Comparison of Epidural Analgesia with Ultrasound-Guided Bilateral Erector Spinae Plane Block in Aorto-Femoral Arterial Bypass Surgery

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ABSTRACT

Objective: Thoracic Epidural Analgesia (TEA) was compared with ultrasound-guided bilateral erector spinae plane (ESP) block in aorto-femoral arterial bypass surgery for analgesic efficacy, hemodynamic effects, and pulmonary rehabilitation.

Design: Prospective randomized.

Setting: Tertiary care centre.

Participants: Adult patients, who were scheduled for elective aorto-femoral arterial bypass surgery.

Interventions: It was a prospective pilot study enrolling 20 adult patients who were randomized to group A (ESP block = 10) and group B (TEA = 10). Monitoring of heart rate (HR) and mean arterial pressure (MAP) and pain assessment at rest and deep breathing using visual analog scale (VAS) were done till 48 h post-extubation. Rescue analgesic requirement, Incentive spirometry, oxygenation, duration of ventilation and stay in Intensive Care Unit (ICU) were reported as outcome measures. Statistical analysis was performed using unpaired Student T-test or Mann-Whitney U test. A value of \( P < 0.05 \) was considered significant.

Results: HR was lower in group B than group A at 1 and 2 h post-surgery and at 0.5, 16, 20, and 32 h post-extubation (\( P < 0.05 \)). MAP were lower in group B than A at 60, 90, 120, 180, 210, 240, 270 minutes and at 0 hour post-surgery and at 4 hours, every 4 hours till 32 hours post-extubation (\( P < 0.05 \)). Intraoperative midazolam and fentanyl consumption, ventilatory hours, VAS at rest, incentive spirometry, oxygenation, and ICU stay were comparable between the two groups. VAS during deep breathing was more in group A than B at 0.5, 4 hours and every 4 hours till 44 hours post-extubation. The time to receive the first rescue analgesia was shorter in group A than B (\( P < 0.05 \)).

Conclusion: Both ESP block and TEA provided comparable analgesia at rest. Further studies with larger sample size are required to evaluate whether ESP block could be an alternative to TEA in aorto-femoral arterial bypass surgery.

Keywords: Erector spinae plane block, thoracic epidural analgesia, visual analogue scale
INTRODUCTION

Prevalence of occlusive arterial diseases involving descending aorta, iliac and femoral vessels leading to critical limb ischemia is increasing worldwide. Aorto-iliac occlusive disease (AIOD) is treated by the management of risk factors, endovascular intervention, and/or surgical revascularization.[4] Surgical revascularization of the lower limb is often established by bypass grafting procedures like aorto-femoral bypass unilaterally or bilaterally requiring midline laparotomy. Revascularization in peripheral vascular diseases (PVD) is associated with significant cardiac-related morbidity and mortality, because of the associated coronary artery diseases (CAD), diabetes, renal, respiratory and cerebro-vascular diseases, and also the nature and duration of surgery.[2]

Pain following laparotomy consists of both visceral pain and somatic pain from the abdominal wall. The visceral pain is conducted to the spinal cord through the sympathetic chain, whereas somatic pain is conducted through the T7–L1 spinal nerves.[3] The most commonly used regional techniques such as thoracic epidural analgesia (TEA) and paravertebral blocks (PVB), have been extensively investigated for perioperative analgesia in major open abdominal surgeries.[4,5] General anesthesia along with epidural analgesia as a part of multimodal analgesia is known to be very useful in minimizing the perioperative hemodynamic fluctuations and surgical stress response and at ensuring effective analgesia and rapid recovery.[6] But TEA and PVB are associated with procedure-related concerns such as technical difficulty and chronic use of anticoagulants and antiplatelet medications in vascular surgical patients.[7,8]

Abdominal wall blocks such as transversus abdominis plane (TAP) block and rectus sheath block, have been used as alternatives to TEA and PVB.[3,10] Limitations of these blocks include limited dermatomal coverage, no visceral analgesia, the requirement of multiple injections and a large volume of local anesthetics. However, analgesic efficacy of these blocks has not yet been established in laparotomy.[3,11-13]

Forero et al. described a novel paraspinal plane block, erector spinae plane (ESP) block, for the treatment of chronic thoracic neuropathic pain. When performed at the T5 level, it provided effective analgesia for thoracotomy, sternotomy and breast surgery.[14-17] Recently, it has been shown that ESP block when performed at a lower thoracic level of T7–T9 can also be used to provide extensive somatic and visceral abdominal analgesia extending up to the C7-T2 transverse processes cranially and down to the L2-3 transverse processes caudally[18,20] with a lower risk of complications than TEA or PVB.[14,15,19] Cadaveric studies showed a range of the ESP block to spread to the dorsal and ventral rami, rami communicates, neural foramina, paravertebral and epidural spaces.[14,21-23]

A pilot study was conducted to compare analgesic efficacy of bilateral ESP block with thoracic epidural block in patients undergoing aorto-femoral arterial bypass surgery. Hemodynamics in the perioperative period, ventilatory hours, length of intensive care unit (ICU) stay, incentive spirometry and oxygenation were also compared.

METHODOLOGY

ASA physical status III-IV patients aged 18-70 years scheduled for elective aorto-femoral arterial bypass surgeries were recruited for this pilot study. Written informed consent was taken from all the patients. Pain scoring based on the Visual Analog Scale (VAS) and use of incentive spirometer were explained to the subjects in both the groups. Twenty patients were randomized to two groups namely ESP block group (Group A: 10 patients) and the TEA group (Group B: 10 patients) by the closed envelope method.

Patients scheduled for elective aorto-femoral arterial bypass surgeries in the age group of 18-70 years were included in the study. Exclusion criteria were patient refusal, allergy to local anesthetics, localized infection, bleeding diathesis, patients on anticoagulants, pre-existing neurological deficit, spinal deformities, left ventricular ejection fraction (EF) <40%, cognitive impairment, an active psychiatric condition, inability to understand pain scoring and emergency surgery.

After obtaining approval from the institutional ethics committee, the study was conducted at a tertiary care centre. We registered the study in WWW.CTRI.NIC.IN, prior to the start of the study (CTRI/2019/03/017922 on 06/03/2019). On the day of surgery, intravenous access, and standard monitoring such as pulse oximetry, continuous 5-lead electrocardiography, central venous catheterization and radial artery catheterization were established in both the groups.

In group A, bilateral ESP block was performed in the left lateral decubitus position under strict aseptic precautions. A high-frequency 12-MHz linear ultrasound transducer (Philips En Visor CHD, Bothell, WA, USA 98041) was placed in a longitudinal orientation 3 cm lateral to the T8 spinous process corresponding to the T7 transverse process. Two muscles trapezius (superior)
and erector spinae (inferior) were identified superficial to the hyperechoic transverse process. Local infiltration with 2% of lignocaine at the site of needle insertion was administered. Using in-plane approach an 18G Tuohy needle was inserted in caudal-cephalad direction, until the tip is placed deep to erector spinae muscle. Hydrodissection was demonstrated upon injection of 5 ml of normal saline. A 20G epidural catheter was threaded 5 cm in cephalad direction. Same procedure was followed on the opposite side. In group A, catheter position on both sides was confirmed by visualizing the catheter floating in the interfascial plane while moving the ultrasound probe up and down after saline administration. Hydrodissection was demonstrated from T6-L1 bilaterally.

In group B, under strict aseptic precautions, 18G Tuohy’s needle with Huber’s tip was inserted via median approach after local infiltration with 5 ml of 2% lignocaine at the level of T9-T10 or T10-T11 intervertebral space in the sitting position. After identifying epidural space using loss of resistance technique, 5 ml of saline was administered after negative aspiration for blood or cerebrospinal fluid and 20G epidural catheter was threaded 5 cm cranially.

After negative aspiration for blood, patients in group A were administered with 15 ml of 0.25% bupivacaine through each catheter followed by continuous infusion of 0.125% bupivacaine at the rate of 0.1ml/kg/hour through each catheter till 48 hours post-extubation. After negative aspiration for blood or CSF, the patients in group B were administered with a bolus dose of 15 ml of 0.25% bupivacaine through epidural catheter followed by continuous infusion of 0.125% bupivacaine at the rate of 0.1 ml/kg/hour till 48 hours post-extubation. After 30 minutes of bolus administration of local anesthetic in either group, sensory blockade was assessed with pinprick test. Patients in either group with inadequate analgesia would be excluded from the study.

Patients in both groups were administered standard general anesthesia protocol as follows: midazolam 0.05 mg/kg IV, fentanyl 2 mcg/kg IV, titrated dose of propofol IV, vecuronium 0.1 mg/kg IV (0.02 mg/kg repeated every 40 min till end of surgery) and lignocaine 1.5mg/kg IV (90 seconds before intubation). Patients in both groups were intubated orotracheally with a cuffed endotracheal tube after adequate muscle relaxation and mechanically ventilated with intermittent positive pressure ventilation (IPPV). Anesthesia was maintained with isoflurane, air, and oxygen.

In both groups, hemodynamics such as heart rate (HR) and mean arterial pressure (MAP) were monitored before induction (baseline), 1 min after induction, 1 min after skin incision, every 30 mins till the end of the surgery, every hourly post-surgery till extubation, at 0.5 h every fourth hourly till 48 hours post-extubation. In both the groups, any increase in HR and/or BP more than 20% from the baseline were treated with IV fentanyl 1 mcg/kg. Intraoperative midazolam consumption, total consumption of fentanyl, duration of aortic cross-clamping and surgery were noted. After the surgical procedure, patients were shifted to postoperative surgical intensive care unit. Patients in both groups were extubated once criteria for extubation were met. Duration of mechanical ventilation was noted.

Postoperative pain assessment was performed using 10 cm visual analog scale (VAS) (10 cm: maximum pain; 0: no pain). VAS at rest and during deep breathing and monitoring of partial pressure of arterial oxygen (PaO₂) using arterial blood gas analysis were performed at 0.5h after extubation and every fourth hourly till 48 hours post-extubation. Simultaneously, peak inspiratory flow spirometry (incentive spirometry) was performed post-extubation to assess the number of balls raised in the spirometer as an indicator of peak inspiratory flow rate (1 ball = 600 ml, 2 balls = 900 ml, and 3 balls = 1200 ml).

Breakthrough pain was defined as VAS score >4 at rest or on patient’s demand, despite basal analgesia. IV paracetamol 1 g was given as the first rescue analgesic. If VAS score was persistently more than 4 after 30 minutes of first rescue analgesia, IV tramadol 1 mg/kg (diluted in 100 ml of normal saline) was infused over 30 minutes as the second rescue analgesia. Patients in either group whose VAS score was persistently more than 4 after 30 minutes of second rescue analgesia would be excluded from study. Dynamic pain was defined as the difference in VAS >2 points between rest and cough. The pain was classified as mild (VAS 0-4), moderate (VAS 5-7), and severe (VAS 8-10). Duration of ICU stay and any complications were recorded.

Data were expressed as a mean ± standard deviation. Parametric data were analyzed using the Student t-test. Mann–Whitney U-test was used to analyze non-parametric data. A two-tailed value of $P < 0.05$ was considered statistically significant. Statistical analysis was performed using Epi Info version 7.2.3.1 (Centers for Disease Control and Prevention (CDC) in Atlanta, GA, USA).

**RESULTS**

All 20 male patients enrolled in either group completed the study. None of the patients in either group had inadequate
analgesia. Both the groups were comparable with respect to age, gender, height, weight, intraoperative consumption of intravenous midazolam and fentanyl, duration of aortic cross-clamping, surgery, mechanical ventilation, and ICU stay [Table 1].

HR was comparable between the two groups from baseline to till the end of the surgery, at 0.5, 3, and 4 hours post-surgery and at 4, 8, 12, 24, 28, 36, 40, 44, and 48 hours post-extubation. HR was lower in group B than group A at 1 and 2 hours post-surgery and at 0.5, 16, 20 and 32 hours post-extubation (P < 0.05) [Table 2a]. MAP was lower in group B than A at 60, 90, 120, 150, 180, 210, 240 and 270 minutes during surgery and at 0 hour post-surgery and at 4, 8,12, 16, 20, 28, 32 hours post-extubation (P < 0.05) [Table 2b].

VAS scores at rest were comparable between the two groups till 48 hours post-extubation [Table 3]. VAS scores during deep breathing were significantly more in group A than B at 0.5, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, and 44 hours post-extubation (P < 0.05) [Table 3]. Time to receive first rescue analgesia was significantly shorter in group A compared to B (10.0 ± 10.5409 min vs. 35.5 ± 35.1544 min) (P < 0.05). Total consumption of first rescue analgesia was comparable (1585.5 ± 490.41 mg in group A vs. 1231.5 ± 425.11 mg in group B [Table 1]). There were 17 breakthrough pain episodes required first rescue analgesia in group A, whereas 13 in group B [Figure 1a]. Group A patients had three breakthrough pain episodes that required second rescue analgesia. None of the patients in group B required second rescue analgesia [Figure 1b].

Incentive spirometry and PaO₂ were comparable between the two groups till 48 hours post-extubation [Table 4]. There were no regional anesthetic-related complications and adverse effects observed in either group.

**DISCUSSION**

Optimal pain management plays an important role in the recovery of patients following major open abdominal surgery. In the present study, VAS ≤4 at rest in both the groups signified effective analgesia, with comparable ventilator duration. Both the groups were compliant with chest physiotherapy in the form of incentive spirometry with an acceptable peak inspiratory flow of around 800 ml and better oxygenation. TEA group had greater MAP reduction than ESP block group from the first hour till the completion of surgery. A similar reduction of MAP was seen during immediate post-operative and post-extubation at 4, 8, 12, 16, 20, 28 and 32 hours in TEA group. However, HR and MAP were found to be within 20% of the baseline values in either group.

As reviewed by Block et al.,[24] Hughes et al.,[25] Nishimori et al.,[26] and Popping et al.,[27] TEA provides better analgesia at rest and with activity, reduced opioid consumption, decreased duration of mechanical ventilation and ICU stay, early mobilization, improved cough and sympathetic block in major abdominal surgeries. In the present study, TEA resulted in improved VAS scores at rest and during deep breathing, reduced consumption of opioid, with better incentive spirometry scores. Even though earlier and many rescue analgesia were required in ESP block group compared to TEA, total rescue analgesic consumption was statistically comparable.

An epidural block is known to produce denser sympathetic blockade compared to superficial nerve blocks and truncal blocks. The authors of this study believe the reduction in MAP and the differences in VAS scores during deep breathing between the two groups occur for the denser sympathetic blockade in TEA group than in ESP block group.

| **Table 1: Demographic and perioperative data** |
|-----------------------------------------------|
| **Indicators** | **Group A (ESP block)** | **Group B (TEA)** | **P** |
| Age (years) | 50.2±10.6228 | 54.9±10.4504 | 0.33179 |
| Gender | Male-10 | Male-10 | 1.00000 |
| Female-0 | Female-0 | | |
| Height (cm) | 164.6±7.0427 | 164.8±6.1246 | 0.94672 |
| Weight (kg) | 67.0±9.3095 | 63.9±7.9784 | 0.43339 |
| Total IV midazolam (mg) | 2 (1-2) | 2 (1-2) | 1.00000 |
| Total IV fentanyl consumption (mcg) | 240.0±21.0819 | 230.0±34.9603 | 0.5485 |
| Duration of aortic cross clamping (min) | 59.±16.7611 | 60.2±17.7376 | 0.91858 |
| Duration of surgery (min) | 243.5±13.5503 | 250.5±8.3166 | 0.18080 |
| Duration of mechanical ventilation (min) | 143.0±31.6403 | 146.0±36.5756 | 0.84668 |
| Time to receive first rescue analgesia (mins) | 10.0±10.5409 | 35.5±35.1544 | 0.04134 |
| Total consumption of first rescue analgesia (mg) | 1585.5±490.41 | 1231.5±425.11 | 0.1017 |
| Time to receive second rescue analgesia (mins) | 8.8±14.8234 | 0.0±0.0 | 0.07678 |
| Duration of ICU stay (hours) | 60.4±8.3693 | 58.6±9.3595 | 0.65571 |

ESP - Erector Spinae Plane . TEA- Thoracic Epidural Analgesia . IV – Intravenous . ICU- Intensive care unit.
In vascular surgical patients, a major concern in using neuraxial techniques is their safety in patients with chronic use of anti-platelets and perioperative systemic anticoagulation. Various studies showed TEA is associated with technical difficulties and complications such as hypotension, bradycardia, motor blockade, urinary retention, total spinal anesthesia and epidural hematoma or abscess.\cite{6-9}

Forero et al., introduced ESP block, an inter-fascial plane block for providing thoracic and abdominal analgesia. ESP block has been described as a successful perioperative pain management strategy for various surgeries involving thoracic and abdominal regions.\cite{14,29} Bilateral ESP block at T7-T9 level provides effective and long-lasting postoperative analgesia following abdominal surgery.\cite{1}

Owing to the less risk of injury to the vessel, pleura, or neuraxis, it is relatively safer than TEA and PVB.\cite{19,30} The exact volume and concentration of the infusion drug required in ESP block are not well established from the limited literature available. ESP block has been described as an effective alternative when TEA and PVB are contraindicated due to thrombocytopenia, antiplatelet or anticoagulant treatments, or coagulopathy.\cite{31-34}

Restrepo-Garcés et al.\cite{35} reported bilateral ESP block at T7, in a patient with recurrence of a bladder adenocarcinoma, who underwent open radical cystoprostatectomy with the urerter and neobladder reconstruction and reported resting and dynamic pain scores 3/10 and 1–2/10, respectively, during the first 72 hours with dermatomal coverage from T5-L2. Bang et al.\cite{36} reported ESP block at T8 transverse process in a 35-year-old female who underwent excision of a larger ovarian mass via laparotomy along with multimodal analgesia. There were resting or dynamic pain scores <4, with no rescue analgesics needed during the first five post-operative days. Hamed et al.\cite{37} in a prospective study involving 60 patients showed that bilateral ESP block provided effective postoperative analgesia and markedly decreased postoperative fentanyl consumption in abdominal hysterectomy.

In the present study, bilateral ESP block at T7 resulted in improved VAS ≤4 at rest and 3-5 during deep breathing in the first 48 hours. There was a comparable first rescue analgesic requirement.
Table 2b: Mean arterial pressure (MAP) changes in the perioperative period

| Time               | Group A (ESP block) | Group B (TEA) | P      |
|--------------------|---------------------|---------------|--------|
| Baseline           | 102.7±3.8887        | 103.1±5.152   | 0.84684|
| 1 min before induction | 101.4±6.8832        | 101.2±6.1968 | 0.94631|
| 1 min after induction | 91.3±5.9451        | 86.3±4.7543  | 0.11458|
| 1 min after skin incision | 88.7±7.1500        | 83.7±6.5498  | 0.12034|
| 30 min             | 87.9±8.9125         | 82.5±6.207   | 0.34133|
| 60 min             | 93.6±6.8832         | 82.7±4.5959  | 0.00058|
| 90 min             | 94.2±5.7310         | 80.2±4.2562  | 0.00007|
| 120 min            | 92.5±11.7118        | 81.7±5.4579  | 0.01653|
| 150 min            | 92.4±10.6479        | 82.3±8.1520  | 0.02848|
| 180 min            | 91.5±4.4557         | 80.8±9.1384  | 0.00672|
| 210 min            | 91.6±3.5653         | 81.7±3.5643  | 0.00124|
| 240 min            | 90.2±6.8443         | 81.5±3.5632  | 0.00094|
| 270 min            | 88.6±3.7771         | 81.0±3.9158  | 0.00033|
| **MAP post-surgery** |                     |               |        |
| 0 h                | 90.3±6.9769         | 81.3±6.6841  | 0.00865|
| 1 h                | 88.1±12.7580        | 80.5±4.507   | 0.11001|
| 2 h                | 85.2±8.8418         | 80.7±5.4579  | 0.18768|
| 3 h                | 88.5±13.2518        | 84.4±9.8002  | 0.44173|
| 4 h                | 91.6±13.9220        | 85.7±7.1032  | 0.24808|
| **MAP post-extubation** |                     |               |        |
| 0.5 h              | 93.0±8.8944         | 84.4±9.8002  | 0.05470|
| 4 h                | 96.5±10.4695        | 85.7±7.1032  | 0.01672|
| 8 h                | 96.7±7.4543         | 84.2±13.6398 | 0.02220|
| 12 h               | 96.0±7.1181         | 86.4±12.3576 | 0.04734|
| 16 h               | 97.5±9.0952         | 84.9±9.2670  | 0.00662|
| 20 h               | 95.3±5.3135         | 86.1±7.8944  | 0.00678|
| 24 h               | 93.6±4.8351         | 87.0±11.3235 | 0.10729|
| 28 h               | 92.8±3.3599         | 86.2±6.0332  | 0.00732|
| 32 h               | 95.9±3.7845         | 87.0±5.5578  | 0.00056|
| 36 h               | 92.4±5.8916         | 89.5±7.5609  | 0.35137|
| 40 h               | 93.2±7.8145         | 86.4±10.1346 | 0.11017|
| 44 h               | 92.9±6.0636         | 88.0±12.2656 | 0.27229|
| 48 h               | 91.3±5.2292         | 87.8±8.7025  | 0.17804|

ESP- Erector Spinae Plane . TEA- Thoracic Epidural Analgesia . MAP - Mean arterial pressure

Table 3: Visual Analog Scale (VAS) post-extubation

| Time since extubation | Group A (ESP block) | Group B (TEA) | P      |
|-----------------------|---------------------|---------------|--------|
| 0.5 h                 | 2.9±0.7379          | 2.6±0.5164   | 0.30611|
| 4 h                   | 3.1±0.7379          | 3.0±0.6667   | 0.75415|
| 8 h                   | 3.0±0.0000          | 3.0±0.0000   | 1.00000|
| 12 h                  | 2.7±0.4830          | 2.7±0.4830   | 1.00000|
| 16 h                  | 2.6±0.5164          | 2.5±0.5270   | 0.67332|
| 20 h                  | 2.6±0.5164          | 2.6±0.5164   | 1.00000|
| 24 h                  | 3.2±1.0328          | 3.0±0.9541   | 0.67332|
| 28 h                  | 3.3±0.4830          | 3.2±0.4216   | 0.62784|
| 32 h                  | 2.5±0.5270          | 2.5±0.5270   | 1.00000|
| 36 h                  | 2.3±0.4830          | 2.3±0.4830   | 1.00000|
| 40 h                  | 2.9±0.8756          | 2.8±0.7888   | 0.79150|
| 44 h                  | 2.6±0.5164          | 2.9±0.8756   | 0.36304|
| 48 h                  | 2.5±0.5270          | 2.5±0.5270   | 1.00000|

b) VAS during deep breathing

| Time since extubation | Group A (ESP block) | Group B (TEA) | P      |
|-----------------------|---------------------|---------------|--------|
| 0.5 h                 | 5.2±0.4216          | 3.3±0.9487   | 0.00002|
| 4 h                   | 5.0±0.0000          | 3.1±0.3162   | 0.00000|
| 8 h                   | 4.7±0.4830          | 3.1±0.7379   | 0.00002|
| 12 h                  | 4.8±0.4216          | 3.1±0.3162   | 0.00000|
| 16 h                  | 4.6±0.5164          | 2.8±0.4216   | 0.00000|
| 20 h                  | 4.8±0.9189          | 3.2±0.4216   | 0.00009|
| 24 h                  | 5.9±0.8756          | 3.0±0.4714   | 0.00000|
| 28 h                  | 5.1±0.7379          | 3.0±0.4714   | 0.00000|
| 32 h                  | 4.5±0.5270          | 2.9±0.5676   | 0.00000|
| 36 h                  | 4.3±0.4830          | 3.2±0.4216   | 0.00004|
| 40 h                  | 4.8±0.4216          | 3.1±0.3162   | 0.00000|
| 44 h                  | 4.6±0.5164          | 3.1±0.8756   | 0.00019|
| 48 h                  | 3.4±0.6992          | 3.3±0.4830   | 0.71416|
Chin et al.,[18] Hacibeyoglu et al.,[38] Tulgar et al.,[39] and Luis-Navarro et al.,[40] reported ESP block in various laparoscopic and open abdominal surgeries and showed improved pain scores and reduced rescue analgesic consumption. In the present study, bilateral ESP block resulted in improved VAS ≤4 at rest and 3-5 during deep breathing in the first 48 hours with comparable first rescue analgesic requirement.

Nagaraja et al.[16] compared TEA with bilateral ESP block at T5 in median sternotomy and showed ESP block facilitated early extubation, improved pain scores, reduced consumption of opioid and rescue analgesics, better incentive spirometry scores and shorter ICU stay, which were comparable with TEA. In the present study, bilateral ESP block at T7 level in laparotomy has provided good analgesia comparable with TEA. ESP block and TEA were comparable with respect to opioid analgesic consumption, ventilatory hours and duration of ICU stay, PaO₂ and incentive spirometry scores.

**CONCLUSION**

Both ESP block and TEA provided comparable analgesia at rest. Further studies with a larger sample size are required to evaluate whether ESP block could be an alternative to TEA in aorto-femoral arterial bypass surgery.

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**Conflicts of interest**
There are no conflicts of interest.

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