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Research Article

Ultrasound-Guided Rhomboid Intercostal Block for Analgesia After Cardiac Surgery: A New Indication for Novel Fascial Plane Block

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ABSTRACT

Objectives: Acute postoperative pain is a common complication after cardiac surgery. When not properly regulated, it may have a negative impact on clinical results. One of the novel fascial plane blocks that aims to blockade the lateral cutaneous branches of the thoracic intercostal nerves is the rhomboid intercostal block. In the literature, there is no research of rhomboid intercostal block in cardiac surgery, and a limited number of reports employing this block to analgesia for thoracotomy, scapulothoracic arthrodesis, and lung transplantation. In our research, we aimed to display a case series of bilateral rhomboid intercostal blocks employed as an element of multimodal analgesia in five consecutive patients who underwent cardiac surgery through a median sternotomy.

Methods: Five adult patients who had a rhomboid intercostal block for postoperative analgesia after cardiac surgery were investigated. Within the first 24 hours after surgery, cumulative morphine consumption and pain scores during rest and coughing were assessed.

Results: In the first 24 h after surgery, the median cumulative morphine intake was 4 mg (0–20 mg). Also, the patients' pain scores were less (NRS≤4) at all-time points. There were no opioid-related adverse events or block-related additions in any patient.

Conclusion: As part of multimodal analgesia, the rhomboid intercostal block was thought to help reduce opioid consumption as well as pain scores in cardiac surgery cases.

Keywords: Acute, cardiac, median sternotomy, nerve block, postoperative pain, surgical procedures, ultrasonography

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Introduction

Pain ranging from mild to severe can be experienced by up to 50% of patients after cardiac surgery.[1] Acute postoperative pain that is not properly managed can lead to chronic pain, lower quality of life and an increased risk of pulmonary complications.[2] Pain after cardiac surgery can be caused by sternotomy or thoracotomy incisions, chest retraction, internal mammary artery harvesting sternal wires, chest tubes, and visceral pain.[3] Recent improvements in ultrasound-guided fascial plane blocks, such as the erector spinae plane block (ESP), pectoral nerve blocks, and superficial and deep parasternal intercostal plane (PIP) blocks, have made them available to cardiac surgical patients. These blocks have been revealed to provide important analgesic benefits to the patients.[4]

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The rhomboid intercostal block (RIB) aims to block the lateral cutaneous branches of the thoracic intercostal nerves (Th3-9) and is one of the novel fascial plane blocks described for the first time by Elsharkawy et al.[5] It has been shown that RIB has been used effectively in the treatment of patients undergoing thoracotomy,[6] scapulothoracic arthrodesis,[7] and lung transplant process.[8]

Here, we report the use of RIB in five consecutive patients employed as an element of multimodal analgesia in those who underwent cardiac surgery through a median sternotomy. The patients were made aware of feasible risks, and they gave their consent to employ their clinical information.

Methods

RIB was performed during the preoperative period just prior to induction, as previously described.[5] Following standard monitoring (non-invasive blood pressure monitoring, five-lead electrocardiography, and pulse oxygen saturation) as recommended by the American Society of Anesthesiologists, the patients were positioned in a sitting position before an aseptic technique and ultrasound guidance were used. Through the adduction of the ipsilateral arm across the anterior thoracic wall, the lateral mobilization of the scapula was achieved. Then, at the T5 level on the oblique sagittal plane medial to the medial side of the scapula, a linear ultrasound probe (8–13 MHz, GE LOGIQ V1 US System, USA) was placed. After locating the trapezius, rhomboid, and intercostal muscles, as well as the pleura, thirty milliliters of 0.25% bupivacaine diluted to 0.25% was injected into the fascial plane between the rhomboid and intercostal muscles (Fig. 1). Concurrent with the injection, real-time visualization of the spread of local anesthetic (LA) in a craniocaudal direction was performed. The same process was performed on the contralateral side. Our institute's standard care protocols for cardiac anesthesia were followed during the perioperative period. Intravenous (IV) midazolam 0.05–0.1 mg/kg, fentanyl 2–5 μ/kg IV, pentothal 4–5 mg/kg IV, and rocuronium (1 mg/kg IV) were used for induction. Inhalation sevoflurane (MAC 1), O2/air (FIO2 0.40), and IV fentanyl infusion (2–5μ/kg/h) was employed to maintain anesthesia. The depth of anesthesia was kept between 40 and 60 bi-spectral index scores. At the end of the procedure, morphine 0.05 mg/kg was administered intravenously.

For the first twenty-four hours, each patient received 1 g/8h of acetaminophen, and patient-controlled analgesia (BodyGuard 575 pain management, UK) was initiated (bolus dosage, 20 μ/kg of morphine; lock-out period, 10 minutes; 4-h limit, 0.5 mg/kg). The pain was assessed using the numerical rating scale (NRS) at rest and coughing at extubation three, six, 12, 18, and 24 hours.

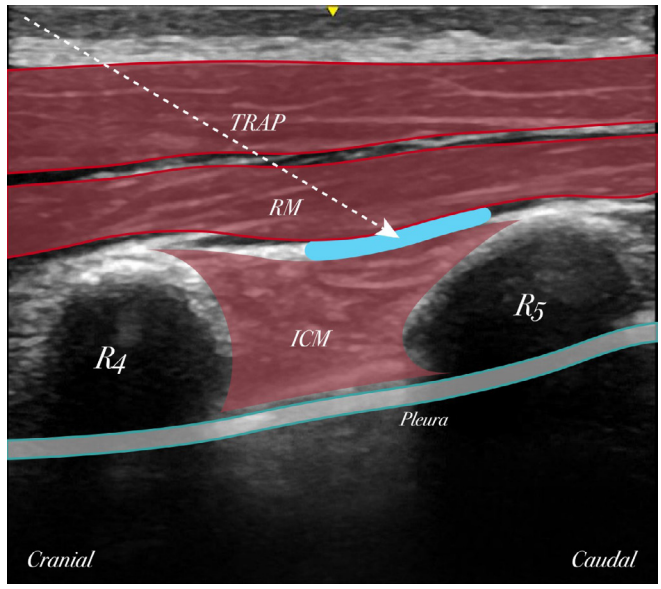

Figure 1. The schematic illustration of where to inject a local anesthetic when using an ultrasound-guided rhomboid intercostal block. The arrow indicates the direction of the needle where to inject a local anesthetic. Blue -the highlighted area is the desired spread of local anesthetic.

TRAP: trapezius muscle; RM: rhomboid muscle; ICM: intercostal muscle.

Statistical Methods

Continuous variables were presented as median (minimum-maximum) values, while categorical data were represented as absolute frequencies and percentages. SPSS Version 24 software (IBM, Armonk, NY, USA) was used.

Results

Table 1 presents the demographic information and surgical attribute of the patients. In the first 24 h after surgery, the median number of morphine employed was 4 mg (0 to 20 mg). Furthermore, patients had low pain scores (NRS≤4) at all-time points (Table 2). Neither opioid-related adverse events nor block-related problems were found in any patient.

Discussion

We present a case series of five patients undergoing open cardiac surgery who had bilateral RIB. The RIB was effective for pain scores and decreased postoperative 24-h morphine intake.

Due to the potential serious complications (epidural or spinal hematoma, hypotension, pneumothorax, etc.) of neuraxial techniques, there is a growing interest in fascial

Table 1. Patient demographic and surgical features

Gender, F/M	2/3
Age, years	55 (47–64)
BMI, kg/m^2	27.3 (21.5–29.8)
ASA, II/III	2/3
EF, %	55 (35–60)
Surgery type, CABG/AVR/ASD	3/1/1
Surgery time, min	305 (240–350)
By-pass time, min	122 (73–257)
Cross-clamp time, min	72 (25–200)
Extubation time, min	360 (240–420)
ICU discharge time, h	28 (24–76)

ASA: American Society of Anesthesiologists; ASD: Atrial Septal Defect; AVR: Aortic Valve Replacement; BMI: Body Mass Index; CABG: Coronary Artery Bypass Grafting; EF: Ejection fraction; ICU: Intensive Care Unit.

Table 2. NRS_{rest} and $NRS_{coughing}$ scores of patients at various time-points and cumulative morphine consumption

	Case 1	Case 2	Case 3	Case 4	Case 5
NRS_{rest}					
Extubation	2	2	3	0	0
3rd h	1	2	2	1	1
6th h	1	4	2	1	1
12th h	1	4	3	2	0
18th h	0	3	2	2	0
24th h	0	3	2	3	0
$NRS_{coughing}$					
Extubation	3	3	4	1	1
3rd h	2	3	3	1	2
6th h	2	5	3	2	2
12th h	2	4	4	4	0
18th h	1	4	3	4	0
24th h	0	4	2	4	0
Cumulative morphine consumption, first 24 h, mg	0	4.5	4	20	3.5

NRS: Numerical rating scale.

plane blocks in cardiac surgery (such as epidural, paravertebral, or intrathecal morphine). The ESP, superficial PIP, and deep PIP blocks have been suggested as effective methods of pain administration for patients undergoing cardiac surgery. Even Although the exact mechanism of action in the ESP block is unknown, the LA is expected to spreads to the paravertebral area and blocks the dorsal and ventral branches of the spinal nerve as well as the sympathetic ganglion. The literature, however, is divided into the absolute spread of LAs to nerve structures other than the dorsal ramus.[9] Moreover, the superficial PIP block, a relatively new fascial plane block, blocks the thoracic nerves' anterior cutaneous branches (Th2-6). Although studies have demonstrated its analgesic effect in cardiac surgery, given the mechanism of action, it is reasonable to expect that the superficial PIP block would be insufficient for managing pain caused by sources other than the sternotomy incision. Because the ESP and shallow PIP blocks only offer a small amount of analgesic coverage, new blocks will inevitably take the lead in heart surgery.

Despite reports that the RIB provides analgesia in the hemithorax and that cadaver studies show a good spread in the craniocaudal and anteroposterior directions, its effectiveness in cardiac surgery is unknown. The RIB's distal and more superficial implementation, as opposed to the RIB block, will make the application easier. In contrast, the issue of inconsistent LA spread found in the ESP block will be removed. While the real-time spread of LA was found in all patients in our research, sono-anatomically, landmarks were defined relatively easily. This proposes that RIB will be a more attractive alternative in cardiac surgery. Our case report has a limitation in that we did not assess the sensory distribution. We are also presently conducting a randomized controlled trial to investigate the analgesic efficacy of RIB after cardiac surgery.

In conclusion, this case series suggests that using the RIB as part of a multimodal analgesia treatment may help lower the amount of opioid intake as well as pain scores. More randomized controlled trials need to be conducted in their entirety.

Disclosures

Informed Consent: Written informed consent was obtained from all patients.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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