mg), but the difference was not statistically significant (P value = 0.364). Also, it had lower mean morphine doses than ESI group ( $1.88 \pm 0.83$  vs  $2.18 \pm 0.60$  doses), although this was

not statistically significant ( $P$  value = 0.364). The percentage of patients who needed analgesia was 26.7% with TEI and 36.7% for ESI, with  $P = 0.405$ . Although the ESI Group requested rescue analgesia earlier than the EPI Group ( $20.55 \pm 1.36$  vs.  $23.88 \pm 2.85$  hrs. ( $P$  value = 0.003), the clinical difference was not significant. (Table 2)

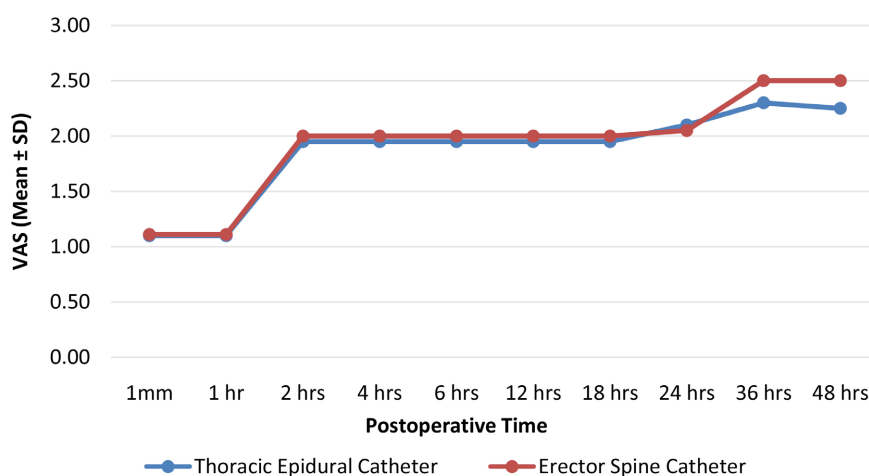


Figure 4. VAS-R (during rest) overtime among studied groups.

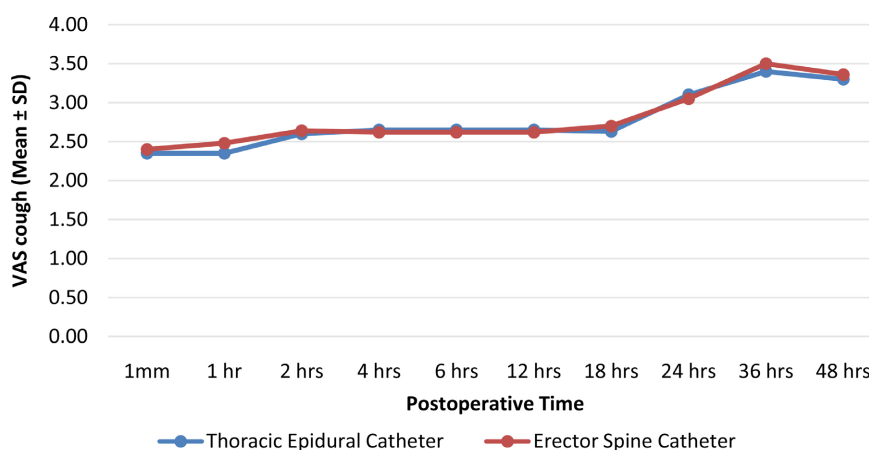


Figure 5. VAS-M (during movement) overtime among studied groups.

Table 2. Analgesic requirements in the studied groups.

	TEPI (n = 30)	ESI (n = 30)	P-value
Number of Patients need analgesia	8 (26.7%)	11 (36.7%)	0.405 <sup>#</sup>
Time of first request for analgesia	23.88 ± 2.85	20.55 ± 1.36	0.003 <sup>a</sup>
Total number of morphine doses	1.88 ± 0.83	2.18 ± 0.60	0.364 <sup>a</sup>
Total morphine consumption (mg)	5.63 ± 2.50	6.55 ± 1.81	0.364 <sup>a</sup>

Data were expressed as mean ± SD, or frequency (%); <sup>a</sup>Independent Sample T-test was used to compare mean difference between groups; <sup>#</sup>Chi-square/Fisher exact test was used to compare the proportion difference between groups.

Postoperative hemodynamics showed statistically significant decrease in mean BP in TEPI group in comparison to ESI group up to 48 hr. postoperatively (P value < 0.05), with statistically significant changes in mean BP within groups over postoperative times (P value < 0.001 & 0.023 respectively). (Figure 6) Regarding postoperative HR, it showed no statistically significant differences between TEPI and ESI groups at each time from preoperative to 48 hrs. postoperative, P value > 0.05, and there were no statistically significant changes in both groups' HR overtime (P value = 0.058). (Figure 7)

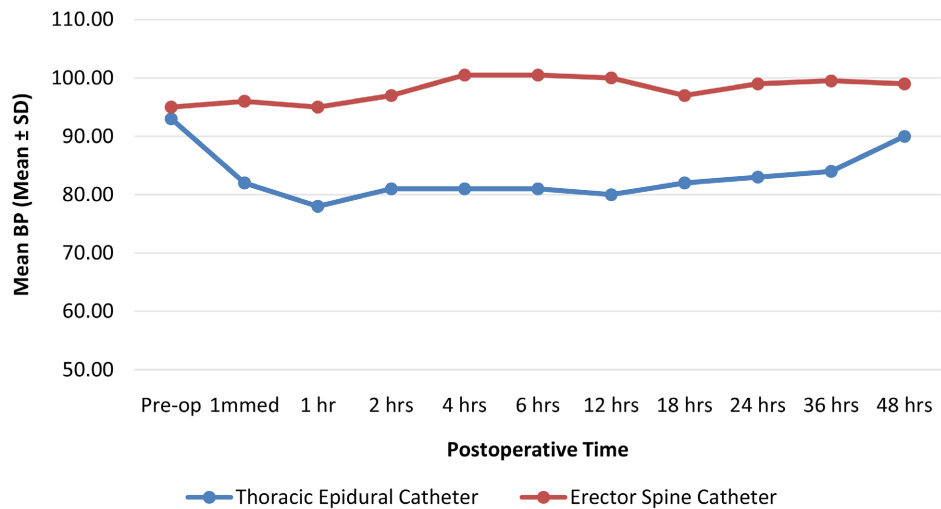


Figure 6. Postoperative mean BP overtime among studied groups.

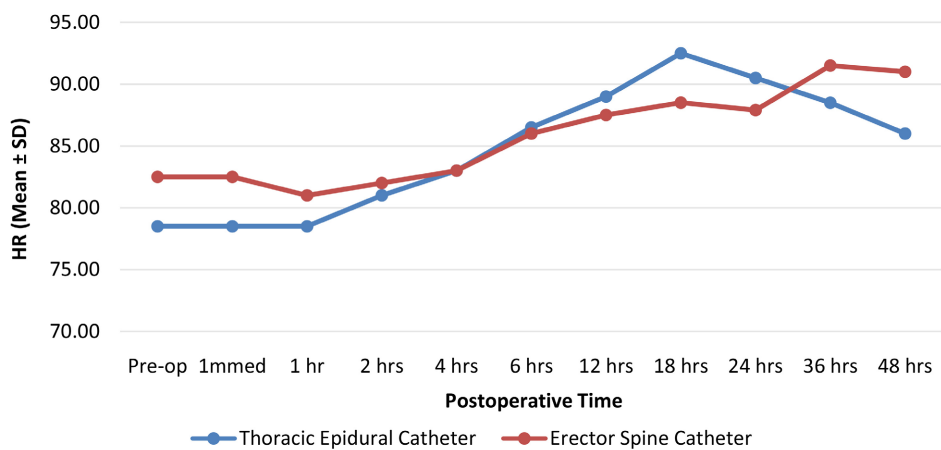


Figure 7. Postoperative Heart rate overtime among studied groups.

Finally, TEPI and ESI groups had similar rates of bradycardia (6.7% vs 3.3%), back pain (6.7% vs 6.7%), hypotension (6.7% vs 0.0%), and PONV (6.7% vs 0.0%) without significance (P value > 0.05). No traumatic needle adverse effects were reported in either group. (Table 3) Also, there was no statistically significant difference between the satisfaction scores of both groups (P value = 0.913), as the majority of patients were well-satisfied in both groups. (Table 3)

**Table 3.** Comparison of side effects & patient's satisfaction among studied groups.

Side effects	TEPI (n = 30)	ESI (n = 30)	P-value*
Bradycardia	2 (6.7%)	1 (3.3%)	0.999
Back pain	2 (6.7%)	2 (6.7%)	0.999
Hypotension	2 (6.7%)	0 (0.0%)	0.491
Nausea	2 (6.7%)	0 (0.0%)	0.491
Vomiting	2 (6.7%)	0 (0.0%)	0.491
Itching	0 (0.0%)	0 (0.0%)	NA
Sedation	0 (0.0%)	0 (0.0%)	NA
Patient's Satisfaction			P-value**
Very unsatisfied	0 (0.0%)	0 (0.0%)	NA
Poor	2 (6.7%)	1 (3.3%)	0.913
Fair	5 (16.7%)	5 (16.7%)	
Good	7 (23.3%)	6 (20.0%)	
Very good	16 (53.3%)	18 (60.0%)	

Data were expressed as frequency (%); \*Fisher exact test was used to compare the proportion difference between groups; \*\*Chi-square test was used to compare the proportion difference between groups.

## 6. Discussion

Erector spinae plane (ESP) block is a regional analgesic modality that involves an LA injection into the paraspinal plane, which is deep into the erector spinae muscle. Since the erector spinae muscle extends to the lumbar spine, it can give abdominal analgesia at lower thoracic levels. The first case report of this block was documented by Forero *et al.*, who described thoracotomy following a failed epidural at the T5 transverse region [9]. Putting a catheter in this plane can extend analgesia [17] [18]. The accessibility of sonographic endpoints and landmarks for needle placement and local anesthetic administration makes this procedure safer and more straightforward [9] [15] [19].

We, in our study, described the use of bilateral ESP catheters to cover abdominal surgeries that cross the midline. A cadaver model showed that with an injection of 20 ml of fluid at the T7 transverse process, it propagated to L2-3 vertebra levels caudally and to C7-T2 vertebra levels cranially [19]. Based on these studies, we performed the blockade and implanted catheters at the T8 level to offer efficient perioperative analgesia compared to the thoracic epidural block for major upper abdominal cancer surgeries. We maintained the intensity and extent of analgesia for 48 hours with a bupivacaine 0.125% infusion regimen at 0.1 mL/kg/h.

After analyzing 60 patients, divided equally into 2 groups, TEPI and ESI, we found that both groups were comparable regarding 48 hours of postoperative analgesia and opioid needs, with most patients having no pain and needing no analgesia at all. Only 8 patients in EPI group and 11 patients in ESI group requested

analgesia, which was infrequent and without any statistical significance. So, the main outcome in the study, VAS at rest and at movement, were comparable in both groups with no clinical or statistical significance as validated by postoperative morphine consumption, which was also statistically insignificant. That was in agreement with previous clinical studies like Nagaraja *et al.* [4], who compared TEPI and ESI in cardiac surgeries and found that pain scores and opioid consumption were comparable. Also, Agata *et al.* [20] discovered that continuous lumbar ESPB was equal to epidural analgesia as a pain treatment approach in patients experiencing hip replacement surgery.

On the other side, previous studies showed different results as Zubier *et al.* [21], who found that ESPB offered superior analgesia than TEA, when evaluated by Vas scores and total opioid analgesic use in donor hepatectomy. Hamilton & Manickam [22] used a continuous catheter in individuals with multiple unilateral rib fractures, and ESP block was successfully performed with better pain relief. They hypothesized that local anesthetic cephalocaudal spread is due to its site near the costotransverse foramina, at which both ventral and dorsal rami of thoracic spinal nerves originated, and supported by thoracolumbar fascia extending from the nuchal fascia of the neck superiorly and continued with the posterior thorax and abdomen. Also, Yogin *et al.* [23] discovered that while both ESPB and CEB provide satisfactory analgesia following lumbar spine surgeries, the ESPB group had a considerably longer duration of action.

Moreover, Wadood's MA. *et al.* [24], who worked on 54 patients who had open nephrectomy, divided into two identical groups, TEA and ESPB, showed that ESPB is less effective than TEA in controlling pain after 6 hrs. postoperatively, which is not consistent with our results, and the difference could be explained by the fact that we had LA infusion for a longer duration (48 hours) than they did, that they used catheters without fenestrations in erector spinae groups, that the analgesic infusion dose was fixed, whereas we calculated doses based on body weight, and that they compared epidural infusion along with unilateral erector spinae infusion rather than bilateral.

Regarding postoperative 48 hours analgesic need, both groups showed no statistically significant difference in terms of total morphine consumption, number of morphine doses and number of patients who needed analgesia. However, the mean time of initial request for analgesia was statistically significantly longer in the TEPI group than in the ESI group. In line with our findings, Bhat *et al.* [25] undertook a prospective analysis of 74 adult patients scheduled for open heart surgery and were randomly assigned to two groups: Group TEA and Group ESP. They demonstrated that, while the postoperative mean rescue analgesic doses used in both groups were comparable, Group TEA required more frequent administration.

Supporting our results, Nagaraja *et al.* [4], who performed a randomized comparative clinical investigation on 50 patients underwent elective cardiac surgeries with median sternotomy and were randomly divided into Group A (TEA) or

Group B (ESP block). They discovered that there was no significant difference between the two groups in total intraoperative fentanyl consumption. Also, Melvin *et al.* [26] conducted case series research to evaluate erector spinae plane block for preoperative analgesia in lumbosacral spine surgeries. They concluded that the ESP block could provide a considerable perioperative opioid-sparing analgesic regimen and improve recovery following lumbosacral spine surgery.

In contrast, Shokri and Kasem [27] conducted a prospective study on 80 patients aged 36 - 65 years, undergoing elective transthoracic esophageal surgical procedures. The patients were randomized into two groups: the TE group, with an injection of 15 ml of bupivacaine 0.25%, followed by 7 ml/h of 0.125% bupivacaine, and the bilateral ESPB group, with injecting the same previous doses in each catheter for 24 hours postoperatively. They observed that total postoperative fentanyl consumption in 24 h was significantly lower in erector spine group than in the thoracic epidural. The different volume and concentration of bupivacaine and also the short duration of observation may explain this difference from our results.

Regarding hemodynamics, during the intra-operative time, TEI Group patients' heart rates were considerably lower than ESI Group patients' for 2.5 hours after loading dosage injection; thereafter, they were insignificantly different. These results are congruent with Moawad *et al.* [28] HR values in the epidural group. Also, Seleem *et al.* [29] reported that the epidural group had a significantly lower HR than the ES group ( $P = 0.001$ ). However, Elsabeeny *et al.* [30] found that intraoperative HR values were comparable between the epidural and erector spinae groups, except at 105 minutes, when the latter had greater values. The LA administered quantities of 30 ml bupivacaine in the erector spinae and 7.5 ml in the epidural may explain this disparity.

Intraoperative MAP was significantly lower in TEPI Group throughout operative time. Similarly, Seleem *et al.* [29] found statistically significant decreased MAP values in the epidural group compared to the erector spinae group ( $P < 0.001$ ). Furthermore, Elsabeeny *et al.* [30] found that the intraoperative MAP values in epidural group were significantly lower than that in erector spinae group.

Preoperative to 48-hour postoperative hemodynamics showed a statistically significant decrease in MBP in the TEPI group and no significant change in HR. Our findings were consistent with those of Mostafa *et al.* [31], who examined ESPB and TE analgesia in traumatic flail chest and found that the TEA group had a much higher rate of hypotension. Shokri and Kasem [27] discovered that epidural anesthesia caused significantly more hypotension in transthoracic esophageal surgery patients than ESPB. Also, Zubair *et al.* [21] compared postoperative analgesia of continuous thoracic epidural to erector spinae block in adult living donor hepatectomy and found that heart rate was similar, but regarding MBP, which was fairly comparable, they disagreed with us. In disagreement with our results, Bhat *et al.* [25] compared bilateral ESPB and TEA's analgesic efficacy in midline sternotomy open heart surgeries. At certain times, HR and MAP were identical in both groups.

Side effects were similar between groups; just two patients suffered nausea, vomiting, and hypotension in TEPI group and without serious adverse events in ESI group, confirming the safety of Continuous bilateral ESP block. Its patients were also more hemodynamically stable than epidural analgesia, allowing appropriate intra- and post-operative dosage without hypotension compromising peri-operative analgesia.

## 7. Conclusions

Lastly, continuous erector spinae analgesia provides visceral analgesia in addition to opioid sparing. Other benefits include pre-emptive analgesia, catheters away from the surgical site, and analgesic efficacy in any anterior abdominal wall surgical incision. All of this suggests that this approach may be an alternative to thoracic epidural analgesia in abdominal cancer procedures.

This study was constrained by a small sample size, a brief follow-up period, and the assessment of multiple tumour types because pain intensity varied. Pain intensity was also measured using the NRS score as the sole measure of pain without assessing other domains. Therefore, bigger sample sizes, follow-up times of at least 72 hours, assessment of a single tumour type and the NIH Patient-Reported Outcomes Measurement Information System (PROMIS) Toolbox could be used as a standard set of measures assessing cognitive, emotional, motor and sensory function will be required in future research.

## Fund Program

This study was registered at [clinicaltrials.gov](https://clinicaltrials.gov) under unique NCT Number NCT04776109 in February 2021 (<https://clinicaltrials.gov/ct2/show/NCT04776109>).

## Conflicts of Interest

There is no conflict of interest.

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