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# Ultrasound-guided serratus anterior plane block for transapical transcatheter aortic valve implantation

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## Abstract

**Background** Reducing postoperative pain due to the thoracotomy incisions in patients undergoing transapical transcatheter aortic valve implantation remains a challenge.

**Methods** We introduced ultrasound-guided serratus anterior plane block (SAPB) in a patient with severe aortic insufficiency and chronic obstructive pulmonary disease before surgical intervention.

**Results** The patient's postoperative 1 h, 4 h, and 12 h resting visual analogue scale scores were 3, 1, and 1 without single injection of morphine or dezocine for rescue analgesia.

**Conclusions** Ultrasound-guided SAPB could improve analgesia after transapical transcatheter aortic valve implantation.

**Keywords** Serratus anterior plane block, Transapical transcatheter aortic valve implantation, Analgesia

## To the editor

Transcatheter aortic valve implantation (TAVI) has become an alternative treatment for aortic valve disease in elderly or high-risk patients [1]. However, reducing postoperative pain due to the thoracotomy incisions remains a challenge in transapical access TAVI [2, 3]. Although regional anesthesia including epidural analgesia and paravertebral nerve block are effective, they can be difficult to perform and increase the risk of pneumothorax and epidural hematoma because TAVI procedure requires heparinization [4].

Ultrasound-guided serratus anterior plane block (SAPB) may be a promising regional analgesia method for patients undergoing transapical TAVI. Blanco R et al.

demonstrated that SAPB can block the lateral cutaneous branches of the thoracic intercostal nerves from T2 to T9 for 750–840 min [5]. The SAPB has been reported as effective for analgesia in mastectomy and video assisted thoracic surgery [5].

Written informed consent was obtained both for the block intervention and publication of the reports. A 79-year-old male patient (weight: 70 kg, height: 172 cm) with chronic obstructive pulmonary disease was scheduled for TAVI due to severe aortic insufficiency. Transapical access was chosen because atherosclerotic plaque in the femoral artery was indicated by preoperative vascular computed tomographic angiography. Before general anesthesia induction, the SAPB was performed on the left under ultrasound guidance (Anaesus ME7, Mindray Bio-Medical Electronics, Shenzhen, China). A high-frequency linear probe was placed in the mid-axillary line to identify the fifth and sixth ribs, the latissimus dorsi muscle, and serratus anterior muscle in a sagittal plane. A 22-gauge, 50 mm needle (Stimuplex® D B.Braun,

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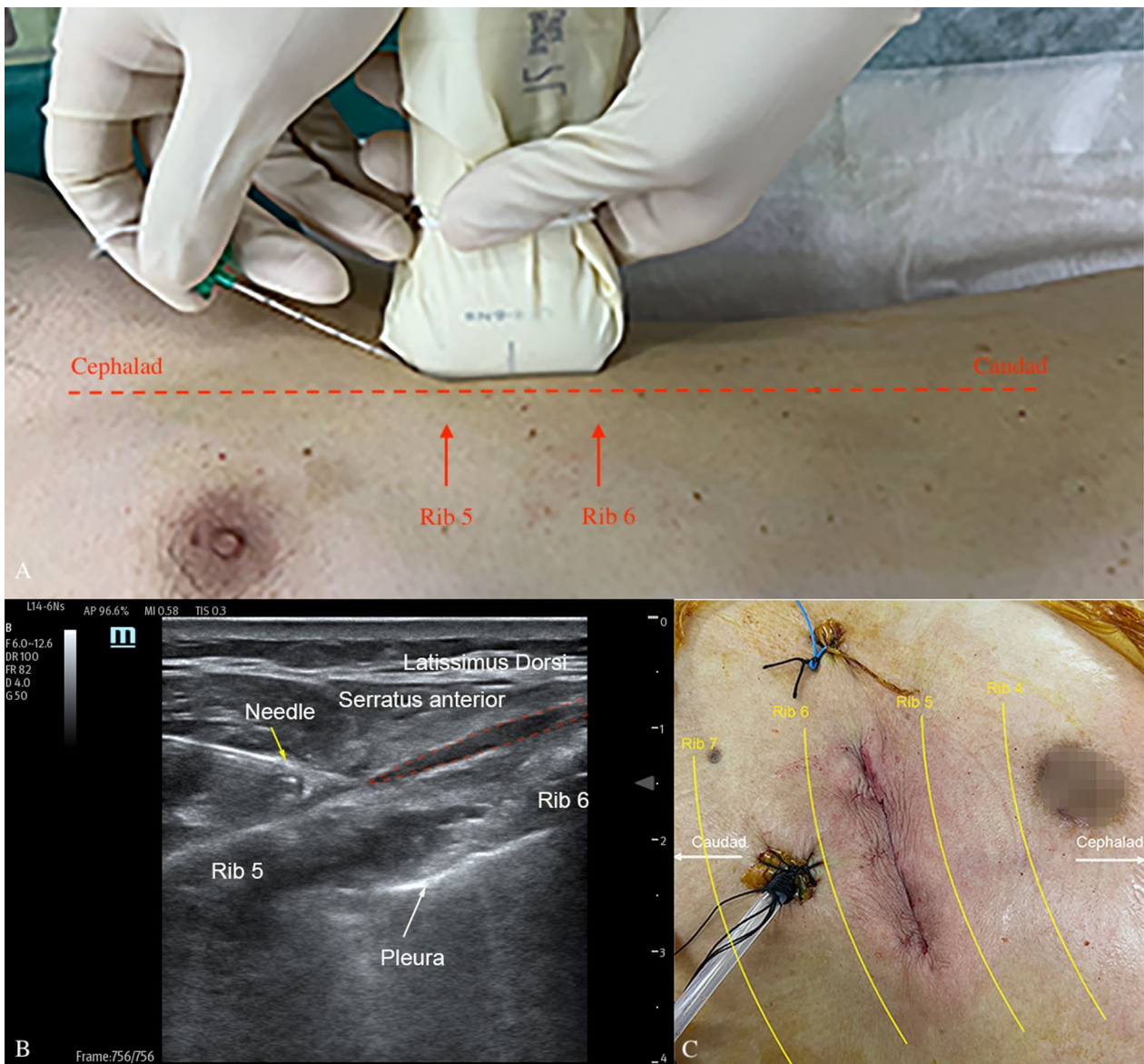
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**Fig. 1** Serratus anterior plane block. **A** Location of administration of the serratus anterior plane block. **B** Ultrasound image of the serratus anterior plane block. The yellow arrow indicates the needle. The area of red dotted line indicates the spread of local anesthetics. **C** The left mini-thoracotomy into left ventricular apex

Melsungen, Germany) was inserted in-plane (Fig. 1A). A total of 100 mg (30 ml 0.33%) ropivacaine was injected above the serratus anterior muscle and below the serratus anterior muscle (Fig. 1B). The local anesthetics linear spread between the latissimus dorsi muscle and serratus anterior muscle and between the serratus anterior and ribs, respectively. An apical access was established through a left mini-thoracotomy (4–5 cm) (Fig. 1C). After surgery, flubiprofen axetil injection (50 mg) and tropisetron hydrochloride injection (5 mg) was routinely administrated for analgesia and antiemetic, respectively.

A standardized postoperative patient controlled intravenous analgesia (PCIA) pump was connected. The PCIA pump was set up with sufentanil 300 µg, dexmedetomidine 200 µg, and granisetron 9 mg in sodium chloride 0.9%, 200 ml at 2 ml/h, with a single bolus dose of 0.5 ml, and lockout time of 15 min.

The patient was extubated in the operating room 8 min after surgery and transferred to the intensive care unit. Postoperative 1 h, 4 h, and 12 h resting visual analogue scale (VAS) scores were 3, 1, and 1 without single injection of morphine or dezocine for rescue analgesia. No

complications associated with the SAPB were observed. The patient was transferred to ward on postoperative day 1 and discharged on postoperative day 4.

The pain of left mini-thoracotomy could increase postoperative complications and delay recovery in patients underwent transapical TAVI [4, 6]. Optimal management of postoperative pain hence is necessary to prevent complications and to enhance recovery. Compared with other regional anesthesia, such as paravertebral blockade, thoracic epidural anesthesia, and pectoralis nerve plane block, the SAPB is priority with easy operation and low risk of epidural hematoma. Therefore, we used SAPB for a specific type of minimally invasive cardiac surgery, transapical TAVI. The efficacious of SAPB in post-thoracotomy pain management has been demonstrated both in pediatric and adult cardiac surgery [7–9]. Edwards JT et al. suggested that both superficial and the deep SAPB can be used for postoperative analgesia [10]. Continuous deep SAPB was also effective for analgesia in mitral valve surgery via right minithoracotomy [11]. In our case, the VAS scores were lower than 3 within 12 h after surgery indicated that combined superficial and deep SAPB was effective. However, the efficiency of different SAPB infusion techniques in patients undergoing transapical TAVI needs further studies.

Ultrasound-guided SAPB is feasible in conjunction with a postoperative multimodal analgesia in patients undergoing transapical TAVI. Perspective randomized controlled studies are needed to further demonstrate its efficiency and safety.

#### Abbreviations

TAVI	Transapical transcatheter aortic valve implantation
SAPB	Serratus anterior plane block
PCIA	Patient controlled intravenous analgesia
VAS	Visual analogue scale

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Not applicable.

#### Author contributions

LP, MD and WW have given substantial contributions to the conception of the manuscript, LP and MD collected the data. All authors have participated to drafting the manuscript, LP revised it critically. All authors read and approved the final version of the manuscript. All authors contributed equally to the manuscript and read and approved the final version of the manuscript.

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#### Availability of data and materials

All data generated or analyzed during this study are included in this published article.

## Declarations

#### Competing interests

The authors declare no competing interests.

#### Ethical approval

Not applicable.

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The authors certify that there is no competing interest with any financial organization regarding the material discussed in the manuscript.

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## References

- Nishimura RA, Otto CM, Bonow RO, Carabello BA, Erwin JP 3rd, Fleisher LA, et al. 2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol*. 2017;70:252–89.
- Shi J, Wei L, Chen Y, Wang X, Ye J, Qin C, et al. Transcatheter aortic valve implantation with J-valve: 2-year outcomes from a multicenter study. *Ann Thorac Surg*. 2021;111:1530–6.
- Wei L, Liu H, Zhu L, Yang Y, Zheng J, Guo K, et al. A new transcatheter aortic valve replacement system for predominant aortic regurgitation implantation of the J-valve and early outcome. *JACC Cardiovasc Interv*. 2015;8:1831–41.
- Strike E, Arklina B, Stradins P, Cusimano RJ, Osten M, Horlick E, et al. Postoperative pain management strategies and delirium after transapical aortic valve replacement: a randomized controlled trial. *J Cardiothorac Vasc Anesth*. 2019;33:1668–72.
- Blanco R, Parras T, McDonnell JG, Prats-Galino A. Serratus plane block: a novel ultrasound-guided thoracic wall nerve block. *Anaesthesia*. 2013;68:1107–13.
- Sengupta S. Post-operative pulmonary complications after thoracotomy. *Indian J Anaesth*. 2015;59:618–26.
- Kaushal B, Chauhan S, Saini K, Bhoi D, Bisoi AK, Sangdup T, et al. Comparison of the efficacy of ultrasound-guided serratus anterior plane block, pectoral nerves II block, and intercostal nerve block for the management of postoperative thoracotomy pain after pediatric cardiac surgery. *J Cardiothorac Vasc Anesth*. 2019;33:418–25.
- Magoon R, Kaushal B, Chauhan S, Bhoi D, Bisoi AK, Khan MA. A randomised controlled comparison of serratus anterior plane, pectoral nerves and intercostal nerve block for post-thoracotomy analgesia in adult cardiac surgery. *Indian J Anaesth*. 2020;64:1018–24.
- Patel SJ, Augoustides JGT. Serratus anterior plane block-A promising technique for regional anesthesia in minimally invasive cardiac surgery. *J Cardiothorac Vasc Anesth*. 2020;34:2983–5.
- Edwards JT, Langridge XT, Cheng GS, McBroom MM, Minhajuddin A, Machi AT. Superficial vs. deep serratus anterior plane block for analgesia in patients undergoing mastectomy: a randomized prospective trial. *J Clin Anesth*. 2021;75:11040.
- Toscano A, Capuano P, Costamagna A, Burzio C, Ellena M, Scala V, et al. The serratus anterior plane study: continuous deep serratus anterior plane block for mitral valve surgery performed in right minithoracotomy. *J Cardiothorac Vasc Anesth*. 2020;34:2975–82.

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