Case Report

Unilateral Erector Spinae Plane Block as Adjuvant for Open Repair of Thoracoabdominal Aortic Aneurysm: Case Report and Literature Review

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ABSTRACT

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Aortic aneurysms occur mainly due to atherosclerotic disease, and their conventional surgical repair is reserved for patients with anatomy unfavorable to endovascular repair. In this context, one of the challenges for the anesthesiologist is perioperative anesthetic-analgesic control. Although the epidural approach is considered the gold standard, it can lead to devastating complications, with neurological injury of hemorrhagic origin being the most feared. The erector spinae plane block (ESP Block) has been shown to be effective in providing anesthesia and analgesia to the chest and abdomen, and the use of adjuvants can improve the quality of the block, in addition to prolonging its duration.

Keywords: Arterial Thrombosis, Recreative Use, Nitrous Oxide, Homocysteine

INTRODUCTION

Conventional aortic aneurysm repair is indicated for patients whose condition presents unfavorable anatomical characteristics for endovascular repair. In this scenario, considering elective surgery, the gold standard analgesia, both for the intraoperative period and for the postoperative period, is epidural[1]. However, performing the epidural technique is not always possible, either because of conditions related to the patient (anticoagulation, dual antiplatelet therapy, among others) or because of technical difficulties, which may be responsible for up to 30% of failures in this technique. Complications, although rare, are severe when present, with neurological injury of hemorrhagic origin being the most feared[1]. In this context, there is a need to seek an alternative analgesic technique that provides the same quality of pain control with less risk. The erector spinae plane nerve block (ESP) is a paraspinal myofascial block initially described for thoracic analgesia. However, it has recently been shown to be efficient in promoting extensive and dense somatic and visceral analgesia at the abdominal level, being used for patients who will undergo conventional repair of abdominal aortic aneurysms[1].

CASE REPORT

A male 66-years old patient, BMI 27.7 kg/m^2), with history of arterial hypertension, former smoker for 40 years (15 packs-year) was admitted to our hospital for conventional surgical repair of a thoracoabdominal aortic aneurysm. The aneurysm was associated with posterior wall penetration in the abdominal component, measuring 75 mm in length, with partial rupture and contained hematoma. The patient was treated with daily varying doses of morphine for 10 months at the time of surgery, due to the pain caused by the aneurysm. The rest of his preoperative evaluation was unremarkable, apart from grade I diastolic dysfunction on echocardiographical examination.

Upon entering operating room, venous sedation was performed with midazolam 3mg and fentanyl 100mcg. Invasive blood pressure was achieved via right radial arterial line, an external lumbar drainage catheter (ELD) was inserted for cerebrospinal fluid (CSF) pressure monitoring (Hpbio®) and an erector spinae plane nerve block (ESP block) was performed in order to promote intra and postoperative analgesia. The blockade was performed with the aid of ultrasound (a linear probe, in a paramedian sagittal orientation, approximately 2cm away from the midline) at the level of the T8 vertebra. After correct identification of the transverse process and the erector spinae muscles over it, we proceeded initially with 1-3 mL of local anesthetic to confirm proper injection plane by visualization of a spread deep to the erector spinae muscles and superficial to the transverse process and then 30 mL of 0.4% ropivacaine with 4 mg of dexamethasone.

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General anesthesia was induced intravenously with etomidate 10mg, fentanyl 150mcg, rocuronium 100mg and lidocaine 140mg. Orotracheal intubation was performed with a double lumen tube and general anesthesia was maintained with sevoflurane 1 MAC, with an air-oxygen mixture, in a 1:1 ratio. A central venous catheter was placed. In addition, dexmedetomidine at a dose of 0.3mcg/kg/min and hourly doses of ketamine (0.3 mg/kg) were used throughout the surgery.

At the time of surgical incision (thoracotomy and laparotomy) no additional dose of opioid was used. The extent of the incision is shown in the figure below (Figure 1).

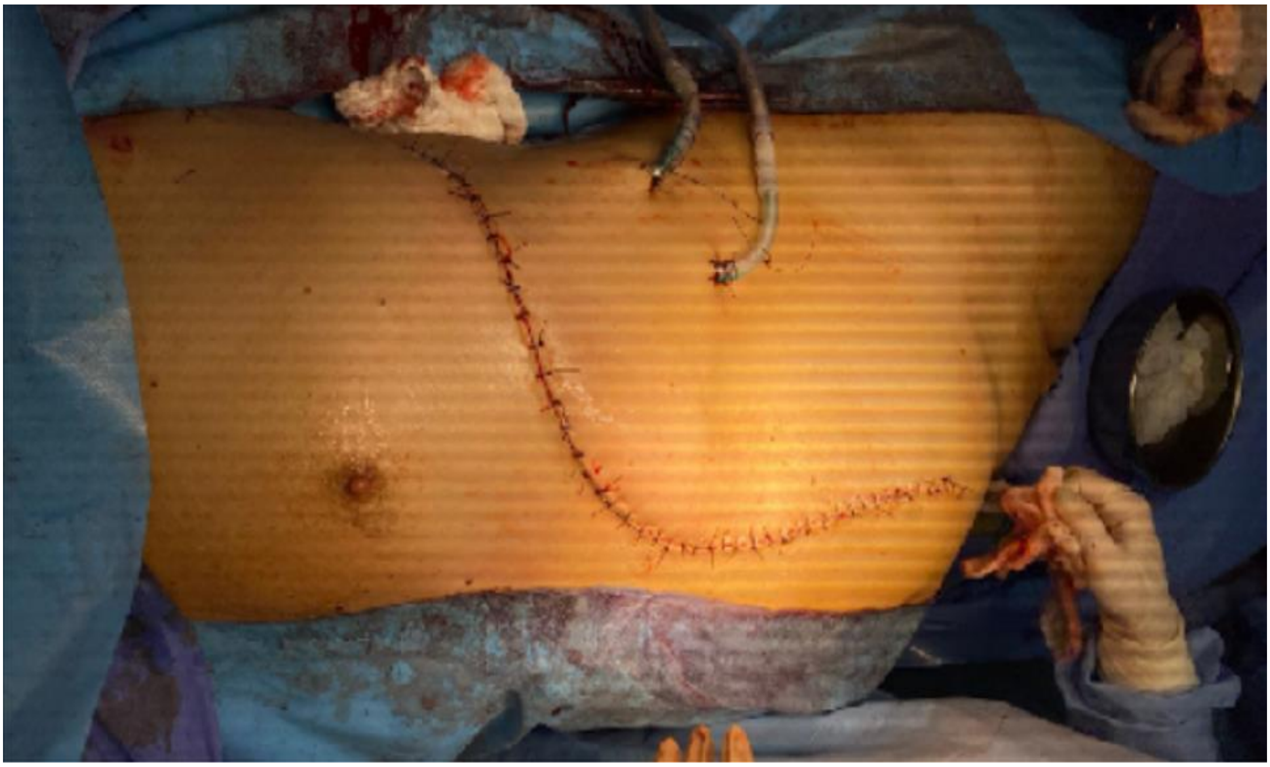

Figure 1. Patient in right lateral decubitus - final appearance of the incision after thoracotomy and laparotomy, and two chest drains.

Prior to the procedure, the patient had hematocrit: 26%, hemoglobin: 9.0 g/dL; Platelets: 188 thousand/mm3; prothrombin time (PT): 88% / INR: 1.07; APTT: 24s. The surgery lasted 4 hours, with an estimated blood loss of 1500 mL. Volume replacement was guided by a minimally invasive cardiac output monitor (Vigileo®) and ΔPP, as well as serial arterial blood gas analysis. In total 3 red blood cell concentrates (RBCs), 6 plasma concentrates (FFP), 5000 mL of Ringer-Lactate and 30 grams of Albumin were infused. At the end of the procedure, it was decided to keep the patient under mechanical ventilatory support, sedoanalgesia with propofol and fentanyl, hemodynamic control with noradrenaline (0.1-0.2 mcg/kg/min). The patient was referred to a intensive care unit (ICU), with CSF pressure monitoring and two chest drains. On the second postoperative day, the patient was extubated and the ELD catheter was removed with a normal coagulogram. Vasopressor in descalation, being removed on the third postoperative day. He received intensive kinesiotherapy and respiratory physiotherapy care, however, initially limited, as he kept complaining of pain at the site of the drains / incision, requiring opioids. We chose to repeat the ESP Block on the morning of the third postoperative day. The same volume (30 mL) of 0.3% ropivacaine with 4mg of dexamethasone was again injected into the erector spinae plane, uneventfully. Since then and on subsequent days, opioid consumption and pain scores have been progressively lower; the patient responded well to common analgesia and to the proposed morphine weaning. There was an improvement in the respiratory and ventilatory pattern, as well as progress in the global physiotherapy work. Oral feeding started on 4th postoperative day, being well tolerated and progressively evolved. On the 8th postoperative day the patient was discharged from the ICU and, after a week, he discharged from the hospital without any problems and the need of further home analgetics.

DISCUSSION

Thoracoabdominal aorta surgery

Open repair of the thoracoabdominal aorta is one of the surgical procedures that presents one of the most difficult anesthetic and perioperative handling in general, and requires broad and clear communication between anesthesiologists, surgeons and the nursing team involved in the case.

Even in specialized centers, morbidity and mortality is high (5% to 15%), particularly in cases of dissecting or ruptured aneurysms[4]. Thoracoabdominal aortic aneurysms (TAAs) occur mainly due to degenerative atherosclerotic disease (80%) and chronic aortic dissection (17%). The remaining cases are caused by trauma or connective tissue diseases. The development of degenerative and dissecting TAAs is related to weakening of the aortic wall[4].

Patients with degenerative and dissecting aneurysms tend, in most cases, to present symptoms already in the initial evaluation. Aneurysm enlargement tends to be progressive and conservative (non-surgical) treatment is associated with poor prognosis. Rupture of thoracic and abdominal segments occurs with equal frequency, particularly with aneurysms larger than 5 cm, and surgical repair is often indicated for aneurysms larger than 6 cm[5].

Open surgical repair of TAA requires extensive preoperative evaluation and planning. Preparation and monitoring should include large-caliber venous accesses for drug administration and rapid infusion of fluids and blood components, including a central venous catheter; invasive monitoring of blood pressure, temperature and, if possible, use of transesophageal echocardiogram, which allows real-time assessment of left ventricular end-diastolic volume, valve function and presence of myocardial ischemia. One-lung ventilation using a double-lumen endobronchial tube provides better visualization of the surgical field and reduces the trauma caused by lung retraction. Blood loss during AAT repair can be profound, and the anesthesiologist must be prepared for the need for massive blood transfusion. It is recommended that a sufficient amount of packed red blood cells, fresh frozen plasma and platelets be immediately available in the operating room, in addition to additional units reserved.Coagulopathy is a frequent complication during AAT repair. Dilutional coagulopathy develops during massive transfusion. Other contributing factors are residual heparin; hepatic ischemia, in which most clotting factors fail to be produced and hypothermia. Early use of fresh frozen plasma and platelets usually prevents this complication[4]. There may be a need for cryoprecipitate to correct coagulopathy, particularly when prothrombin time and partial thromboplastin time are prolonged and hypervolemia precludes administration of large volumes of fresh frozen plasma. Thoracic aorta and descending thoracoabdominal surgery can be performed without extracorporeal support. In addition to the location and extent of the aneurysm, the duration of aortic clamping is the main determinant of paraplegia and renal failure with the clamp-and-suture technique. Paraplegia is a devastating complication of surgery. When clamping times are between 30 and 60 minutes, the incidence of paraplegia increases by approximately 10% to 90% as time passes[4-5]. CSF drainage is often used to improve spinal cord perfusion during AAT repair and is important because CSF pressure generally increases with clamping of the descending thoracic aorta. This increase in CSF pressure reduces spinal cord perfusion pressure and increases the likelihood of ischemic injury. Although CSF drainage is widely used during TAA repair, it carries a risk of complications such as headache, meningitis, chronic CSF leak, spinal or epidural haematoma, and subdural haematoma[4]. In surgery without extracorporeal support, the application of aortic clamp results in significant proximal hypertension, which requires active pharmacological intervention, with vasodilators such as nitroprusside and nitroglycerin, for example. However, they should be used with caution because of the likelihood of greatly increasing body perfusion proximally to the clamp and producing hypoperfusion distally.

In addition to neurological and renal complications, pulmonary and cardiovascular complications are also very common after the surgical procedure, the latter being the main cause of perioperative mortality

Patients undergoing open surgical repair of the thoracoabdominal aorta have large incisions causing significant postoperative pain, in addition to an increased risk of developing chronic pain later in life. Appropriate pain management can decrease the incidence of postoperative reintubationand pneumonia incidence, and improve the haemodynamic stability of these patients[6]. Several anesthetic and analgesic techniques can be used to manage perioperative pain, such as intermittent intravenous analgesia and patient-controlled intravenous analgesia, or regional analgesia via fascial or paraspinal nerve blocks. The use of epidural analgesia should take into account any associated surgery complications (e.g. coagulation abnormalities) and the need for CSF monitoring.

Erector spinae plane nerve block

ESP block in a relatively new technique, first described in 2016 by Forero et al,[7] as analgesic technique for neuropathetic pain. Since then, it has been effectively used for various clinical and surgical conditions. Each superior thoracic spinal nerve divides into a dorsal and ventral branch on its exit from the intervertebral foramen. The dorsal branch travels posteriorly through the costotransverse foramen and ascends in the erector spinae plane (ESP). This is formed by 3 muscles that run thelength of the spine from the base of the skull to the medial crest of the sacrum: iliocostal, longissimus and spinal. Here, the dorsal branch divides into lateral and medial branches. The medial branch continues to ascend through the rhomboid major and trapezius muscles in a superficial location before terminating in a posterior cutaneous branch.The ventral branch travels laterally as the intercostal nerve, running first deep to the internal intercostal membrane and then in the plane between the internal intercostal muscle and the inner surface of the rib. The lateral cutaneous branch arises from the intercostal nerve near the angle of the rib and ascends to a location superficial to the anterior and posterior branches that supply the lateral thoracic wall (Fig. 2). The intercostal nerve terminates in an anterior cutaneous branch that innervates the anterior chest wall and upper abdomen. In addition to these mainbranches, each intercostal nerve also gives rise to multiple muscle branches that innervate the intercostal muscles, as well as intersegmental communicant branches[7].

Standard practice for performing an ESP block today uses ultrasound to deposit local anesthetic deep into the 3 columns of muscle. The goal of an ESP block is compartmentalized spread; its strength depends on the local anesthetic agent passively distributing itself within the plane until it reaches the target nerves. The prevailing theory is that, due to the discontinuity of the intercostal muscles, local anesthetic diffuses anteriorly to the ventral and dorsal rami of the spinal nerves and through the intertransverse connective tissue to enter the thoracic paravertebral space[8].

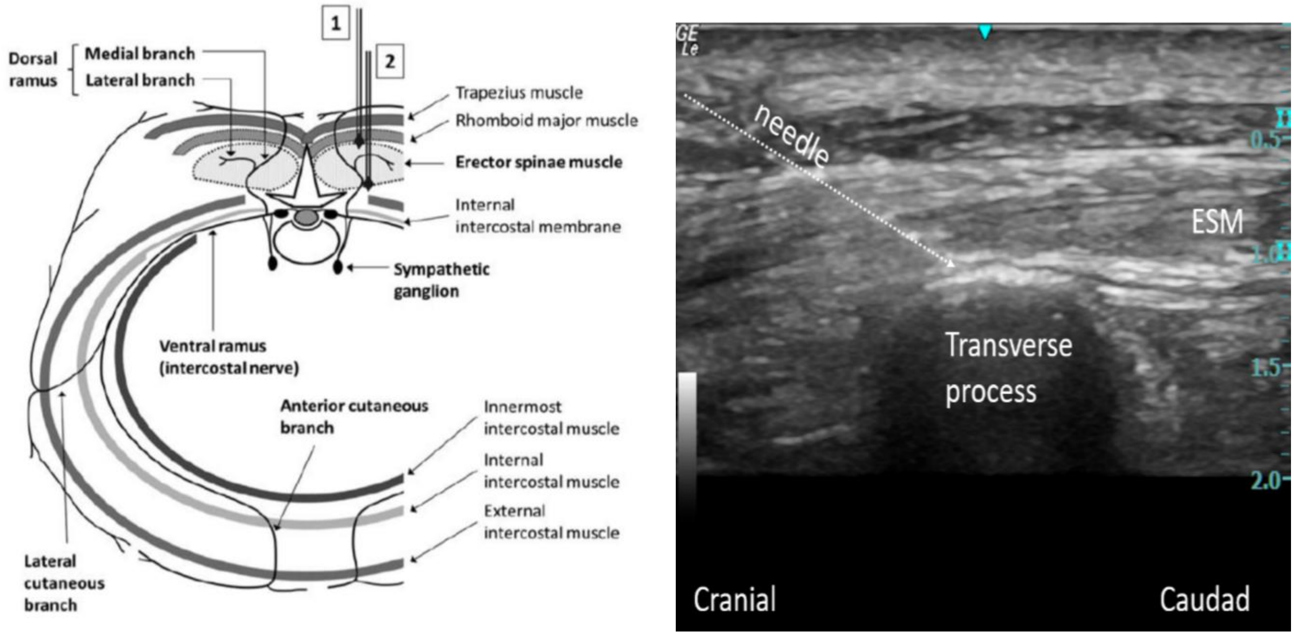

Figure 2. Schematic illustration of anatomy left. It is recommended to perform ESP block deep (needle approach 2) rather than superficial (needle approach 1) to the erector spinae muscle in order to deposit the local anesthetic close to the costotransverse foramina and the origin of the dorsal and ventral rami[7]. At the right transverse plane ultrasound view with faint image of pleura[8].

Our patient underwent a major surgery, with extensive surgical access, covering practically the entire left hemithorax and abdomen, with great potential for pain, the erector spinae plane block (ESP Block) with ropivacaine plus dexamethasone[10-12] provided excellent intraoperative analgesia, without the need for supplementation with opioids. Additionally, the repetition of the block on the second post-operative day provided good pain control, facilitating patient's rehabilitation work, greater ventilatory comfort, in addition to reducing the need for rescueopioids. Considering that the patient made chronic use of morphine prior to the surgical procedure, we believe that the adequate analgesia provided by the blockade both intraoperatively and postoperatively facilitated the de-escalation and withdrawal of this opioid, allowing the patient to be discharged without the need for analgesics. The findings of several studies presented in this paper corroborate our impression, indicating that the erector spinae plane block is a safe and effective anesthetic and analgesic strategy for thoracoabdominal surgery

CONCLUSION

In the case presented, the patient arrived at the hospital dependent on morphine and underwent major surgery and cardiovascular risk. The anesthetic technique chosen provided less consumption of intraoperative anesthetics and postoperative analgesics, as well as facilitating respiratory and global rehabilitation, providing analgesia for an adequate period of time, and

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allowing the discontinuation of chronically used opioids. In this context, the erector spinae plane blockade has been shown to be a safe, simple and effective technique for thoracic surgical procedures; should be considered as part of the multimodal analgesia strategies.

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