ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

https://jcardcritcare.org

Journal of Cardiac Critical Care TSS

Case Series *Cardiac Critical Care*

Pain Control Following CABG – Where do we Stand in 2023?

Rashmi Singh[1], Arindam Choudhury[1], Milind Padmakar Hote[2]

Departments of [1]Cardiac Anaesthesia and Critical Care and [2]CTVS, All India Institute of Medical Sciences, New Delhi, India.

***Corresponding author:**
Rashmi Singh,
Department of Cardiac Anaesthesia and Critical Care, All India Institute of Medical Sciences, New Delhi, India.

rashmisingh5509@gmail.com

Received : 20 February 2023
Accepted : 25 April 2023
Published : 30 May 2023

DOI
10.25259/JCCC_9_2023

Quick Response Code:

ABSTRACT

Despite conventional entity such as opioids and non-steroidal anti-inflammatory drugs, post-operative pain management, and poor pain control is still inevitable. Thus, generating the need for other modalities of post-operative pain control. Moreover, fast-tracking and enhanced recovery after anesthesia requires opioid-free multimodal analgesia. Newer, lesser invasive regional nerve blocks such as bilateral erector spinae (ESP) nerve blocks and bilateral pectoral nerve blocks are increasingly used nowadays. The use of ultrasound has made these blocks to be performed with utmost safety. A novel, interfascial plane block (namely, subpectoral interfascial plane block), has been used in pain management of rib fracture, sternal fracture, and mastectomy. We hereby want to share our experience in the institution of subpectoral interfascial plane block and ESP plane block in combating post-operative pain management following coronary artery bypass graft surgery. We have reported the efficacy of bilateral ESP block and bilateral subpectoral interfascial block in patients undergoing cardiac surgery. Both ESP block and SPIF block provided effective and long-lasting analgesia. Numeric rating scale scores were substantially low for significant duration post-surgery. As far as the consumption of rescue analgesia is concerned, its requirements were very less in all four cases. All the patients were discharged from the intensive care unit early. We want to emphasize here these regional blocks have immense potential in early recovery from what is called MAJOR cardiac surgery. However, more trials are required to know the adjact duration of action, and their efficacy and to compare between ESP block and subpecto-interfascial block.

Keywords: Erector spinae block, Subpecto-interfascial block, Post-sternotomy pain, Cardiac surgery

INTRODUCTION

Post-operative pain management in patients undergoing cardiac surgery through midline sternotomy is always a challenging entity. Despite advancements in various modalities of pain management, poor post-operative pain control is still inevitable. Recent data show that midline sternotomy causes significant pain with an incidence as high as 49% at rest post-coronary artery bypass graft surgery (CABG).[1] CABG when accomplished through internal mammary artery harvesting causes much intense pain.[2]

Institution of fast-tracking and enhanced recovery after anesthesia (ERAS) requires opioid-free multimodal analgesia. Non-steroidal anti-inflammatory drugs (NSAIDs) and opioids have been used for pain control traditionally.

Excessive use of NSAIDs is associated with bleeding, various gastrointestinal complications, and acute kidney injury.[3,4] Likewise, tolerance, dependence, and respiratory depression are well-known complications of opioids.[5]

Thoracic epidural analgesia provides superior analgesia, better hemodynamics, and lesser respiratory complications as compared to conventional parenteral analgesia. Complications such as bleeding and epidural hematoma hinder its widespread use in cardiac surgical patients. The thoracic paravertebral block provides similar efficacy in the management of post-operative analgesia. Again, the risk of spinal injury and technical difficulty are reasons behind its limited use.

Newer, lesser invasive regional nerve blocks such as bilateral erector spinae (ESP) nerve blocks and bilateral pectoral nerve blocks are increasingly used nowadays. The use of ultrasound has made these blocks to be performed with utmost safety. A novel, interfascial plane block (namely, subpectoral interfascial plane block), has been used in pain management of rib fracture, sternal fracture, and mastectomy. There is a paucity of literature on the application of this novel block in post-sternotomy pain. On the other hand, ESP block has been used successfully in cardiac surgical patients for the management of post-operative pain both in adults and pediatric age groups.

We hereby want to share our experience in the institution of subpectoral interfascial plane block and ESP plane block in combating post-operative pain management following CABG.

CASE SERIES

Case 1

A 57-year-old hypertensive male, weighing 73 kg, diagnosed to have triple vessel disease was scheduled for CABG. On pre-anesthetic check-ups, history, physical examination, and airway examination were done. Hypertensives and antianginal medication were continued until the day of surgery and 8 h fasting for solid food was advised. Premedication in the form of inj. morphine 7 mg and inj. phenergan 30 mg was given as per institutional protocol. On the day of surgery, the patient was taken to the operation theatre. Routine monitors were attached and baseline heart rate (HR), blood pressure (BP), and saturation were noted. Induction was done with inj. fentanyl 200 mg, inj. etomidate 14 mg, and inj. rocuronium 70 mg. The patient was intubated with an ET tube of 8.5 mm ID and the central venous catheter and arterial line were secured. The patient was maintained on inj. vecuronium 1 mg, sevoflurane 1 mac, and inj. fentanyl 100 mg bolus.

The drug reconstituted was as follows – inj. ropivacaine (0.75%) 20 mL was diluted with 19 mL NS and approximately 1 mL of 1 mg/kg dexmedetomidine in a bowl. The final concentration of 40 mL ropivacaine in the mixture was 0.375%.

A high-frequency linear ultrasound probe was placed in the parasagittal plane 3 cm lateral to mid-sternum. Pectoralis major, internal intercostal, ribs, and pleura were identified. The needle was initially positioned superficial to the T5-T6 space and subsequently repositioned in a cephalad direction to target each rib space up to the T1-2 rib space. A total of 3 needle insertion was performed on each side. Total 40 ml of drug was deposited between pectoralis and internal intercostal muscle at 3 spaces bilaterally with 6.5 ml volume in each site [Figure 1]. HR and BP were monitored at baseline, 5 min after the institution of the block, after sternotomy, and 30 min after sternotomy. Baseline HR was 88, BP was 150/70, 5 min after institution of block HR was 74, and BP was 130/64, after sternotomy, it became 78 and BP 140/78 and 30 min post-sternotomy HR was 64 and BP 124/60.

CABG surgery was performed through midline sternotomy under transesophageal echocardiography guidance. Total intraoperative consumption of fentanyl was noted and it was 600 mg. After closure, the patient was shifted to the intensive care unit (ICU). The patient was extubated 6 h post-surgery.

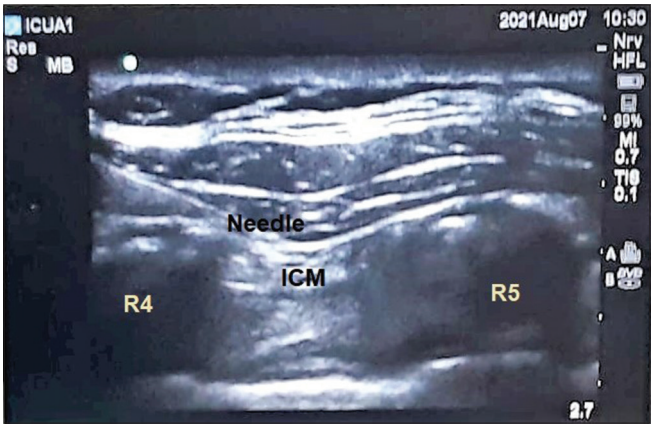

Figure 1: Sonoanatomy of subpectoral interfascial plane block. ICM: Intercostal muscle, R4 and R5: 4th and 5th Rib.

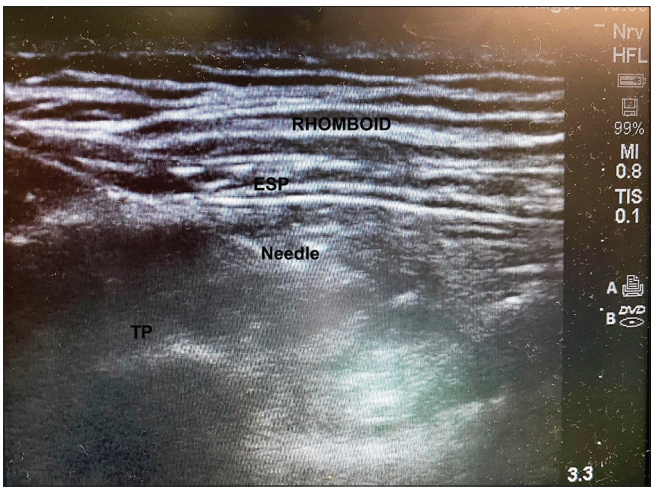

Figure 2: Sonoanatomy of erector spine plane block showing position of needle below the erector spine muscle. TP: Transverse process, ESP: Erector spine plane.

At the time of extubation, the numeric rating scale (NRS) score was 2. NRS score was followed 2 h, 4 h, 8 h, and 12 h post-extubation. NRS score was 2, 3, 4, and 6, respectively, at 2, 4, 8, and 12 h post-extubation. At 8 h and 12 h, rescue analgesia in the form of inj. fentanyl 70 mg given. The patient had satisfactory pain control. He was able to ambulate early and shifted from ICU on day 3.

Case 2

A 65-year-old male, weighing 74 kg, diabetic and hypertensive diagnosed with triple vessel disease was scheduled for off-pump CABG. A day before surgery, a pre-anesthetic checkup was done. Antianginal and antihypertensive were continued, whereas oral hypoglycemics were stopped on the day of surgery. Inj. morphine 7 mg and inj. Phenergan 30 mg was advised 30 min before surgery. After confirmation of nil per oral states and premedication, the patient was taken to the operation theater, and routine monitors were attached. HR, BP, and saturation were noted before induction. The patient was induced with inj. fentanyl, inj. etomidate, and inj. rocuronium. Direct laryngoscopy and intubation were done. Post-intubation arterial line and central venous catheter were secured. Ultrasonography (USG)-guided subpecto-interfascial block was performed after confirming the needle position with proper hydrodissection. A total of 3 needles were inserted in T1-2, T3-4, and T5-6 space bilaterally. A total of 6.5 mL of ropivacaine (0.375%) mixed with dexmedetomidine were injected. Baseline BP was 160/78 and HR was 86. 5 min after the institution of the block, it became 120/67 and HR became 64. At sternotomy, it was 138/74 and HR was 72, and 30 min post-sternotomy it became 112/64 and HR 58. The intraoperative course was uneventful and the total intraoperative consumption of fentanyl was 700 mg. The patient was shifted to ICU and after confirming stable hemodynamics with minimal drain output patient was extubated after 6 h. NRS score at extubation was 2. The patient was followed at 2, 4, 8, and 12 h post-extubation and scores were 2, 3, 3, and 5. Rescue analgesia in the form of in. fentanyl 70 mg was given at 12 h post-extubation. With satisfactory pain control, the patient was shifted from ICU on day 3.

Case 3

A 48-year-old hypertensive female, weighing 63 kg diagnosed to have triple vessel disease posted for off-pump CABG. On preanesthetic check-up, thorough history, and physical examination including airway examination were done. Antihypertensives and antianginal were continued. Premedication in the form of inj. morphine 6 mg and inj. phenergan 30 mg intramuscular were given. Operation theater was kept ready with emergency drugs, an airway cart, a perfusionist, and a surgeon. Once the patient came to the operation theater, ECG, NIBP, and saturation probe were attached. The arterial line was secured in the right radial artery under local anesthesia. Routine induction with inj. fentanyl, inj. etomidate, and inj. rocuronium was done. Central venous line secured in the right internal jugular vein post-intubation. The patient then turned into the left lateral position for the institution of a bilateral ESP block. Linear and high-frequency USG probe is placed 2–3 cm lateral to T5 spinous process and trapezius, rhomboid major, and ESP muscle is then identified superficial to transverse process (TP) [Figure 2]. The block needle was then inserted superior to the USG probe from the cephalad to the caudal direction using an in-plane approach. Once the needle tip was between ESP and TP, a small bolus of normal saline was injected to appreciate hydrodissection. After confirmation of hydrodissection, 20 mL of 0.375% ropivacaine along with 0.5 mg/kg of dexmedetomidine were injected. The total volume of ropivacaine will be 40 mL along with 1 mg/kg of dexmedetomidine.The patient was repositioned to supine and surgery was started. Vitals were noted at baseline, 5 min after block, at sternotomy, and 30 min after sternotomy. Baseline BP was 140/84 and HR was 68. Five min. after the institution of the block, it became 110/64 and HR became 54. At sternotomy, 118/74 and HR 60, and 30 min post-sternotomy, it was 104/68 and HR 56. Total intraoperative consumption of fentanyl was 500 mg. After hemostasis and closure, the patient was shifted to the intensive care unit. Hemodynamic parameters, arterial blood gas, and drain output were followed and the patient was extubated 5 h after surgery. NIRS at extubation was 2. The same score was followed for 2, 4, 8, and 12 h and it was 2, 2, 3, and 5, respectively. 60 mg fentanyl was given at 12 h post-extubation. Pain control was satisfactory and the patient was shifted from ICU at day 3.

Case 4

A 66-year-old male, diabetic and hypertensive, weighing 78 kg with triple vessel disease was posted for CABG. Routine preanesthetic check-up was done a day before surgery and nil per oral orders were given accordingly. Antihypertensives and antianginal drugs were continued, whereas oral hypoglycemics were stopped a day before surgery. Inj. morphine 7 mg and inj. phenergan 35 mg was injected 30 min before surgery. In the operation theater, routine monitors were attached and baseline reading was noted. The right radial artery was cannulated under local anesthesia. Inj. fentanyl, inj. etomidate, and inj. rocuronium were given as induction agent and intubation was done. Once the airway and central venous line is secured, the patient was positioned in the left lateral position. T5 space is identified and the linear ultrasound probe was placed 2–3 cm lateral to T5 spinous process. Block needle is inserted from cephalad to caudal and once it reached between ESP and TP 20 mL ropivacaine (0.375%) along with inj. dexmedetomidine 70 mg was injected bilaterally. The patient then turned into a

supine position and surgery started. Baseline BP was 148/84 and HR was 78. 5 min after the block it became 124/64 and HR became 64. At sternotomy, it was 130/78 and HR was 68, and 30 min after that it was 112/64 and HR was 62.

Total intraoperative consumption of fentanyl was 600 mg. Post-surgery, the patient was shifted to ICU. Once stable hemodynamics and minimal drain output patient was extubated at 4 hrs post-surgery. NRS score at extubation was 2, at 2 hours score was 2, at 4 hour it was 2 , at 8 hours it was 3 and 12 hours it was 4. As rescue analgesia, 70 mg of fentanyl was given. The patient was able to ambulate early and he was shifted from ICU on day 3.

DISCUSSION

As a primary caregiver, it is the responsibility of the anesthesiologist to provide patients with a pain-free perioperative course. Sternotomy causes immense pain following cardiac surgery.

Poor pain control acts as a nidus for post-operative tachycardia, hypertension, and various arrhythmias catering to myocardial ischemia. Persistent pain in the post-operative period causes atelectasis, pulmonary infection, difficult weaning, prolonged immobilization, and the development of chronic pain.[6]

Now, when fast-tracking and ERAS have come to clinical practice, it is customary to find an opioid-free, safe, and effective analgesic regime.

Various regional techniques such as the application of bilateral paravertebral nerve block, pectoral nerve block, and ESP block have been instituted. These rely on the principle that the thorax has rich sensory innervation and targeting these sensory nerves through interfascial plane block will not only provide long-lasting analgesia but also many side effects of other regional techniques such as epidural hematoma and hypotension can easily be bypassed.

de la Torre *et al*. first described subpecto-interfascial plane block for anesthesia for breast surgery.[7] To anesthetize the anterior cutaneous branch of the intercostal nerve, local anesthetic is deposited into the interfascial plane between the pectoralis major and external intercostal muscle. Few case reports have also described the applicability of this block to patients with rib fractures and difficult weaning from mechanical ventilators.[8] One case report also states its application in post-sternotomy pain.[9] To date, no study establishes its effectiveness in post-sternotomy pain post-cardiac surgery.

ESP block was first practiced by Forero *et al*. in successful management of chronic neuropathic pain, in patients who were not responding to oral pharmacotherapy.[10] This block provides an extensive multi-dermatomal sensory block with the proposed site of action being ventral and dorsal thoracic rami, causing anesthesia of the posterior, lateral, and anterior thoracic walls. To show the extent of the spread of local anesthetic, Forero *et al*. analyzed the extent of spread by computerized tomography, both in patients and in cadavers. On injecting 25 mL of local anesthetic superficial to ESP muscle at T 5 level, a cephalocaudal spread from T1 to T11 was noted further establishing its extensive coverage. Hamilton and Manickam had successfully applied continuous ESP block in patients with multiple unilateral rib fractures.[11] They further emphasized the fact that local anesthetic is injected in close proximity to costotransverse foramina, site of origin of dorsal, and ventral rami, explaining its extensive spread.

ESP block has also been used successfully in breast surgery,[12] abdominal surgery,[13] and in spine fusion.[14] As far as cardiac surgery is concerned, successful application of this block has been there in both thoracotomies and sternotomies.[15]

Both ESP block and SPIF block provided effective and long-lasting analgesia. NRS scores were substantially low for a significant duration post-surgery. As far as the consumption of rescue analgesia is concerned, it requirement was very less in all four cases. Till 12 h post-extubation, one or two doses of rescue analgesia were given. The patient was able to do spirometry more effortlessly, which was able to ambulate early and pain control was also satisfactory. All the patient was discharged from ICU early. We want to emphasize; here, these regional blocks have immense potential in the early recovery from what is called MAJOR cardiac surgery. However, more trials are required to know the adjact duration of action and their efficacy and to compare between ESP plane block and subpecto-interfascial block.

CONCLUSION

To conclude, regional inter-fascial plane block provide a durable postoperative analgesia contributing in faster recovery of patients.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Lahtinen P, Kokki H, Hynynen M. Pain after cardiac surgery: A prospective cohort study of 1-year incidence and intensity.

Anesthesiology 2006;105:794-800.
2. Kamalipour H, Vafaei A, Kazemi AP, Khademi S. Comparing the prevalence of chronic pain after sternotomy in patients undergoing coronary artery bypass grafting using the internal mammary artery and other open heart surgeries. Anesth Pain Med 2014;4:e17969.
3. Nussmeier NA, Whelton AA, Brown MT, Langford RM, Hoeft A, Parlow JL, *et al*. Complications of the COX-2 inhibitors parecoxib and valdecoxib after cardiac surgery. N Engl J Med 2005;352:1081-91.
4. Qazi SM, Sindby EJ, Nørgaard MA. Ibuprofen-a safe analgesic during cardiac surgery recovery? A randomized controlled trial. J Cardiovasc Thorac Res 2015;7:141-8.
5. White PF, Kehlet H, Neal JM, Schricker T, Carr DB, Carli F, *et al*. The role of the anesthesiologist in fast-track surgery: From multimodal analgesia to perioperative medical care. Anesth Analg 2007;104:1380-96.
6. Kehlet H, Jensen TS, Woolf CJ. Persistent postsurgical pain: Risk factors and prevention. Lancet 2006;367:1618-25.
7. de la Torre PA, García PD, Álvarez SL, Miguel FJ, Pérez MF. A novel ultrasound-guided block: A promising alternative for breast analgesia. Aesthet Surg J 2014;34:198-200.
8. López-Matamala B, Fajardo M, Estébanez-Montiel B, Blancas R, Alfaro P, Chana M. A new thoracic interfascial plane block as anesthesia for difficult weaning due to ribcage pain in critically ill patients. Med Intensiva 2014;7:463-5.
9. Liu V, Mariano ER, Prabhakar C. Pecto-intercostal fascial block for acute poststernotomy pain: A case report. A A Pract 2018;10:319-22.
10. Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The erector spinae plane block: A novel analgesic technique in thoracic neuropathic pain. Reg Anesth Pain Med 2016;41:621-7.
11. Hamilton DL, Manickam B. Erector spinae plane block for pain relief in rib fractures. Br J Anaesth 2017;118:474-5.
12. Gürkan Y, Aksu C, Kuş A, Yörükoğlu UH, Kılıç CT. Ultrasound guided erector spinae plane block reduces postoperative opioid consumption following breast surgery: A randomized controlled study. J Clin Anesth 2018;50:65-8.
13. Tulgar S, Selvi O, Kapakli MS. Erector spinae plane block for different laparoscopic abdominal surgeries: Case series. Case Rep Anesthesiol 2018;2018:3947281.
14. Chin KJ, Lewis S. Opioid-free analgesia for posterior spinal fusion surgery using erector spinae plane (ESP) blocks in a multimodal anesthetic regimen. Spine (Phila Pa 1976) 2019;44:E379-83.
15. Krishna SN, Chauhan S, Bhoi D, Kaushal B, Hasija S, Sangdup T, *et al*. Bilateral erector spinae plane block for acute post-surgical pain in adult cardiac surgical patients: A randomized controlled trial. J Cardiothorac Vasc Anesth 2019;33:368-75.

How to cite this article: Singh R, Choudhury A, Hote MP. Pain control following CABG – Where do we stand in 2023? J Card Crit Care TSS 2023;7:106-10.