Blok Fascial Pecto-intercostal Bilateral sebagai Analgesia untuk Median Sternotomi pada Anak

A A Gde Putra Semara Jaya [1,2*], Raden Besthadi Sukmono[1], Aries Perdana[1]

1. *Departemen Anestesiologi dan Terapi Intensif, Fakultas Kedokteran Universitas Indonesia, RSUPN Dr. Cipto Mangunkusumo, Jakarta, Indonesia*
2. *Departemen Anestesiologi dan Terapi Intensif, Fakultas Kedokteran Universitas Udayana, Rumah Sakit Mangusada, Bali, Indonesia*

**penulis korespondensi*

DOI: 10.55497/majanestcricar.v38i2.189

ABSTRAK

Median sternotomi pada anak mengakibatkan nyeri akut pascabedah dengan derajat sedang hingga berat, yang berhubungan dengan berbagai efek samping pascabedah. Blok fascia pecto-intercostal yang dipandu ultrasonografi memiliki potensi analgesia untuk median sternotomi sehingga dapat bermanfaat pada populasi anak. Kami melaporkan satu kasus anak laki-laki berusia tiga setengah tahun dengan tumor mediastinum anterior, yang akan menjalani median sternotomi dan eksisi tumor. Pasien dengan status fisik American Society of Anesthesiologists (ASA) 2, fibrosis segmen 2 dan 3 paru kanan dengan riwayat tuberkulosis paru. Eksisi tumor mediastinum anterior melalui median sternotomi berhasil dilakukan dengan fasilitasi kombinasi anestesi umum dan blok fascia pecto-intercostal bilateral. Pemulihan pascabedah juga berjalan dengan lancar. Penggunaan blok fascia pecto-intercostal bersama modalitas lainnya dapat memberikan analgesia yang memadai untuk median sternotomi.

Kata Kunci: blok fascia pecto-intercostal; sternotomi; manajemen nyeri

Bilateral Pecto-intercostal Fascial Block as Analgesia for Median Sternotomy in Children

A A Gde Putra Semara Jaya [1,2*], Raden Besthadi Sukmono[1], Aries Perdana[1]

1. *Departement of Anesthesiology and Intensif Care, Faculty of Medicine, Universitas Indonesia, Dr. Cipto Mangunkusumo National General Hospital, Jakarta, Indonesia*
2. *Department of Anesthesiology and Intensive Care, Faculty of Medicine Udayana University, Mangusada Hospital, Bali, Indonesia*

**corresponding author*

ABSTRACT

Median sternotomy in children produces moderate to severe acute postoperative pain and associated with various postoperative adverse events. Ultrasound-guided pecto-intercostal fascial block has a potential analgesic effect for median sternotomy and may give benefits in the pediatric population. We present a case of three and a half years old boy, with anterior mediastinal tumor underwent median sternotomy and tumor excision. He was assessed with American Society of Anesthesiologists (ASA) physical status 2, segment 2 and 3 right lung fibrosis with history of lung tuberculosis. Anterior mediastinal tumor excision via median sternotomy was successfully facilitated with combined general anesthesia and bilateral pecto-intercostal fascial block, and postoperative course was uneventful. This interfascial plane block may provide adequate pain control for median sternotomy in conjunction with other modalities.

Keywords: *pecto-intercostal fascial block; sternotomy; pain management*

INTRODUCTION

Median sternotomy produces moderate to severe acute postoperative pain on the first day after surgery.[1] Sternotomy pain is associated with postoperative adverse events, such as pulmonary complications, tachycardia, and persistent (or chronic) postsurgical pain.[2,3] Pediatric patients are special population that requires special consideration. Common pain management for median sternotomy in children includes opioids, nonsteroidal anti-inflammatory drugs, and regional analgesia. Systemic opioids are generally used as the primary analgesic agent, and the use of regional analgesia is not widely accepted due to technical and safety issues in children. Pediatric population may receive benefits from the use of ultrasound-guided peripheral regional analgesia. Pecto-intercostal fascial block (PIFB) is an ultrasound-guided regional analgesia that was introduced in 2014 by de la Torre et al. for breast analgesia and intended to block several anterior cutaneous branches of intercostal nerves.[4] PIFB has been described in adults for various indications. However, there are minimal supportive evidence to explore its usages and advantages in children.

CASE PRESENTATION

Authors present a case of three and a half years old boy, 13 kg of body weight, with anterior mediastinal tumor underwent median sternotomy and tumor excision. Thorax CT scan revealed right paracardial mass sized 1.5 cm x 1.8 cm x 3.3 cm. He was assessed with physical status ASA 2, segment 2 and 3 right lung fibrosis with history of lung tuberculosis and was declared treatment completed nearly six months ago. No shortness of breath and limitation in daily activities. His parents were fully informed and gave written informed consent for the use of the figure and case description.

Intravenous (IV) midazolam 0.5 mg and ketamine 5 mg were administered as premedication. The patient was induced using propofol 25 mg IV and fentanyl 25 mcg IV, and tracheal intubation was facilitated by atracurium 7.5 mg IV. General anesthesia was maintained with sevoflurane 2-2.5 vol% and 60% oxygen mixed with compressed air. After induction of general anesthesia and central venous catheter placement, with patient in supine position, skin was disinfected, and a high-frequency linear probe of Mindray M7 (Mindray, Shenzhen, China) was placed parallel to longitudinal axis of sternum on lateral border and scanned laterally to identify 4th and 5th costal cartilage (Figure 1a). The pectoralis major muscle (PMM), internal intercostal muscle (IIM), transversus thoracis muscle (TTM), ribs, and pleura were identified. Color Doppler ultrasonography was used to determine perforating branches of internal thoracic artery, which travel anteriorly through the anterior chest wall, piercing the intercostal

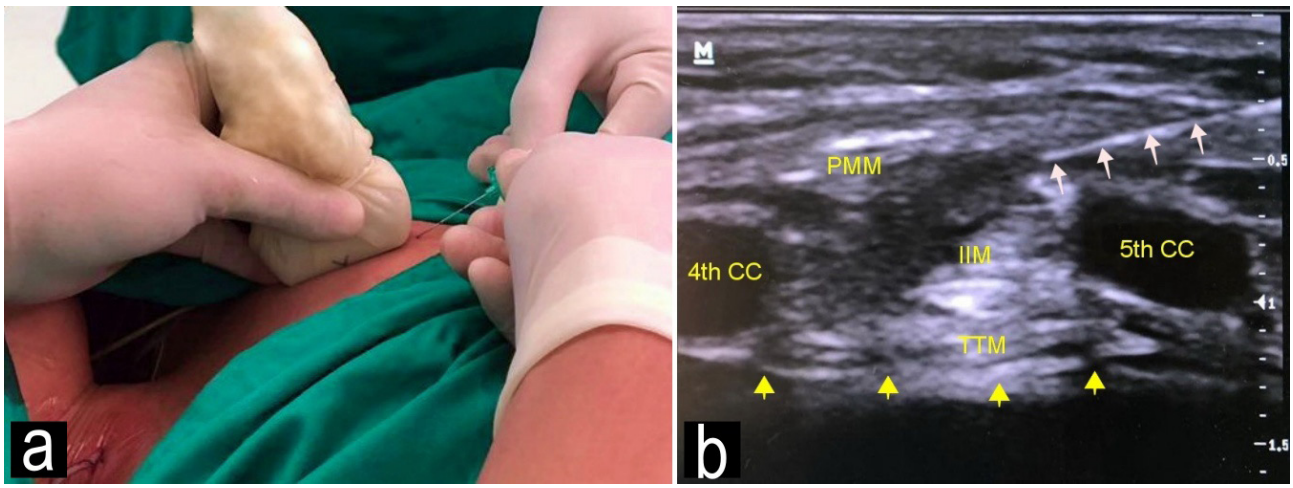

Figure 2. a. Ultrasound-guided PIFB: probe and needle position, in-plane approach, a caudal-to-cranial direction; b. The needle tip is positioned in the interfascial plane between the PMM and IIM. Notes: white arrow, needle; yellow head arrow, pleura. Abbreviations: CC, costal cartilage; IIM, internal intercostal muscle; PMM, pectoralis major muscle; TTM, transversus thoracis muscle.

muscle and PMM. A 22G, 50 mm peripheral block needle, Stimuplex® Ultra 360 (B. Braun, Melsungen, Germany) was inserted in-plane with ultrasound probe, in caudal-to-cranial direction until the tip is positioned in interfascial plane between the PMM and IIM (Figure 1b). Normal saline was used to determine correct placement of needle tip in interfascial plane, as shown by separation of fascial layers. A total of 10 mL 0.25% bupivacaine was injected bilaterally (Figure 2).

Fentanyl 25 mcg IV was administered before skin incision. No hemodynamic changes occurred during skin incision, sternal incision, and retraction. Fentanyl 20 mcg IV as a rescue was given during tumor removal because of raising blood pressure and heart rate. No additional opioid was needed until the end of surgery. The duration of surgery was 110 minutes. He was extubated immediately in the operating theater, and he looked calm and comfortable. The postoperative course was uneventful in the pediatric intensive care unit. We used paracetamol 200 mg IV QID and oral ibuprofen 150 mg TID for postoperative analgesia, and no opioid rescue was administered. In this case, we could visualize soft tissues, vessels, bone, pleura, and needle movement easily. There were no complications occur following bilateral PIFB, such as pneumothorax, hematoma, and infection.

DISCUSSION

Postoperative pain remains a problem following median sternotomy, particularly in pediatric patients who are special population that requires additional considerations. Excessive postoperative sternotomy pain reduces patient satisfaction and may lead to pulmonary complications, prolonged length of stay, and persistent (chronic) postsurgical pain. Several efforts have been done in order to manage postoperative sternotomy pain in pediatric population, such as minimally invasive surgery, multimodal analgesia, and regional anesthesia.[1–3] Systemic opioids are conventionally used as primary analgesic agent for pain management in children undergoing median sternotomy.[3] Unfortunately, opioid administration is associated with respiratory depression, prolonged sedation, and delayed extubation. The application of regional analgesia has become popular to reduce the opioid dose and side effects. Regional analgesia blocks the afferent impulses and has been shown to decrease pain and opioid requirements.[3,5] Several regional analgesia techniques, such as neuraxial, paravertebral block (PVB), erector spinae plane block (ESPB), parasternal intercostal block, pecto-intercostal fascial block, transversus thoracis muscle plane (TTP) block, and wound infiltration/infusion have been used for sternotomy pain management.[3]

In PIFB, local anesthetic is placed in the

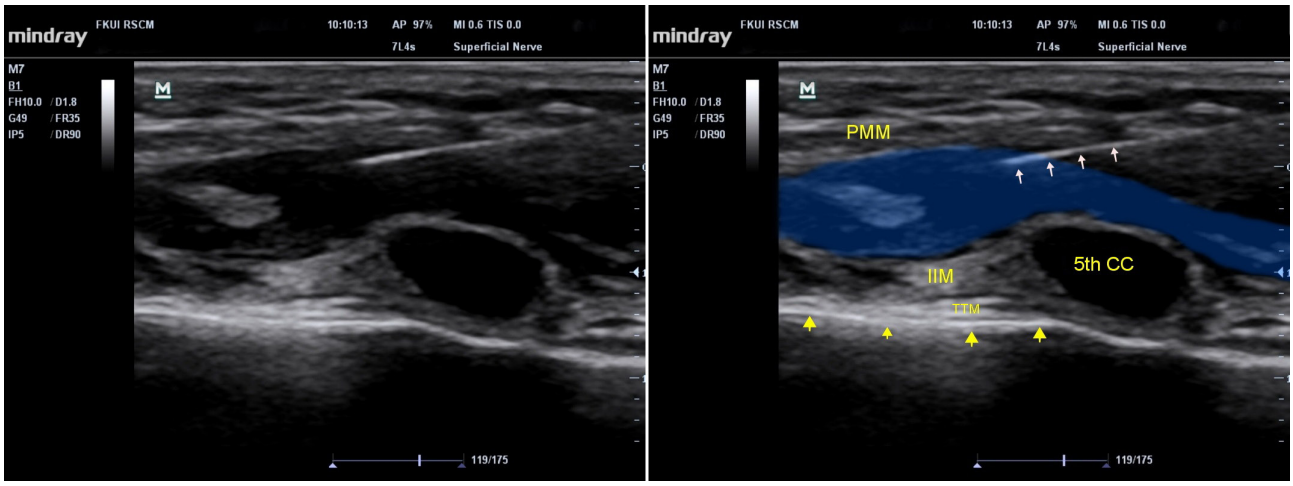

Figure 2. PIFB during the local anesthetic injection. Notes: blue-shaded area, local anesthetic; white arrow, needle; yellow head arrow, pleura. Abbreviations: CC, costal cartilage; IIM, internal intercostal muscle; PMM, pectoralis major muscle; TTM, transversus thoracis muscle.

interfascial plane between PMM and IIM to block several anterior cutaneous branches of intercostal nerves. The anterior cutaneous branches are terminal branch of intercostal nerves, which innervate sternum and skin near midline of anterior chest wall. They pierce intercostal muscles and PMM and divide into medial and lateral branches that extend over sternum and PMM respectively. The number of injections depends on local anesthetic spreading in the interfascial plane.[4,6]

Compared to other regional analgesia techniques bilateral PIFB is more beneficial based on several reasons such as, 1) PIFB is performed in supine position; therefore less manipulation is required as in neuraxial technique, PVB, and ESPB, 2) avoidance pleural puncture due to superficial target of local anesthetic placement and costal cartilage as barrier to needle advancement, compared to TTP block. In the other side, the transversus thoracis muscle in TTP block for pediatrics may be challenging to observe, 3) bilateral PIFB requires only one injection on each side, in contrast, parasternal intercostal block needs multiple injections, 4) bilateral PIFB can be used as intraoperative analgesia if performed before surgical incision, and 5) use of ultrasonography improves safety by provides visualization of soft tissues, vessels, bone, and adjacent structures; real-time visualization of needle movement and local anesthetic distribution; may avoid undesirable pleural and vessel punctures, and reduce amount of local anesthetics.

CONCLUSION

Compared to other regional analgesia techniques, bilateral PIFB is considered as an easy procedure and may provide safe and effective pain management for median sternotomy, particularly in pediatric population, which in turn improves patient satisfaction, clinical outcomes, minimize pain- and opioid-related postoperative adverse events. Several advantages of PIFB may increase the use of regional analgesia in children. However, further studies are required to verify safety and effectiveness of PIFB in pediatric population.

CONFLICT OF INTEREST

None.

REFERENCE

1. Gerbershagen HJ, Aduckathil S, van Wijck AJM, Peelen LM, Kalkman CJ, Meissner W. *Pain Intensity on the First Day after Surgery.* Anesthesiology [Internet]. 2013;118(4):934 — 44. Available from: https://dx.doi.org/10.1097/aln.0b013e31828866b3
2. Lauridsen MH, Kristensen AD, Hjortdal VE, Jensen TS, Nikolajsen L. *Chronic pain in children after cardiac surgery via sternotomy.* Cardiology in the Young [Internet]. 2013/09/21. 2014;24(5):893 — 9. Available from: https://www.ncbi.nlm.nih.gov/pubmed/24044632
3. Raj N. *Regional anesthesia for sternotomy and bypass-Beyond the epidural.* Paediatric Anaesthesia [Internet]. 2019/03/13. 2019;29(5):519 — 29. Available from: https://www.ncbi.nlm.nih.gov/pubmed/30861264
4. de la Torre PA, Garcia PD, Alvarez SL, Miguel FJ, Perez MF. *A novel ultrasound-guided block: a promising alternative for breast analgesia.* Aesthetic Surgery Journal [Internet]. 2014/01/08. 2014;34(1):198 — 200. Available from: https://www.ncbi.nlm.nih.gov/pubmed/24396082
5. Greco C. *Summary of the Pediatric Pain Management Symposium 2018 in Boston, MA.* Pain Rep [Internet]. 2018/10/17. 2018;3(Suppl1):e683. Available from: https://www.ncbi.nlm.nih.gov/pubmed/30324175
6. Liu V, Mariano ER, Prabhakar C. *Pecto-intercostal Fascial Block for Acute Poststernotomy Pain.* A & A Practice. 2018 Jun;10(12):319 — 22.