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Application of a conventional paravertebral block on the thorax with a novel intrathoracic approach during the intraoperative period: Two case reports

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Abstract

Pain management significantly reduces mortality by aiding in the effective elimination of secretions after thoracic surgery. We present two cases requiring emergency surgical intervention due to major trauma. Both patients were provided pain control with an intrathoracic approach of the paravertebral block performed by a sterile-clothed anesthetist with a single-shot 20 ml injection of 0.25% bupivacaine from the inner surface to the superior costo-transverse ligament (SCTL). After extubation, the measured VAS score was no higher than 3–4, and the patients could breathe and cough comfortably. The intrathoracic approach may be an effective method to implement for postoperative acute pain.

Keywords: paravertebral space, intrathoracic approach, major thoracic trauma, superior costo-transverse ligament

Introduction

Pain management contributes to physical rehabilitation; therefore, it impacts mortality after major thoracic surgery by reducing the release of stress factors and inflammatory mediators. Pain management also reduces the incidence of atelectasis and pneumonia by enabling patients to eliminate secretions effectively with comfortable coughing [1].

Although epidural analgesia is considered the gold standard in pain management, it can be contraindicated or difficult to apply, leaving hemodynamically stable and unilateral paravertebral block (PVB) as an alternative choice [2]. PVB has been used for many years with the loss of resistance technique that forms after passing the superior costo-transverse ligament (SCTL) [3].

In cases of major trauma, the primary target of pain relief is to start the surgery and provide hemodynamics. Here, we present two patients whose pain control was ensured by intrathoracic application as an alternative to conventional PVB at the end of surgery.

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Case presentation

Case 1: A 37-year-old male patient with Chronic obstructive pulmonary disease (COPD) disease had severe thoracic trauma injury due to a traffic accident caused by a car rolling onto him from a high place. He experienced multiple rib fractures in many places, from the first rib to the tenth rib, haemopneumothorax, and extensive subcutaneous emphysema on the right side, as detected from thorax computed tomography (CT) scans (Figure 1a). The patient's preoperative hemodynamic values were a measured non-invasive brachial arterial pressure (BAP) of 64/36, SpO2 of 83% and heart rate (HR) of 151. In the induction phase, 1 mcg/kg fentanyl, 0.5 mg/kg ketamine, 0.5 mg/kg propofol, and 0.5 mg/kg rocuronium were administered. After double lumen intubation, the patient was placed in the decubitus position on the left lateral side and left radial arterial monitoring was achieved. After repair of the related traumas, thoracic integrity was established by applying six fixators (posterior of the 3rd, 4th, 5th, 6th and 7th ribs and anterior of the 4th rib) to the major rib fractures (Figure 1b). Before extubation, the patient's invasive radial arterial pressure (RAP), SpO2, and HR were measured as 130/71, 97% and 61, respectively.

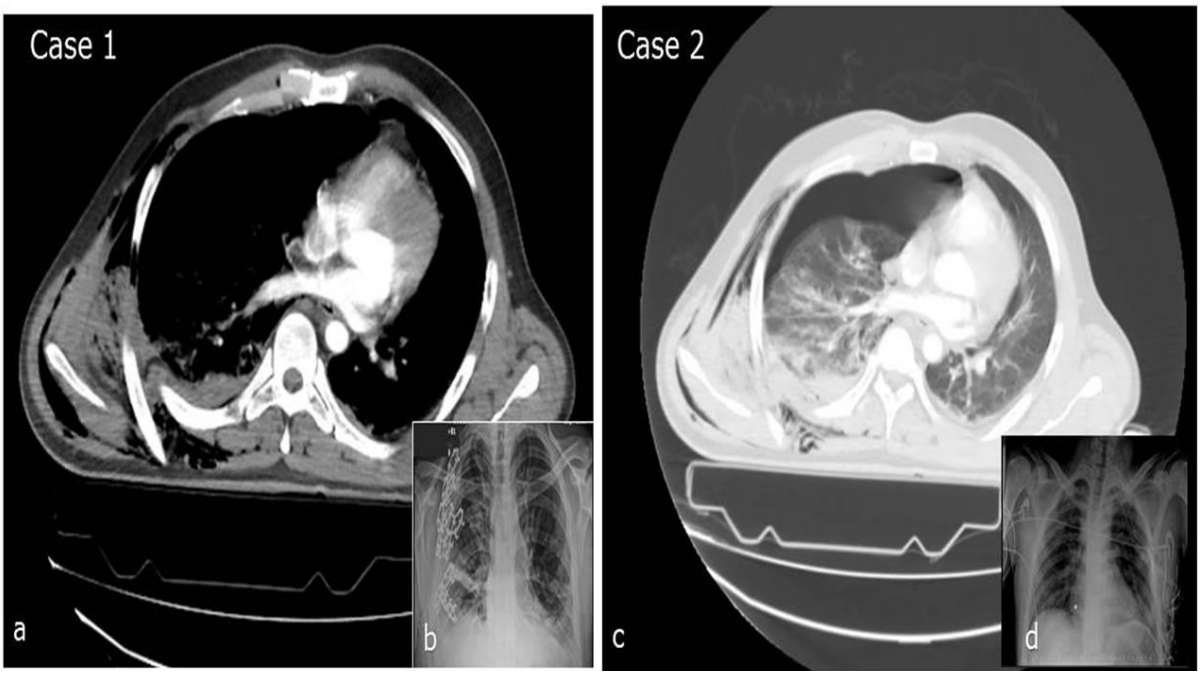
After extubation, the patient had extensive pulmonary secretions but was observed to breathe and cough easily and had a Visual Analog Scale (VAS) score of 3–4. The patient's invasive RAP, SpO2, and HR were 138/76, 92% and 83, respectively. The VAS score did not exceed 3–4 in the first 12 h. The patient received 100 mg of tramadol and 75 mg of diclofenac three times a day after 12 h as a routine pain treatment. The VAS score was assessed as 1–2 in the 24th hour. An intraspinal injection of 0.2 mg morphine was administered at L4-5 to the patient when he had difficulty coughing and discarding his secretions, and his VAS score increased to 3–4 in the 36th hour. After the injection, the VAS score decreased to 1–2, and the patient again began to cough easily and discard his secretions. He did not describe any chest pain in the 48th and 72nd hours. No additional problem was detected in the continuing follow-ups, and the patient was discharged on the 12th postoperative day.

Case 2: A 22-year-old male patient was brought into the emergency service due to a sharp object injury at 3.5 cm below the breast on the left mid-axillary line. Surgery was immediately performed on a massive haemothorax on the left side detected by thoracic CT (Figure 1c). The patient's preoperative hemodynamic values were measured as a non-invasive ABP of 83/41, SpO2 of 90%, and HR of 138. In the induction phase, 1 mcg/kg fentanyl, 0.5 mg/kg ketamine, 0.5 mg/kg propofol, and 0.5 mg/kg rocuronium were administered. After double lumen intubation, the patient was placed in the decubitus position on the right lateral side, and right radial arterial monitoring was achieved. The intercostal arterial hemorrhage and an approximately 2.5 cm laceration of the lung were repaired from the 5th intercostal space. Before extubation, the patient's invasive RAP, SpO2, and HR were measured as 121/65, 97%, and 97, respectively.

After the extubation, the patient had a VAS score of 3–4 and was breathing comfortably. Postoperative VAS scores ranged between 0 and 2, and no additional analgesia was required. No additional problems were detected in the continuing follow-ups, and the patient was discharged on the 3rd postoperative day (Figure 1d).

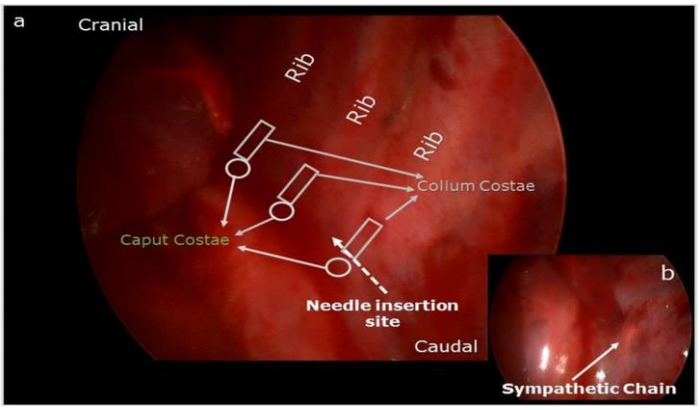
The blocks were performed just before the thoracotomy's closure and after the surgery's completion. The anesthetist wore sterile gear and was involved in the operative field from the posterior side of the patient in the lateral decubitus position. The costovertebral joint (the joint formed at the junction of the caput costae and vertebral corpus) was palpated on the inner surface of the thorax. The location of the collum costae was determined by proceeding laterally through the caput costae. The injection point was determined away from the intercostal neurovascular bundle, just above the base of the collum costae (Figure 2a), in the incision line and lateral to the sympathetic chain (Figure 2b). Our sterile medicine was connected to a 24-G blunt-ended needle and entered from the predetermined site. The needle was advanced with constant pressure, parallel to the ground, towards the SCTL. When resistance loss developed within the first 1 cm during needle orientation, and after confirming no blood or other fluids on negative aspiration, 20 mL of 0.25% bupivacaine was

Figure 1: Preoperative CT (a) and postoperative chest X-ray (b) images of Case 1. Preoperative CT (c) and postoperative chest X-ray (d) images of Case 2. CT: Computerized tomography.



administered at 1 mL per second as a single injection for postoperative analgesia. After the injection, the thoracotomy closure was routinely continued, and the surgery was terminated. At 15 min before the completion of the surgery, 100 mg of tramadol citrate was administered routinely. Extubation-induced pain in the extubated patients was prevented by administering 100 mcg of fentanyl citrate. The patient was transferred to the postoperative intensive care unit, and VAS scores were evaluated at 0, 1, 2, 4, 6, 12, 24, 36, 48, and 72 h after extubation.

Figure 2: Demonstration of the intrathoracic approach (a) and view of the sympathetic chain (b).



Discussion

Pain control and early extubation directly impact mortality, so effective pain management is important following major thoracic surgeries. However, regional approaches are difficult to apply in major traumas where the integrity of the thorax is impaired and emergency surgery is required. In these cases, alternative pain management approaches are needed [4].

One alternative site is the PVB area, which constitutes the first transition point of the peripheral nerves separated from the central nervous system and can therefore serve as an effective area for pain control. In the PVB, the SCTL is targeted as a reference point in both the conventional and ultrasound-guided (USG) approaches [5]. Our aim in this report was to present two cases in which we targeted the SCTL as an intrathoracic site for postoperative pain management.

In the PVB, fluctuation of the drug in the subpleural area is observed when targeting the anterior (or deep) regions of the SCTL. The posterior (or superficial) point of the SCTL is not a closed area, so the drug can spread to the effective cranio-caudal and pleural area via fenestras [6]. Today, the points on the posterior of the SCTL are targeted in variants (such as the Erector Spinae Plane Block [ESPB], retrolaminar and paraspinal blocks) defined to avoid the undesirable complications of the PVB [7]. The injection points at the posterior point of the SCTL are now used as the block names (ESPB, mid-transverse block, and costotransverse block) [8].

In the clinic, the applied approaches include intrathoracic approaches, intercostal blocks, pleural infiltrations or catheter application, and wound infiltration. The surgical team usually applies these approaches; however, they have disadvantages, such as a requirement for multiple injections, the possibility of catheter dislocation, the risk of infection or the formation of only a limited block in a specific area [9].

We came across only one clinical study that targeted the paravertebral area intrathoracically. In that study, the block was applied by passing the needle 5 mm at 1 cm lateral to the sympathetic chain and applying a subpleural fluctuation of 8 ml 0.5 ropivacaine at each injection, followed using two separate injection points [10]. In our study, the loss of resistance technique for the SCTL was targeted, and this is an approach that we have not encountered in any previous study. We aimed to increase the cranio-caudal spread by restricting the drug to a certain area.

A need for intubation did not develop in hemodynamically stable patients after surgery. No pulmonary pathology was observed in the ongoing recovery of patients who could actively cough and be mobilized.

Conclusion

This novel alternative method should be kept in mind because the paravertebral area is very close to the intrathoracic area and is easy to access compared to conventional approaches. In our opinion, this area deserves a multidisciplinary intrathoracic approach by the surgical-anesthetic team. Further studies are needed on the subject.

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