



Case Report

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Erector spinae plane block and altered hemostasis: is it a safe option? -a case series-

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Background: We described 5 cases of uneventful administration of the erector spinae plane (ESP) block to patients with altered hemostasis.

Case: Five patients were admitted to the intensive care unit with altered hemostasis, defined by the activated partial thromboplastin time ratio or international normalized ratio exceeding 1.5 times the normal value; platelet count equal to or below 80000/μl; or use of anticoagulation therapy. A multimodal analgesic regimen was used for all patients, which proved unsatisfactory and limited successful ventilator weaning, until the administration of the ESP block. Effective analgesia was observed in all patients, with at least 70% reduction in numeric pain scale scores and 83% reduction in opioid consumption, which enabled successful ventilator weaning. No neurologic or hemorrhagic complications were recorded during daily surveillance over 5 days.

Conclusions: The ESP block may be a suitable regional analgesia technique for patients with altered hemostasis. Further studies are needed to support this finding.

Keywords: Acute pain; Critical care; Hemostasis; Interventional ultrasonography; Pain management; Postoperative pain; Ventilator weaning.

The erector spinae plane (ESP) block is a novel interfascial regional analgesic technique that was described by Forero et al. [1] in 2016, to treat thoracic neuropathic pain. Growing evidence of its efficacy and relative simplicity of performance has resulted in an increase in its use for managing acute and chronic pain [2-5]. The spread of local anesthetic through the paravertebral spaces is thought to be responsible for its analgesic effect on somatic and visceral pain, and thus, it has been reported to be as effective as thoracic epidural analgesia when administered bilaterally [6].

The ESP block may have some advantages over thoracic epidural analgesia, as it is a moderately simple technique that can be used unilaterally. It provides lesser sympathetic blockade with fewer cardiovascular effects, compared to the paravertebral block. However, the administration of the ESP block requires ultrasonographic guidance.

The ESP block seems to be similar to a superficial block compared to the epidural and paravertebral blocks, with a lower risk of hemorrhage, especially in patients with altered hemostasis, i.e., the risk of spinal hematoma and spinal cord compression is lower, as the block is administered superficial to the transverse processes, allowing the spinal cord to be protected by the vertebral canal. However, these aspects have not been studied in depth and established firmly in current literature [7].

We describe a case series of 5 patients with altered hemostasis (activated partial thromboplastin time [aPTT] ratio or international normalized ratio [INR] exceeding 1.5 times the normal value, a platelet count equal to or below 80000/μl, or use of anticoagulant

medication) in whom the ESP block was performed for acute pain management. The risks of the technique were described to all the patients and discussed with them or their legal representatives. We believed that the benefits outweighed the risks of the technique in each patient. All procedures were performed by one of the two principal authors. We monitored the patients daily for the first 5 days after the technique. No neurologic or hemorrhagic complications were recorded.

There seems to be growing evidence supporting the fact that the ESP block is a superficial block. We believe that the relationship with the surrounding anatomical structures, absence of major vessels in the vicinity, compressibility, and the use of ultrasonographic guidance are facts that support this argument.

Case Reports

We described a series of 5 patients in whom inadequate acute pain control caused difficulty in weaning them off the ventilator. Conventional neuraxis analgesia techniques, namely epidural or paravertebral blocks, were contraindicated due to a well-established risk of severe bleeding and spinal cord compression.

All the potential risks and benefits were discussed with all patients when possible, or their legal guardians, and verbal and written informed consent were obtained in all situations for reporting these cases.

All procedures were performed under ultrasonographic guidance (M-Turbo®, Sonosite Inc., USA), using a linear high-frequency probe (HFL38x®, Sonosite Inc., USA) in the longitudinal position, after identifying the transverse processes of the desired vertebra. Once identified, a 100-mm needle (Echoplex®, Vygon, France) was inserted in plane along the cephalad to caudal direction, until the needle tip contacted bone, between the erector spinae muscle and the transverse process.

Daily assessment of potential complications was performed for 5 days.

We have described all the clinical cases and the rationale behind our decision-making process as follows.

Case 1

A male patient, weighing 88 kg, was diagnosed with septic shock caused by acute necrotizing pancreatitis with multiorgan dysfunction and altered hemostasis (thrombocytopenia: 18000/μl, INR: 2.52, and aPTT: 45.2/29 s).

There was difficulty in weaning the patient off the ventilator due to poor acute pain management. He was under deep sedoanalgesia with midazolam (2 mg/h), propofol (1 mg/kg/h), parac-

etamol (3 g/day), ketamine (0.15 mg/kg/h), and fentanyl (2.5 μg/h or 5280 μg/day, equivalent to morphine 245 mg/day).

We proposed a bilateral ultrasound-guided single-shot ESP block, which was performed at the level of T7 and 20 ml of 0.5% ropivacaine was administered to each side. We were able to stop all sedatives and successfully wean the patient off the ventilator over the next few hours, after which a score of 0 was recorded on the numerical pain scale (NPS). A score of 3 was recorded the day after and an infusion of morphine was started, with an average requirement of 24 mg/day.

No ESP-technique related complications were observed.

Case 2

A 16-year-old boy, weighing 80 kg, was admitted to the pediatric intensive care unit due to polytraumatism. He had pelvic fracture, right femoral fracture, and severe lesions of the right femoral artery and vein, which were responsible for below-knee amputation of the lower right limb.

A multimodal strategy with paracetamol (3 g/day), metamizol (4 g/day), ketamine (0.3 mg/kg/h), gabapentin (1400 mg/day), and morphine (300 mg/day) afforded poor pain control in the lower limb, which was consistent with neuropathic pain (Douleur Neuropathique 4 [DN4] score of 6/10, NPS score of 6/10 at rest, and 10/10 during nursing care, needed twice daily).

He also presented with persistent altered hemostasis (INR: 1.8–2.24).

We performed a continuous ESP block at the level of T10 using 0.375% ropivacaine (20 ml every 6 h), which produced a better analgesic effect over 5 days (maximum NPS score of 3/10) and reduced the daily dose of morphine to 44 mg/day.

No technique-related complications were observed.

Case 3

A 69-year-old man was admitted to the intensive care unit due to hemorrhagic shock after elective open splenectomy and left nephrectomy, due to refractory immune thrombocytopenic purpura and left kidney tumour.

He had a left subcostal incision, approximately 30 cm in length. His usual platelet count was around 30000–40000/μl, which plummeted to a minimum count of 5000/μl.

Poor acute pain management with a multimodal strategy with paracetamol (4 g/day), ketamine (0.5 mg/kg/h), and morphine (140 mg/day) caused difficulty in ventilator weaning.

We performed a continuous left ESP block at the level of T7 with 0.2% ropivacaine (20 ml every 4 h), which allowed adequate

analgesia and extubation after 6 h.

No technique-related complications were observed.

Case 4

A 71-year-old man was admitted to the intensive care unit after open endoluminal aortic thrombectomy, with a left subcostal incision, and a thoracotomy at the level of the sixth intercostal space.

Post-operative systemic anticoagulation was required after surgery and he was also under anticoagulant therapy with enoxaparin (1 mg/kg/day, adjusted for acute kidney injury and an estimated glomerular filtration rate below 30 ml/min) and presented with thrombocytopenia (platelet count: 80000/ μ l).

He experienced acute pain with an NPS score of 7/10 despite a multimodal analgesic regimen with paracetamol (4 g/day), ketamine (0.2 mg/kg/h), and fentanyl (3 μ g/kg/h), which did not permit ventilatory weaning.

We performed a continuous left ESP block at the level of T6, with 0.2% ropivacaine (20 ml every 4 h), which produced adequate analgesia, permitting extubation after 4 h.

No technique-related complications were observed.

Case 5

A 21-year-old man was admitted to the intensive care unit due to hemorrhagic shock caused by a massive left hemothorax and hypertensive pneumothorax after penetrating thoracic trauma, which was complicated by cardiac arrest. Emergency atypical lung resection was performed with a left thoracotomy at the level of the sixth intercostal space.

Thrombocytopenia was observed (43000/ μ l) despite correction of INR and aPTT.

A multimodal regimen with paracetamol (4 g/day), ketamine (0.3 mg/kg/h) and fentanyl (3 μ g/kg/h) provided poor pain control as an NPS score of 9/10 was recorded, which made ventilator weaning difficult.

We performed a continuous left ESP block at the level of T5, with 0.2% ropivacaine (20 ml every 4 h), and adequate analgesia was achieved, which allowed extubation after 4 h.

No technique-related complications were observed.

Discussion

Few regional analgesia techniques are available for ameliorating thoracic or abdominal visceral pain (such as the thoracic or lumbar epidural or paravertebral block) for patients with altered he-

mostasis. The ESP block is a fascial plane block, which is performed between the transverse processes and erector spinae muscles, with a moderate level of difficulty, and can provide adequate analgesia through multiple dermatomes by cephalocaudal spread, as reported by Ivanusic et al. [8]. Although this study reported no spread of dye to the ventral rami, several (published) studies have provided evidence, supporting the idea that anterior spread of local anesthetic provides visceral fiber blockade, explaining its use in thoracic, cardiac and abdominal surgery [9–13]. A recent case report described Harlequin syndrome after the ESP block, which is clearly consistent with the anterior spread of local anesthetic solution responsible for sympathetic fiber chain blockade [14].

We believe that although the anterior spread of the dye has not been well-established in cadaveric studies, a sufficient number of clinical reports currently support the existence of anterior spread that is responsible for the visceral analgesia provided by this block. We believe that the lack of dye spread in cadavers may be dependent on the lack of thoracic wall movement caused by respiratory movement (either spontaneous breathing or by mechanical ventilation), which may be a major factor that facilitates anterior spread of the local anesthetic.

We achieved adequate analgesia in all patients. We observed 70% to 89% of reduction in the NPS scores and 83% to 100% reduction in opioid consumption (Table 1). This amelioration in pain allowed all patients to be successfully weaned off the ventilator, within the next few hours.

There is a safe distance between the anatomical fascial plane and neuraxis or pleura, which renders this block suitable for patients with altered hemostasis under ultrasonographic guidance. This hypothesis has not been tested in randomized controlled trials and the safety of this technique in these circumstances has not been tested yet.

We used this technique in 5 patients with major alterations in hemostasis, such as severe thrombocytopenia, INR > 1.5, and one patient under therapeutic anticoagulation with low molecular weight heparin.

We did not observe any neurological complications, including spinal hematoma or nerve root compression, or hemorrhagic complications, including internal or external bleeding 5 days after administration of the ESP block.

Although these observations may represent a small pool of patients, it is the largest sample of such patients to the best of our knowledge and may represent a major contribution that establishes the safety of this block in patients with altered hemostasis.

The duration of mechanical ventilation and use of deep sedation have been linked with increased mortality and delirium in intensive care practice. An adequate analgesic regimen allows pa-

Table 1. Description of the Five Clinical Cases

| Case no. | Diagnosis / Procedure | Maximum NPS (0–10) | | Initial analgesic regimen | | Opioid in equivalent morphine daily dose | | Altered hemostasis | | | Level of ESP block | Single-shot vs continuous technique | Local anesthetic regimen | Complications |
|----------|---|--------------------|-----------------|--|--------|--|-----------------|-----------------------------|-------------|----------------------------|--------------------|-------------------------------------|-------------------------------------|---------------|
| | | Before ESP block | After ESP block | | | Before | After ESP block | INR > 1.5 | aPTT > 1.5 | Platelet count ≤ 80,000/μl | | | | |
| 1 | Acute necrohemorrhagic pancreatitis with multiorgan dysfunction | N/A | 3 | Paracetamol (3 g/day) | 245 mg | 24 mg | 24 mg | Yes (2.52) | Yes (1.55x) | Yes (18,000/μl) | T7 | Single-shot | 0.5% ropivacaine 20 ml, bilaterally | No |
| 2 | Right lower limb amputation (below knee) | 10 | 3 | Paracetamol (3 g/day) Ketamine (0.15 mg/kg/h) Fentanyl (2.5 μg/kg/h) | 300 mg | 44 mg | 44 mg | Yes (1.8 - 2.24) | No | No (85,000/μl) | T10 | Continuous | 0.375% ropivacaine 20 ml every 6 h | No |
| 3 | Open splenectomy and left nephrectomy | 10 | 2 | Paracetamol (4 g/day) Ketamine (0.5 mg/kg/h) Morphine (140 mg/day) | 140 mg | 0 mg | 0 mg | No | No | Yes (5,000/μl) | T7 | Continuous | 0.2% ropivacaine 20 ml every 4 h | No |
| 4 | Open endoluminal aortic thrombectomy | 7 | 2 | Paracetamol (4 g/day) Ketamine (0.2 mg/kg/h) Fentanyl (3 μg/kg/h) | 288 mg | 0 mg | 0 mg | Therapeutic anticoagulation | No | Yes (80,000/μl) | T6 | Continuous | 0.2% ropivacaine 20 ml every 4 h | No |
| 5 | Left thoracotomy | 9 | 1 | Paracetamol (4 g/day) Ketamine (0.3 mg/kg/h) Fentanyl (3 μg/kg/h) | 252 mg | 0 mg | 0 mg | No | No | Yes (43,000/μl) | T5 | Continuous | 0.2% ropivacaine 20 ml every 4 h | No |

Values are presented as number (%). ESP: erector spinae plane, INR: international normalized ratio, aPTT: activated partial thromboplastin time, 1.5X: 1.5 times the normal value, N/A: not applicable.

tients to be mechanically ventilated with a lower level of sedation for the shortest time possible, which allows for quicker ventilatory weaning and extubation, which are the primary goals in this setting. The ESP block is a regional analgesic technique with a moderate level of difficulty, which can be used in patients with altered hemostasis and inadequate pain control and which allows them to be quickly and successfully weaned from the ventilator. This may be particularly important in patients who have experienced trauma and those who have undergone surgery, since this technique may decrease the duration of mechanical ventilation and eventually reduce mortality. We think that these aspects are particularly interesting and deserve further study [15].

Nevertheless, we strongly believe that an individualized risk-benefit assessment should be performed for every patient and that more studies are needed to support our hypothesis.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

Author Contributions

João Galacho (Conceptualization; Data curation; Formal analysis; Methodology; Validation; Visualization; Writing – original draft; Writing – review & editing)

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