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

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ESP block and altered hemostasis

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Running title: ESP block and altered hemostasis
Abstract

Background: We describe 5 cases of uneventful performance of erector spinae plane (ESP) block on patients with altered hemostasis.

Case: Five patients admitted in an intensive care unit, with altered hemostasis, defined by aPTT ratio or INR above 1.5 times, platelet count equal or below 80000/L or patients under therapeutic anticoagulation. In all patients a multimodal analgesic regimen was applied, which showed itself unsatisfactory and limited a successful ventilator weaning, until performance of ESP block. In all patients we observed an effective analgesic effect, with at least 70% reduction in the Numeric Pain Scale and 83% of reduction in opioid consumption, which allowed all to be successfully weaned from the ventilator on the following hours. No neurologic or hemorrhagic complications were recorded during a 5-day daily surveillance.

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

Keywords: Acute pain; Critical care; Hemostasis; Interventional ultrasonography; Pain management; Postoperative pain; Ventilator weaning.
Erector spinae plane (ESP) block is a novel interfascial regional analgesic technique described by Forero et al. [1] in 2016, to treat thoracic neuropathic pain. Growing evidence of its efficacy and relative simplicity of performance has led to its spreading use in acute and chronic pain management [2–5]. The spread of local anesthetic through the paravertebral space is believed to be responsible for its analgesic effect on somatic and visceral pain, and thus, when bilaterally performed, it has been reported to be as effective as thoracic epidural analgesia [6].

ESP block may have some advantages over thoracic epidural analgesia as it is a moderately simple technique, that can be used unilaterally. Compared to paravertebral block it has less sympathetic blockage with less cardiovascular effects. On the other hand, its performance requires sonographic guidance.

Compared to both epidural and paravertebral blocks, ESP block seems to be compared to a superficial block, with less hemorrhagic risks, especially in patients with altered hemostasis, namely lesser risk of spinal hematoma and spinal cord compression as the block is performed superficially to the transverse processes, allowing spinal cord to be protected by the vertebral canal. However, these statements are not yet well studied and established in current literature [7].

We describe a case series of 5 patients with altered hemostasis (aPTT ratio or INR above 1.5 times, platelet count equal or below 80000/L or patients under anticoagulation) in whom ESP block was performed for acute pain management. In all patients, the risks of the technique were described and discussed with the patients or their legal representatives. In every case we believed the benefits outweighed the risks of the technique. All the techniques were performed by one of the two main authors. We performed a daily surveillance on the first 5 days after the technique. No neurologic or hemorrhagic complications were recorded.
There seems to be growing evidence supporting ESP block as a superficial block. We believe that its anatomical relationships, the absence of nearby major vessels, its compressibility and the use of ultrasound guidance are facts that support this statement.
Case Reports

We describe a series of 5 patients that presented with an inadequate acute pain control, causing a difficult ventilatory weaning. Conventional neuraxis analgesia techniques, namely an epidural or a paravertebral block, were contraindicated due to a well established risk of severe bleeding and spinal cord compression.

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

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

A 5-day daily assessment of potential complications was performed.

We describe all the clinical cases and the rationale of our decision-making.

Case 1

Male patient, weight 88kg, diagnosed with septic shock due to an acute necrotizing pancreatitis with multiorganic disfunction, with altered hemostasis: thrombocytopenia (18000/uL), INR 2.52 and aPTT 45.2/29 s.

There was difficulty in ventilatory weaning due to poor acute pain management. He was under deep sedoanalgesia with midazolan (2 mg/h), propofol (1 mg/kg/h), paracetamol (3 g/day), ketamine (0.15 mg/kg/h) and fentanyl (2.5 μg/kg/h or 5280 μg/day, equivalent to 245 mg/day of morphine).
We proposed a bilateral ultrasound-guided single-shot ESP block. The technique was performed at the level of T7 and 20 ml of ropivacaine 0.5% was administered on each side.

On the following hours, we were able to stop all sedatives and to successfully wean the patient from the ventilator, after which he referred a score of 0 in the Numeric Pain Scale (NPS). The day after, he graded a score of 3 and an infusion of morphine was started, with an average consumption of 24 mg per day.

There were no complications of the technique.

**Case 2**
A 16-year-old boy, weight 80 kg, admitted in the pediatric intensive care unit due to polytraumatism. He had pelvic fracture, right femur fracture and severe lesions of the right femoral artery and vein, which led to below-knee right lower limb amputation.

He had poor lower limb pain control, compatible with neuropathic pain (DN4 score of 6/10, NPS of 6/10 at rest and 10/10 during nursing care, needed twice daily) with 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.

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

We performed a continuous ESP block at the level of T10 with ropivacaine 0.375% (20 ml every 6 hours), which led to a better analgesic effect during 5 days (maximum NPS of 3/10) and the reduction of daily dose of morphine to 44 mg/day.

There were no complications of the technique.

**Case 3**
A 69-year-old male, admitted in 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 with approximately 30 cm of length. His usual platelet count was around 30000–40000/μl which lowered to a minimum of 5000/μl.

His ventilator weaning was difficult due to a poor acute pain management with a multimodal strategy with paracetamol (4 g/day), ketamine (0.5 mg/kg/h) and morphine (140 mg/day).

We performed a continuous left ESP block at the level of T7 with ropivacaine 0.2%, 20 ml every 4 hours, which allowed adequate analgesia and extubation after 6 hours.

There were no complications of the technique.

Case 4

A 71-year-old male, admitted in the intensive care unit after open endoluminal aortic thrombectomy, with a left subcostal incision and a thoracotomy at the level of the 6th intercostal space.

The surgical procedure he was submitted to needed post-operative systemic anticoagulation and, as such, he was under therapeutic anticoagulation with enoxaparin (1 mg/kg/day, adjusted to acute kidney injury and an estimated glomerular filtration rate below 30 ml/min) and presented with thrombocytopenia of 80000/μl.

He presented with acute pain with NPS of 7/10 with a multimodal analgesic strategy with paracetamol (4 g/day), ketamine (0.2 mg/kg/h) and fentanyl (3 μg/kg/h), which didn’t allow ventilatory weaning.

We performed a continuous left ESP block at the level of T6, with ropivacaine 0.2%, 20 ml every 4 hours, and the patient presented adequate analgesia, which allowed extubation after 4 hours.

There were no complications of the technique.
**Case 5**

A 21-year-old male, admitted in the intensive care unit due to hemorrhagic shock due to massive left hemothorax and hypertensive pneumothorax after penetrating thoracic trauma, complicated with cardiac arrest. He was submitted to an emergent lung atypical resection with a left thoracotomy at the level of the 6th intercostal space.

After correction of INR and aPTT, he still presented with thrombocytopenia (43000/μl).

Ventilatory weaning was difficult by poor pain control as the patient referred a NPS of 9/10 under a multimodal strategy with paracetamol (4 g/day), ketamine (0.3 mg/kg/h) and fentanyl (3 μg/kg/h).

We performed a continuous left ESP block at the level of T5, with ropivacaine 0.2%, 20 ml every 4 hours, and the patient presented adequate analgesia, which allowed extubation after 4 hours.

There were no complications of the technique.
Discussion

Patients with altered hemostasis have limited options for regional analgesia techniques for thoracic or abdominal visceral pain, such as thoracic or lumbar epidural or paravertebral block. ESP block is a fascial plane block performed between the transverse processes and the erector spinae muscles, with a moderate level of difficulty of performance, that can provide adequate analgesia through multiple dermatomes by the cephalocaudal spread, as reported by Ivanusic et al. [8]. Although this study reported no spread of dye to ventral rami, multiple reports have been published that support the evidence compatible of anterior spread of local anesthetic that provide visceral fibers block, namely its use in thoracic, cardiac and abdominal surgery [9–13]. A recent case report described a Harlequin syndrome after ESP block performance, which is clearly compatible with anterior spread of local anesthetic, responsible for sympathetic fiber chain block [14].

We believe that although in cadaveric studies the anterior spread of dye has not been yet well established, currently that is enough clinical reports that support the evidence that this anterior spread does exist, which 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 by respiratory movements, either spontaneous breathing or by mechanical ventilation, which may be a major factor that improves anterior spread of local anesthetic.

We achieved an adequate analgesia in all patients. We observed 70% to 89% of reduction in the Numeric Pain Scale and 83% to 100% of reduction in opioid consumption (see table 1). This accomplishment allowed all to be successfully weaned from the ventilator on the following hours.

There is a safe distance between this anatomical fascial plane and neuraxis or pleura, which under ultrasound guidance may make it a suitable block to perform in patients with altered hemostasis. This hypothesis has not been tested in randomized controlled trials and the security of performing this technique in those circumstances has not been yet tested.
We performed this technique in 5 patients with major hemostasis alterations, such as severe thrombocytopenia, INR > 1.5 and one patient under therapeutic anticoagulation with low molecular weight heparin.

We didn't report any complication during the 5 days following the performance of the technique, namely neurologic, such as spinal hematoma or nerve root compression, or hemorrhagic, such as internal or external bleeding.

Although this description may represent a small pool of patients, it is the biggest one of our knowledge and may represent a major contribution to define this block as a safe alternative in patients with altered hemostasis.

The duration of mechanical ventilation and the use of deep sedation have been linked with increased mortality and delirium in intensive care practice. An adequate analgesic regimen allows patients to be mechanically ventilated with a lower level of sedation, for a shortest time, which allows for a quicker ventilatory weaning and extubation, which are main goals in this setting. As such, ESP block may represent a regional analgesic technique with a moderate level of difficulty, that can be applied in patients with altered hemostasis and inadequate pain control and allow them to be quickly and successfully weaned from the ventilator. This may be particularly important in trauma and surgical patients, in which this technique may allow for less days of mechanical ventilation and eventually less mortality, which are points that the authors find particularly interesting and deserve further studies [15].

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


### Table 1. Description of the 5 Clinical Cases

<table>
<thead>
<tr>
<th>Case</th>
<th>Diagnosis / Procedure</th>
<th>Maximum NPS (0 – 10)</th>
<th>Initial analgesic regimen</th>
<th>Opioid in equivalent morphine daily dose</th>
<th>Altered hemostasis</th>
<th>Platelet count</th>
<th>Level of ESP block</th>
<th>Single-shot vs continuous technique</th>
<th>Local anesthetic regimen</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acute necrohemorragic pancreatitis with multiorgan disfunction</td>
<td>10</td>
<td>Paracetamol (3g/day)</td>
<td>Ketamine (0.15mg/kg/hour)</td>
<td>Yes (2.52)</td>
<td>Yes (1.55x)</td>
<td>T7</td>
<td>Single-shot</td>
<td>Ropivacaine</td>
<td>0.5% No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Paracetamol (3g/day)</td>
<td>- Ketamine (0.3mg/kg/hour)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20ml, bilaterally</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Right lower limb amputation (below knee)</td>
<td>10</td>
<td>Paracetamol (3g/day)</td>
<td>Ketamine (0.3mg/kg/hour)</td>
<td>Yes (1.8 - 2.24)</td>
<td>No</td>
<td>T1</td>
<td>Continuous</td>
<td>Ropivacaine</td>
<td>0.375% No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Paracetamol (4g/day)</td>
<td>- Ketamine (0.5mg/kg/hour)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20ml every 6 hours</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Open splenectomy and left nephrectomy</td>
<td>10</td>
<td>Paracetamol (4g/day)</td>
<td>Ketamine (0.5mg/kg/hour)</td>
<td>Yes (5000)</td>
<td>No</td>
<td>T7</td>
<td>Continuous</td>
<td>Ropivacaine</td>
<td>0.2% No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Paracetamol (4g/day)</td>
<td>- Ketamine (0.2mg/kg/hour)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20ml every 4 hours</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Open endoluminal aortic thrombectomy</td>
<td>7</td>
<td>Paracetamol (4g/day)</td>
<td>Ketamine (0.3mg/kg/hour)</td>
<td>Yes (80000)</td>
<td>No</td>
<td>T6</td>
<td>Continuous</td>
<td>Ropivacaine</td>
<td>0.2% No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Paracetamol (4g/day)</td>
<td>- Ketamine (0.3mg/kg/hour)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20ml every 4 hours</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Left thoracotomy</td>
<td>9</td>
<td>Paracetamol (4g/day)</td>
<td>Ketamine (0.3mg/kg/hour)</td>
<td>Yes (43000)</td>
<td>No</td>
<td>T5</td>
<td>Continuous</td>
<td>Ropivacaine</td>
<td>0.2% No</td>
</tr>
</tbody>
</table>

- N/A: Not applicable
- ESP: Epidural Anaesthesia Procedure
- INR: International Normalized Ratio
- aPTT: Activated Partial Thromboplastin Time

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