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CASE REPORT

# Serratus Anterior Plane Block failed to relieve Pain in Multiple Fractured Ribs: Report of Two Cases

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## ABSTRACT

The serratus anterior plane block (SAPB) has been used successfully to treat pain of multiple fractured ribs (MFRs). We report two cases of MFRs where pain relief was not satisfactory with SAPB and, therefore, thoracic epidural was used for further management of pain. We have discussed the possibility of failure and suggested that if fracture is in the posterior part of the ribs, then thoracic epidural or paravertebral should be preferred over SAPB.



**Keywords:** Chest injury, Fracture rib, Regional analgesia, Serratus anterior plane block, Ultrasound-guided blocks.

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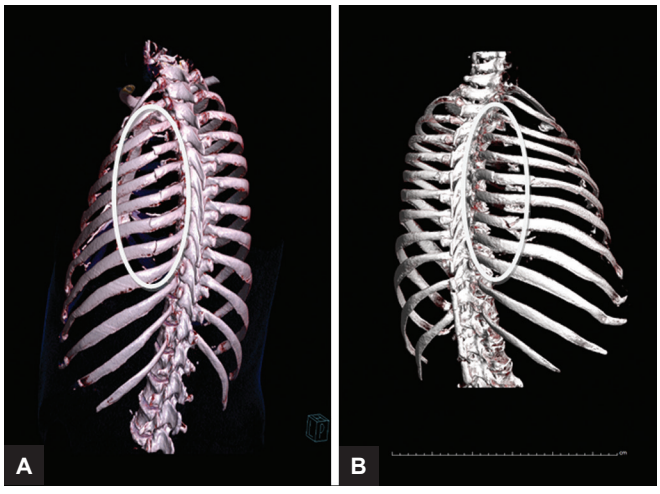


**Figs 1A and B:** White circles (A and B) showing MFRs in posterior one-third portion of the ribs

## INTRODUCTION

Intense pain due to multiple fractured ribs (MFRs) continues to be a challenging problem as it is associated with increased morbidity and mortality. Proper analgesia is required for early ambulation and to prevent respiratory failure.[1,2] Serratus anterior plane block (SAPB) has been used successfully to treat the pain of MFRs.[3-5] However, the optimal point of needle tip or catheter to inject local anesthetics (LAs) is still debatable.[4,6]

We report two cases of MFRs, which were managed with SAPB. However, pain relief was inadequate, and thoracic epidural had to be given for further pain management.

## CASE REPORTS

### Case 1

A 50-year-old male with MFRs and severe pain (Fig. 1A) managed initially with injectable nonsteroidal anti-inflammatory drugs and tramadol was given serratus plane block due to poor pain relief. Under ultrasound (USG) guidance using high-frequency linear probe (HFL-38, 13-6 MHz, Sono Site®) and using inline approach, an 18G Tuohy needle was inserted in the midaxillary line (from posterior to anterior direction) both below and above the serratus anterior muscle (Figs 2 to 4), and catheters were inserted 3 cm beyond needle tip. Both the catheters were secured over skin with an adhesive plaster and were tagged to identify from outside. Positions of catheters were further confirmed with linear spread of contrast in two fascial planes on injection of 2 mL contrast (Omnipaque-300®) (Fig. 5).

**Fig. 2:** Two catheters being inserted in mid-axillary line through 18-G Tuohy needles, below and above the serratus anterior muscle


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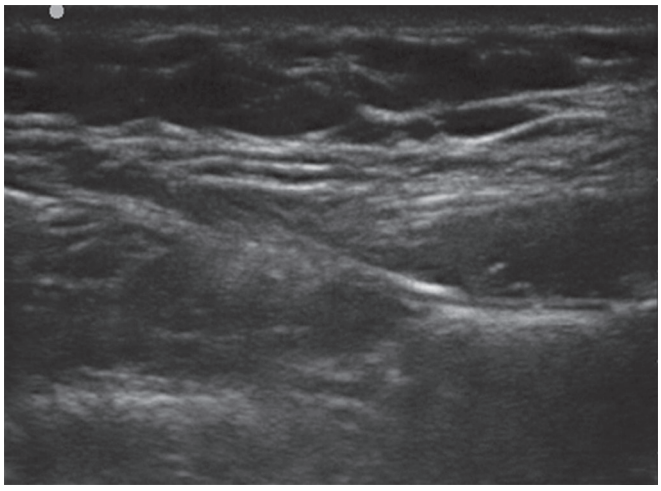

**Fig. 3:** Catheter inserted below the serratus anterior muscle

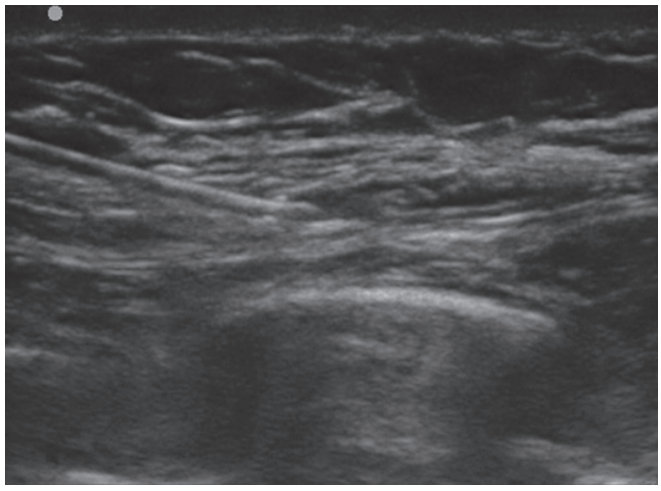

**Fig. 4:** Catheter inserted above the serratus anterior muscle

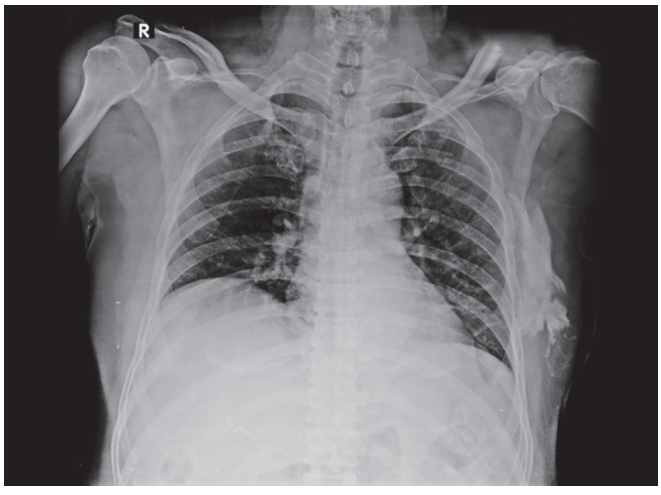


**Fig. 5:** Contrast spread in two distinct fascial planes above and below serratus muscle

A bolus of 20 m 0.2% ropivacaine with adrenaline (5 µg/mL) was given through the catheter placed above the serratus muscle, and an infusion of 0.2% ropivacaine and fentanyl 2 µg/mL was started at 10 mL/hr. Injection paracetamol 1 gm 8 hourly was continued. Pain relief was monitored at 2-hourly intervals by visual analog scale (VAS, 10 = maximum pain and 0 = no pain). The patient reported minimal pain relief (VAS = 6/10 at rest, but 10/10 at movement or deep breathing) and the infusion was increased to 14 mL/hr. However, there was no improvement in pain relief during cough or movements. After 12 hours, a bolus of 20 mL 0.2% ropivacaine was given through the second catheter below the serratus muscle and similar infusion was started at 10 mL/hr and increased to 14 mL/hr after 4 hours. Pain during rest improved (VAS 2–4/10 on rest), but remained 10/10 on movement. Both the catheters were removed after 24 hours and thoracic epidural catheter was inserted at T8–9 level (tip of the catheter at T6), and the position of the catheter was confirmed by fluoroscopy. Through the epidural catheter, 5 mL 1% xylocaine was injected, which provided significant pain relief (VAS 1/10 on rest and 3/10 on coughing). An infusion of 0.2% ropivacaine and fentanyl 2 µg/mL at the rate of 5 mL/hr was started epidurally, which provided sustained pain relief for the next 5 days. After the 7th day, the catheter was removed and patient was discharged on oral diclofenac and paracetamol.

## Case 2

A 42-year-old male with a body mass index of 38 (weight 98 kg) was admitted with MRFs due to road traffic accident. He had fractures of three to eight ribs on the right side (Fig. 1B). Due to severe pain and associated obesity, SAPB was given. The USG technique was similar to the first case, and 30 mL of 0.3% ropivacaine with adrenaline 5 µg/mL was injected below the serratus anterior muscle. An infusion of ropivacaine 0.2% with fentanyl 2 µg/mL was started at the rate of 10 mL/hr. After 40 minutes, patient reported pain score of VAS 5/10 on rest, but 10/10 on movement and on deep breathing. Infusion was continued for 8 hours at the rate of 14 mL/hr. However, no further improvement in VAS during movement was noticed. Serratus plane catheter was removed and thoracic epidural catheter was inserted at T7–8 level, keeping the tip at T6. A similar infusion was connected to epidural catheter at the rate of 5 mL/hr. He maintained good pain relief with VAS 0 to 1 at rest and 3 to 4 on movements. After 48 hours, pain on movement was significantly reduced (VAS 2–3/10 on movement) and patient requested to discontinue the infusion. For the next 2 days, patient received two boluses of 5 mL ropivacaine 0.2% with morphine 2.5 mg. On the 7th day, he was discharged on oral tramadol and paracetamol.

## DISCUSSION

The SAPB is an USG-guided facial block described by Blanco et al.[7] In this block, cutaneous branches of the intercostal nerves are blocked as they pass through these planes to innervate the skin and muscles to most of the chest wall.[8] This anatomical fact is the basis for pain relief in MFRs.

Primarily, the serratus plane block was described for breast surgery. However, as it provides analgesia for hemithorax, it has also been used successfully to relieve pain in patients with thoracotomy[6] and multiple rib fractures.[3,4]

Blanco et al[7] recommended that LA can be deposited either above or below the serratus anterior muscle with equal effectiveness and coverage of sensory block. He also observed that an injection superficial to the serratus anterior muscle spreads wider and lasts longer than an injection deep to it.[7]

Contrary to Blanco's belief, Fajardo et al[9] recommend that LA should be injected below the serratus muscle because there is a greater spread of LA between the serratus–intercostal plane due to poor dispensability of the space. Moreover, respiratory movements allow the LA to be dispersed along the space. They also argued against Blanco's approach by stating that, the long thoracic nerve (LTN) may be affected if drug is injected above serratus and can cause winged scapula syndrome due to temporary palsy of the LTN.

As there is still no consensus about the optimal place for injection, in our first case, we inserted two catheters in both the planes to observe the relative efficacy. Another reason we have used two catheters in one patient is because it is almost impossible to replicate two similar patients in terms of clinical presentation (amount, distribution of injury, and response to level of pain, i.e., pain threshold). This case has worked as a model to compare the efficacy of the block and catheter-related technical issues in two serratus muscle planes. We observed that the pain relief was marginally better with below the serratus anterior injection in the first case and reasons may be as observed by Fajardo et al.[9] In the second case, we intentionally used below the serratus plane injection based on our past experience. However, in both the patients, only pain relief at rest was reduced and there was no relief in pain on movement.

We have been using serratus plane block successfully to treat MFRs (2–6 ribs) for the last 7 months. Seven patients have been managed with excellent pain relief until now. Then, why two of our patients did not get good pain relief is an intriguing question. When we reviewed the records, we found that all patients who responded successfully to serratus plane block had fractures either at angle of ribs or distal to it. However, these two patients had fractures exclusively in the posterior parts of the ribs (toward spine). We speculate that during serratus plane block in these two patients, the LA was unable to block the nerves supplying the affected part as suggested by Mayes et al.[8] During their cadaveric study on USG-guided serratus plane block and injection of either dye or latex, they found that out of 12 specimens, the intercostal nerves at origin were involved on three occasions only, while the lateral cutaneous branches of the intercostal nerve were stained on all occasions. They concluded that the serratus plane block appears to be mediated through blockade of the lateral cutaneous branches of the intercostal nerves. Anatomically, the serratus plane block does not appear to be equivalent to paravertebral block for rib fracture analgesia.[8] Tighe and Karmakar,[10] in their editorial, also suggested that serratus plane block will not achieve such widespread somatic and autonomic block, and, if complete anesthesia of the hemithorax is required, an alternative approach will be necessary. Contrary to serratus plane block, the thoracic epidural provides a complete sensory analgesia in the area of blockade and is, therefore, considered the most reliable technique to relieve pain and improve pulmonary outcomes in patients with MFRs.[11] However, recent studies have questioned the unequivocal superiority of epidural over other techniques.[12] Thoracic paravertebral block (TPVB) could be a safer alternative to thoracic epidural in patients with unilateral MFRs, but there are only few trials that have evaluated the safety and efficacy of TPVB in patients with MFRs.[1,13] However, TPVB is a promising regional anesthetic technique for pain control in MFRs and deserves greater attention and investigation in the future.[14]

With experience of presented cases, we can suggest that the serratus plane block is effective only up to the anterior two-thirds of the fracture of ribs. If the posterior one-third is involved, thoracic epidural or paravertebral blocks are appropriate choices.[14,15]

## LIMITATION

This report included only two cases addressing the issues of inefficacy of serratus plane block in MFRs of posterior part.

## CONCLUSION

In the presented two cases of MFRs, when the serratus plane block failed to provide effective pain relief, thoracic epidural provided effective pain relief. The possible reason was the inability of LA to reach up to posterior chest wall and block the pain sensation from the fractured sites. However, more studies are warranted before making any conclusion for superiority of one technique over the other.

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