Transversus Thoracic Muscle Plane Block for Acute Pain Management after Sternal Wire Removal: A Case Series

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Introduction

Secure sternal closure after median sternotomy is important to facilitate sternal healing, optimize ventilatory mechanics, and minimize discomfort in the early postoperative period. Unfortunately, persistent anterior chest wall pain after sternotomy and wire closure can occur in as many as 28% of patients after median sternotomy. Although the underlying primary etiology of this pain is often unclear, secondary causes include sternal irritation, scar entrapment neuralgia, chondritis, wire hypersensitivity reaction, and protruding wires. Perioperative pain management after cardiac surgery has traditionally been accomplished with liberal use of potent narcotics. Fascial plane blocks can help to decrease opioid consumption, improve patient pain scores, decrease duration of hospitalization, and thus may be be useful in minimizing pain. We present two cases in which transversus thoracic plane blocks (TTPB) were used to minimize opioid requirements as part of enhanced recovery after a cardiac surgery for sternal wire removal.

Case Reports

Case 1: An 84-year old 82-kg male with significant past medical history including hypertension, chronic atrial fibrillation, CHF, renal insufficiency, aortic valve replacement (2005), ascending aortic aneurysm repair (2002) and mitral valve repair (1989), presented for the removal of sternal wires protruding from his upper sternum that were causing him sternal pain. Of note, the patient related significant recent weight loss and his physical examination was notable for a lean body habitus.

Case 2: a 77-year old 88 kg male with significant past medical history including hypertension, CAD, DM type II, and coronary artery bypass grafting two years prior, presented for removal of sternal wires due to persistent midsternal discomfort with movement thought to be secondary to his sternal wires.

After a thorough discussion, both patients consented to bilateral transversus thoracic plane blocks (TTPB) as part of an enhanced recovery after cardiac surgery (ERAS-C) multimodal pain management plan.

Case Report (continued)

Written consent for publication of non-identifying medical information and Health Insurance Portability and Accountability Act authorization was obtained. In both patients, general anesthesia was induced with propofol, midazolam, and rocuronium. Bilateral TTP bocks were then performed at the T4 level. After chlorhexidine 4% prep, the ultrasound probe was positioned in a parasagittal orientation to obtain a parasternal view (Figure 1). The ribs were identified as hyperechoic structures with acoustic shadowing below (Figure 3). The block needle was inserted in a cranial-to-caudal direction using the in-plane technique. When the needle tip was positioned just below the intercostal muscle, the correct tip position was confirmed by the visualization of linear fluid spreading in the myofascial plane between the transversus thoracic and internal intercostal muscles (Figure 4). Fifteen milliliters of 0.25% bupivacaine with 10 ml of liposomal bupivacaine was injected in 5 ml aliquots. This procedure was repeated on the opposite side for a total of 50 ml of local anesthetic. All blocks were performed with Ultrasound-guidance using a linear array ultrasonography 8-13 Hz probe (HFL38x, M-Turbo; SonoSite, Bothwell, WA) and 50-mm 22-gauge Stimulplex needle (B-Braun, Melsungen, Germany). Anesthesia was maintained in both patients with sevoflurane and rocuronium. Both patients received 1000 mg intravenous acetamionophen, 15 mg ketoralac, and 4 mg dexamethasone prior to surgical incision. The patient in Case one had two sternal wire removed and the patient in Case two had six sternal wires removed (Figure 2). After completion of surgery, both patients were taken to the postanesthesia care unit (PACU). Demographic and pain information on each case is illustrated in the table below:

Case Number	Age (y)	Sex	Opioid Consumption in MME during Admission	Time in PACU (hours)	Pain Score In PACU
1	84	M	0	6	0
2	77	M	0	2.5	2

Both patients made an unremarkable recovery without narcotics and were discharged home on the day of surgery. Both patients noted complete resolution of their preoperative pain during their postoperative visit with their surgeon two weeks after surgery.

Discussion

In these case reports, a single-shot injection provided analgesia at multiple intercostal levels due to the cranial-caudal spread of local anesthetic. Liposomal bupivacaine was utilized to provide extended analgesia at the site of surgical incision. While the potential risk of pneumothorax and internal mammary artery injury does exist during TTPB, we did not observe this adverse event clinically. Limitations of this case series include small sample size, non-homogenous distribution of patients, as well as the fact that the sensory-cutaneous blockage could not be evaluated because the blocks were administered after the induction of general anesthesia.

Conclusion

Combined regional anesthesia techniques may be underutilized in the population of patients with acute post-sternotomy pain, and increased usage may provide significant benefits for both patient morbidity and satisfaction. In these particular patients, the combination of intraoperative conduction blockade with TTPB, administration of anti-inflammatory agents, and modulation of nociceptive processing may explain the robust analgesic effect observed in these case reports. The potential that this multimodal anesthetic approach may hold for significantly improving postoperative pain control in this patient population as part of an enhanced recovery after cardiac surgery warrants further investigation.

References

Special thanks to Bill Lahiff for assistance with poster authorship and technical support.

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Figures

Fig 1. Staged photograph showing transducer and needle orientation during transversus thoracic muscle plane block.

Fig 2. Staged photograph showing anterior chest wall with sternal wires in situ

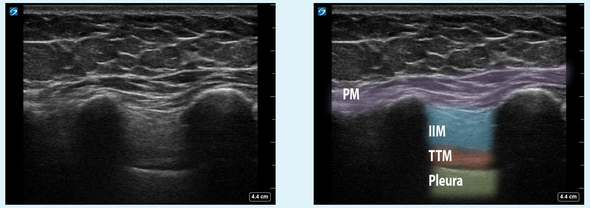

Fig 3. Pre-block TTP ultrasound image between the fourth and fifth ribs parasagittal to the sternum. At the lateral edge of the sternum each muscle layer, the pectoralis major (PM), internal intercostal (IIM), and transversus thoracic muscle (TTM), as well as the pleura, are shown.

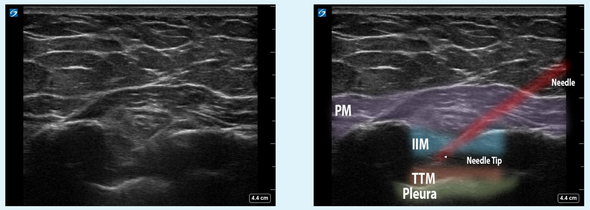

Fig 4. Peri-block TTP ultrasound image between the fourth and fifth ribs parasagittal to the sternum. At the lateral edge of the sternum each muscle layer, the pectoralis major (PM), internal intercostal (IIM), and transversus thoracic muscle (TTM), as well as the pleura and block needle are shown.