Case Report

Continuous Bilateral Transversus Thoracicmuscle Plane Block: An Analgesia Boon for Scoliotic Patients Undergoing Cardiac Surgery

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ABSTRACT

A person with thoracolumbar scoliosis for cardiac surgery presents with problems of restrictive lung disease with the additional risk of reduced lung compliance and respiratory complications compared to the other patients. Post-operative analgesia in the form of continuous bilateral transversus thoracic muscle plane block (TTMPB) may help such patients in early respiratory rehabilitation by decreasing the time to extubation, reducing the opioid requirement, and early initiation of physiotherapy decreasing the risk of complications.

Keywords: Analgesia, scoliosis, transversus thoracic muscle plane block

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INTRODUCTION

Thoracolumbar scoliosis is associated with abnormal thoracic muscle development and impaired alveolar growth,[1,2] increasing their risk of reduced pulmonary function after sternotomy.[3] In such patients, a robust multimodal analgesia plan with early rehabilitation may improve respiratory outcomes.[4] The transversus thoracic muscle plane block (TTMPB) decreases immediate post-operative pain, decreases opioid use, and can be helpful in the early initiation of respiratory physiotherapy in cardiac surgery patients.[5] However, the efficacy of bilateral continuous TTMPB in improving patient outcomes is not yet known. We report a case of a patient with thoracolumbar scoliosis undergoing atrial septal defect (ASD) closure, managed with bilateral continuous TTMPB in the postoperative period, resulting in favorable outcomes. The patient provided written informed consent for the publication of this case report.

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CASE REPORT

A 32-year female patient, (weight 50 kgs, height 137.6 cms), came to our outpatient department with complaints of breathlessness on walking and abnormal sensation of her heartbeat. She was diagnosed with 38 mm ostium secundum ASD (left to right shunt), aneurysmal inter-atrial septum, moderate tricuspid regurgitation, dilated right heart, and 60% left ventricle ejection fraction. The pulmonary artery pressures were 64/22 mmHg, Qp: Qs 3:7, and an indexed pulmonary vascular resistance of 3.5 WU. She had an irregularly irregular heartbeat with electrocardiogram changes of atrial fibrillation, for which she underwent radio-frequency ablation before surgery. Additionally, she had thoracolumbar scoliosis (Cobb's angle 60 degrees) [Figure 1] and Mayer-Rokitansky-Küster-Hauser

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syndrome. Her functional vital capacity was 47% and forced expiratory volume in first second was 56% of predicted showing moderate restrictive lung disease. Her exertional room air saturation was measured at 94%.

In the operating room, the anesthesia was induced with graded doses of propofol and 2 mcg/kg of fentanyl, and endotracheal intubation was facilitated with 0.1 mg/kg of vecuronium. The surgery proceeded with midline sternotomy, cardioplegic arrest using St. Thomas cardioplegic solution, and normothermic bypass were maintained with an aortic cross-clamp time of 33 minutes and bypass time of 60 minutes. A polytetrafluoroethylene patch repair of ASD was performed, and the post-repair transesophageal echocardiography showed the absence of residual ASD, mild tricuspid regurgitation, and good biventricular functions. She was supported with noradrenaline 0.05 mcg/kg/minute.

After normalization of activated clotting time and sternum closure, bilateral TTMPB was performed under ultrasound guidance and using 18 G Tuohy's needle. The 6–13 MHz linear probe (Sonosite Fujifilm M-Turbo) was placed atfourth intercostal space 1 cm lateral to the sternum and the internal intercostal, transversus thoracic, internal thoracic artery, and vein were identified. For the right side, the probe was positioned longitudinally [Figure 2] and transversely on the left side [Figure 3]. The localization of the interfacial plane between the inner intercostal and transversus thoracic muscles was confirmed with 5 ml hydro-dissection on each side by observing the downward movement of the pleura. A dose of 20 ml of 0.2% ropivacaine was injected bilaterally and an epidural catheter was inserted upto 6 cm. This was connected to a single drug injection port created using three-way stopcocks to facilitate continuous infusion of local anesthesia post-operatively. Additionally, 10 ml of 0.2% ropivacaine was infiltered around the chest tube. The post-operative analgesia was planned as a continuous infusion of 0.2% ropivacaine at 10 ml/hour (started after four hours) [Figure 4] with intravenous patient-controlled analgesia (IV-PCA) of 10 mcg/bolus of fentanyl with lock-out interval of 10 minutes. This was supplemented with an injection paracetamol 1 gm six hourly. The patient was shifted to the intensive care unit and extubated in the next hour. The TTMPB and IV-PCA were continued for five days. The time to first bolus opioid requirement was 210 minutes. The total fentanyl consumption up till day 5 was 240 mcg. She had maximum numerical pain scores of 4/10 on mobilization on day 0 which decreased to 1-2/10 at rest and 2-3/10 on mobilization and physiotherapy on the fifth day. The patient could be ambulated with incentive spirometry on post-operative day one. She maintained good oxygenation and ventilation during the post-operative stay. She was discharged home on day six and has been doing well in her follow-up visits.

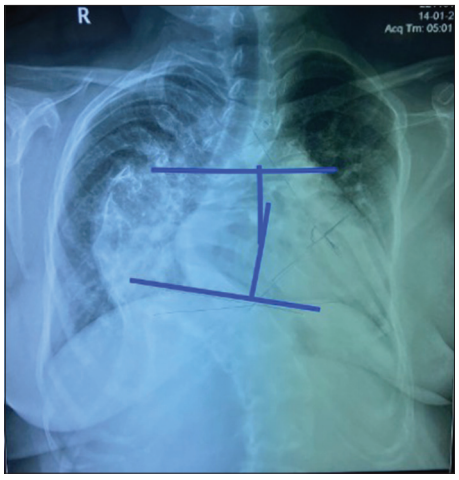

Figure 1: Pre-operative chest roentgenogram showing thoracolumbar scoliosis with Cobb's angle of 60 degrees

DISCUSSION

This case highlights the utility of continuous bilateral TTMPB for post-operative analgesia after sternotomy. The continuous bilateral TTMPB resulted in early post-operative extubation, decreased opioid consumption, and early patient recovery. We selected TTMPB for our patient because of its anterior approach to the intercostal nerve, less local anesthesia requirement, and easy visualization of muscle planes in a patient with severe scoliosis.

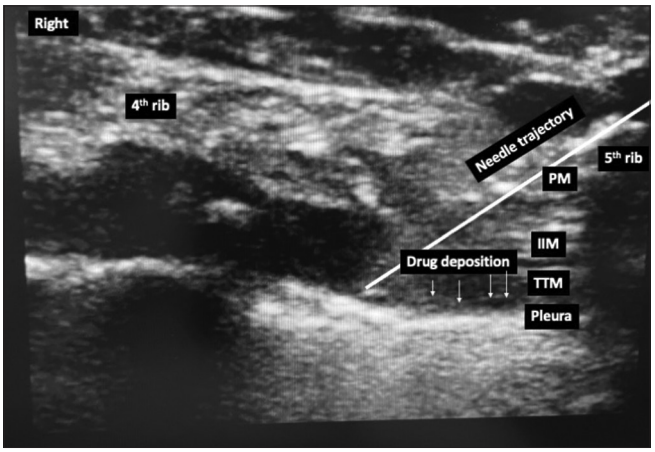

Figure 2: The ultrasound image showing out of the plane technique for Tuohy's needle placement between the inner intercostal and transverses thoracic muscles, depositing the ropivacaine between transverse abdominis muscle and transversalis fascia on the right side *(IIM: Internal intercostal muscle; PM: Pectoralis major; TTM: Transversus thoracic muscle)*

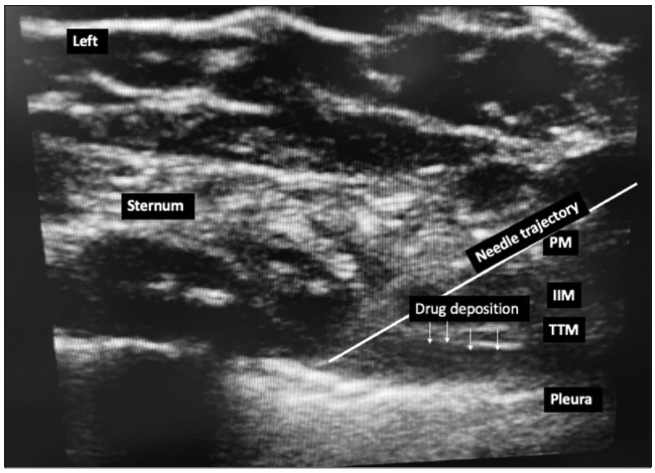

Figure 3: The ultrasound image showing an in-plane technique for Tuohy's needle placement between the inner intercostal and transverses thoracic muscles, depositing the ropivacaine between transverse abdominis muscle and transversalis fascia on the left side *(IIM: Internal intercostal muscle; PM: Pectoralis major; TTM: Transversus thoracic muscle)*

Figure 4: Final arrangement with bilateral catheters connected at the distal end with three-way connectors

Scoliosis causes spine and chest wall deformities, impairing alveolar growth and thoracic muscle strength, making the lungs less compliant.[1] The decreased vital capacity is compensated with an increased work of breathing, early muscle fatigue, and respiratory failure. An effective post-operative analgesia regimen facilitates early mobilization, improves respiratory functions, decreasing the length of intensive care unit stay, and improving patient outcomes.[4,6]

The variation in pain thresholds mandates an individualized multi-modal analgesia regimen for patient satisfaction.[7] The epidural and paravertebral blocks are seldom used because of the risk of hematoma.[8] Single-shot neuraxial block may provide inadequate analgesia in a scoliotic spine.[9] Bilateral erector spinae block requires a larger drug volume and provides analgesia only upto the posterior axillary line.[10] TTMPB is a novel fascial plane block first described by Ueshima and Kitamura in 2015.[5] It targets the anterior branches of intercostal nerves from thoracic segments 2–6th to provide effective analgesia in the internal mammary area. The drug dosage for initial and continuous infusion for TTMP block is not defined and we assumed 4 ml of 0.2% ropivacaine per intercostal space would be required initially,[11] followed by 1 ml per intercostal space as a maintainance dose. TTMPB can be performed either in a transverse plane with needle insertion from lateral to medial direction or in a sagittal plane with needle insertion from caudal to cranial direction.[12] The transverse approach was feasible on the left because the wide-spaced intercostal spaces facilitated easy probe placement. We used the sagittal approach on the right because of the narrow intercostal spaces. The post-operative fentanyl requirement for our patient was 260 mcg compared to the average of 420 mcg in patients with only IV analgesia regimens in our hospital.

In this case, we highlight the utility of continuous bilateral TTMPB as an effective analgesia to reduce post-operative opioid requirement, decreasing time to extubation, and early mobilization providing good respiratory hemodynamics in a patient with scoliosis for cardiac surgery. Additionally, we used a continuous local anesthesia infusion, whose dosing and pharmacokinetics require further evaluation.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initial s will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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