Brazilian Journal of Anesthesiology 2023;73(3):347–350

Sociedade Brasileira de Anestesiologia

Brazilian Journal of ANESTHESIOLOGY

CASE REPORT

Ultrasound-guided continuous costoclavicular block through retrograde stimulating catheter technique for postoperative analgesia in shoulder surgery: a case series

Sandeep Diwan [a], Divya Sethi [b,*], Parag Sancheti [c], Abhijit Nair [d]

[a] Sancheti Institute of Orthopedics and Rehabilitation, Department of Anesthesiology, Pune, India
[b] Employees' State Insurance Cooperation Postgraduate Institute of Medical Sciences and Research (ESIC–PGIMSR), Department of Anesthesia, New Delhi, India
[c] Sancheti Institute of Orthopedics and Rehabilitation, Department of Orthopedics, Pune, India
[d] Basavatarakam Indo-American Cancer Hospital and Research Institute, Department of Anesthesiology, Hyderabad, India

Received 14 September 2020; accepted 2 January 2021
Available online 19 February 2021

KEYWORDS
Ultrasonography;
Regional anesthesia;
Shoulder;
Costoclavicular

Abstract In five patient undergoing surgery for proximal humerus fracture we investigated into postoperative analgesia provided by continuous costoclavicular block using continuous stimulating catheter. The postoperative pain scores were less than 4 in all patients except in two patients who required intravenous tramadol 50 mg as a rescue analgesic. The radiocontrast dye study executed in two patients revealed contiguous contrast spread through the brachial plexus sheath with the catheter tip in the interscalene space. We propose that a continuous costoclavicular block with a retrograde stimulating catheter is a feasible alternative regional anesthesia technique for postoperative analgesia in shoulder surgery.

Introduction

The costoclavicular block (CCB) was described as an alternative to traditional lateral infraclavicular block for forearm and hand surgery.[1] In the CCB, the brachial plexus cords are approached in the costoclavicular space at the midpoint of the clavicle below the subclavius and the pectoralis muscle under ultrasound (US) guidance. Anatomically, the cords are

The work was carried out and entirely supported by Sancheti Institute of Orthopedics and Rehabilitation, Pune, India.
* Corresponding author.
E-mail: divyasth@gmail.com (D. Sethi).

https://doi.org/10.1016/j.bjane.2021.01.004

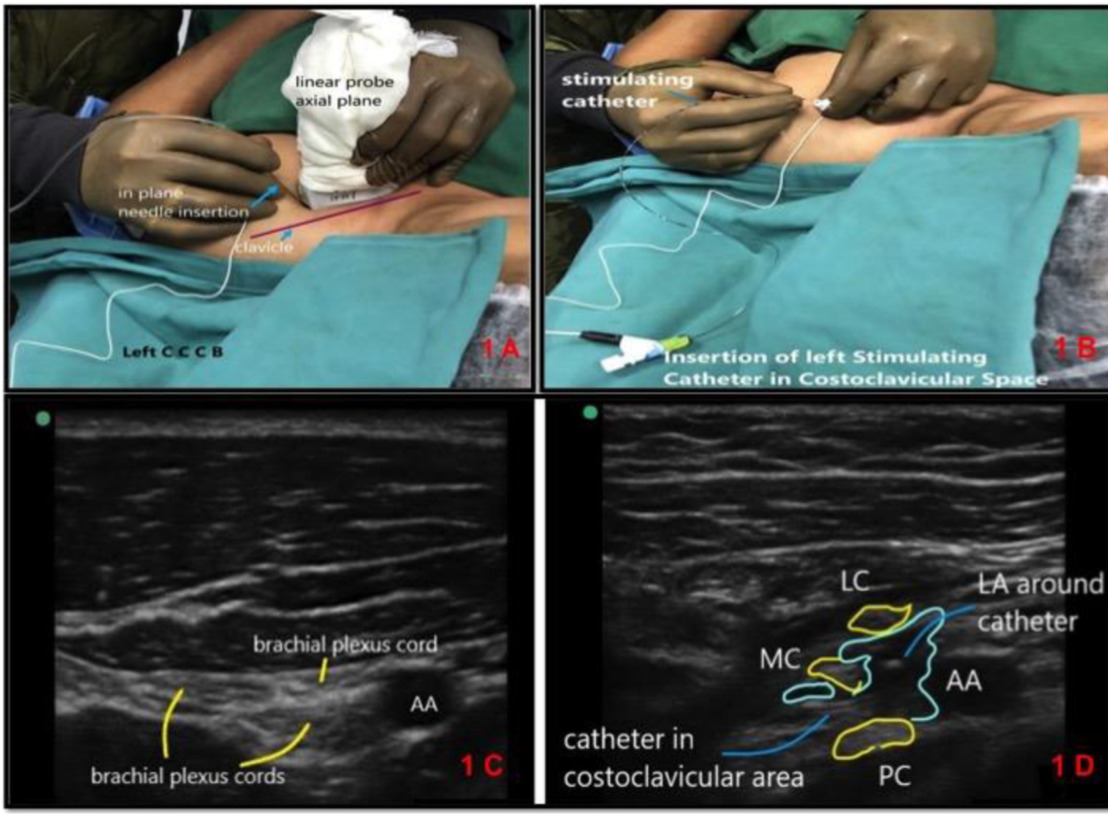

Fig. 1 A, left Costoclavicular block: In Plane approach with a linear transducer; Needle insertion from lateral to medial. B, insertion of stimulating catheter. C, ultrasound image depicting the brachial plexus cords. D, stimulating catheter positioned in the costoclavicular space; Injection of LA displaces the cords; A hyperechoic dot is seen of the catheter.

arranged more superficial and are clustered together lateral to the axillary artery. The costoclavicular space is continuous cranially with the supraclavicular fossa and caudally with the medial infraclavicular fossa, thus it can be used as a conduit for a catheter for continuous CCB. In this case series of five patients with proximal humerus, we implemented continuous stimulating catheter in the costoclavicular area to evaluated postoperative analgesia provided by continuous CCB. All patients received a standard general anaesthesia. We performed a radiocontrast dye study in two patients to evaluate the catheter tip position and spread of drug in the costoclavicular space.

Case report

After approval of the hospital ethics committee (Sancheti Instute of Orthopedics and Rehabiliation, Pune, India), five patients undergoing open surgery for proximal humerus fracture under general anesthesia were enrolled for this case series after their written informed consent during January to July 2019. Patients with American Society Anesthesiologists (ASA) physical status greater than III, pregnancy, neuromuscular disease, renal disorders, skin infection at the needle insertion site, prior surgery on infraclavicular fossa, history of brachial plexus injury, bleeding disorder, or allergy to local anesthetic were excluded.

With the patient in the supine position and under due asepsis, a linear array US probe (5–13 MHz, Sonosite, USA) was placed in a transverse oblique plane in the costoclavicular space (Fig. 1A), and the three cords of the brachial plexus lateral to the axillary artery were visualized (Fig. 1C). A 50-mm, 17G insulated needle with a 19G, 100-mm stimulating catheter (StimuLong Nanoline- Pajunk®, Germany) was used for the block. Under US guidance, the needle was inserted in-plane from lateral to medial direction (Fig. 1B) till its tip was positioned between the posterior and medial cord (Fig. 1D). The posterior cord was identified by the extensor response of the fingers using neurostimulation at 0.4 mA. At this point, the needle was stabilized, and its bevel was rotated by 90 degrees to face cephalad towards the supraclavicular fossa. The stimulating catheter was then inserted to a depth of 7–8 cm from the needle tip under continuous neurostimulation (Fig. 1B). The needle and catheter were visualized in the costoclavicular space in all images (Fig. 1D). The evoked muscle response observed at a current of 0.8–1.2 mA was of the deltoid and biceps in one patient each; and of multiple muscles including the deltoid, biceps, and triceps in three patients. After injecting 12 mL of 0.2% ropivacaine with 30 μg clonidine, the contractions ceased, and the catheter was fixed and subcutaneously tunneled on the medial aspect of the chest wall. The entry point was secured with sterile biofilm (Tegaderm, 3M®). General anesthesia was then induced with intravenous (IV) propofol 2–2.5 $mg.kg^{-1}$, fentanyl 2 $\mu g.kg^{-1}$, and cisatracurium 0.15 $mg.kg^{-1}$; and the airway was secured with an appropriately sized endotracheal tube. The tunnelled catheter was safely tucked below

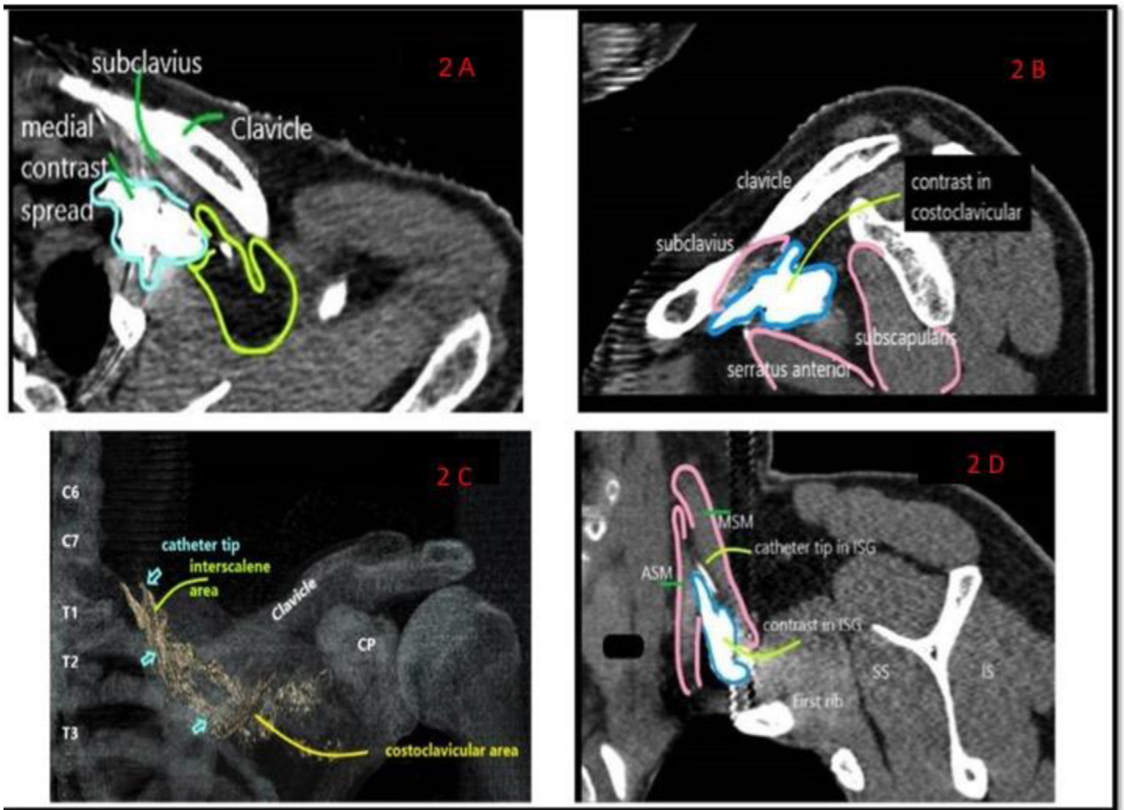

Fig. 2 A, axial view of contrast collection below the subclavius with a more medial contrast spread. B, sagittal view of contrast collection in CCS below the subclavius muscle. C, volume rendering CT technique of radiocontrast injection delineates the spread from CCS to the interscalene area delineating the cervical roots. CP, coracoid process. D, coronal view of contrast translocation in the posterior interscalene area between ASM and MSM. ASM, anterior scalene muscle; MSM, middle scalene muscle; SS, subscapularis; IS, infraspinatus; ESM, erector spinae muscle.

the drapes. During the surgery, 0.1% ropivacaine was infused at 4 $mL.h^{-1}$ through the catheter which was continued postoperatively.

After completion of the surgery, neuromuscular blockade was reversed with appropriate doses of neostigmine and glycopyrrolate, and the patients were transferred to postoperative recovery after tracheal extubation. The VAS at 0, 6, 12, and 24 hours was recorded and tramadol 50 mg IV was administered as rescue analgesia if VAS was more than 4. The first analgesic request time and the requirement of rescue analgesia in 24 hours were recorded. The VAS was less than 4 in the first 24 hours, at all points of time in all patients except in two who required tramadol 50 mg IV at 18 and 19.5 hours, respectively.

All patients were monitored in PACU and there was no drop in oxygen saturation in the immediate postoperative period. As a routine protocol in our institution, US-guided diaphragm excursions were noted before patients were discharged from the recovery room after all brachial blocks above the clavicle. None of the patients revealed hemi-diaphragmatic paresis. On the second postoperative day before the removal of the catheter, a CT (computed tomography) radiocontrast study was performed in two patients after informed consent. Five millilitres of Omnipaque (iohexol 300 mg $I.mL^{-1}$ diluted in 7 mL of normal saline 0.9%) was injected through the catheter and CT images of the dye spread were analysed in consultation with a senior radiologist.

The axial scan depicts the contrast beneath the subclavius muscle and a more medial spread in the infraclavicular area (Fig. 2A). A sagittal image demonstrated the contrast spread was seen localized beneath the subclavius, superficial to the serratus anterior and in front of the subscapularis muscles (Fig. 2B). An image of the CT volume rendering technique revealed a spread above the clavicle in the supraclavicular and interscalene area and below the clavicle, beneath the subclavius muscle in the costoclavicular space (Fig. 2C). The contrast injection leads to more cephalad spread filling the interscalene space between the anterior and the middle scalene muscle (Fig. 2D).

Discussion

In this case series, continuous CCB using retrograde stimulating catheter provided effective postoperative analgesia for open proximal humerus surgeries. The retrograde stimulating catheters could be placed successfully without any technical difficulty using neurostimulation. Further, the radiocontrast studies revealed the contiguous spread of contrast through the brachial plexus sheath in the supraclavicular region with a maximum spread in the costoclavicular space.

The shoulder joint is chiefly innervated by the suprascapular nerve which emerges from the superior trunk and the axillary nerve from the posterior cord at the lateral edge of the pectoralis minor. The other nerves contributing towards innervation are the subscapularis and lateral pectoral nerves arising from the posterior and lateral cords, respectively. Interscalene block is the gold standard regional anesthesia technique for shoulder surgery but it carries a risk of phrenic nerve palsy, with volumes greater than 5 mL. Literature mentions CCB efficiently anesthetizes the axillary, subscapular, and the lateral pectoral nerves which innervate the shoulder joint.[3] However, it is doubtful whether the suprascapular nerve which emerges from the superior trunk and courses below the omohyoid is blocked in CCB.

Our case series is based on the understanding that the costoclavicular space is continuous cranially with the supraclavicular fossa and caudally with the medial infraclavicular fossa above the superior border of the pectoralis minor muscle.[1,2] Previous anatomical study of costoclavicular space confirms the lateral cord is engulfed in a separate connective tissue, and the medial and posterior cords are closely opposed to each other. We, therefore, intended to place the stimulating catheter between the medial and posterior cord and then directed the catheter cephalad towards the supraclavicular fossa. The final tip position was confirmed with continuous neurostimulation by evoked muscle responses of the deltoid, biceps, or mixed contractions of the deltoid, biceps, and triceps. Positioning the catheter as demonstrated by CT contrast studies at the level demonstrated in our study is probably appropriate for shoulder surgeries.

Though there are randomized controlled trials comparing CCB with other regional anesthesia techniques for distal upper limb surgery, retrograde placement for catheter through costoclavicular space for shoulder surgery has not been previously described. Victoria et al discussed retrograde placement of a catheter in the supraclavicular area through the costoclavicular space.[4] However, a limitation of their technique was the need to advance the needle blindly behind the anechoic shadow of the clavicle; the final catheter tip position appeared as a hyperechoic dot at the corner pocket on the US.[4] Aldwinkle retorts that the above-mentioned technique is not simple, efficacious, or safe.[5]

Our technique embarks upon ''the journey behind the dark side of the moon'', as has been categorically and rightfully mentioned by Aldwinckle.[5] The stimulating catheter allows the continuous objective assessment of the catheter tip positioning in close contact with the brachial plexus. Thus, the combined use of the infraclavicular approach and supraclavicular placement of the catheter allows lesser volumes of a local anesthetic to block nerves innervating the shoulder joint. Local anesthetic injection at this point is followed by caudal spread as evident from two CT contrast studies performed in our series. Though we do not report phrenic nerve paresis, this needs to be investigated in a larger sample size. The ease of catheter fixation with lower chances of catheter displacement is the other potential advantage of this technique.

In our case series, there was no procedural complications in the form of vascular penetration, paresthesia related to the needle-nerve contact and during insertion and removal of the stimulating catheter. On the 5th postoperative day, a neurological evaluation of the operated side (block side) did not reveal sensory-motor dysfunction before patients' discharge. Surgeons follow up at 4 and 6 weeks was also normal in all the patients.

The tunneled catheter with biofilm dressing in our series was not a hurdle for the surgeon while performing surgery. Alternatively, catheters can be placed out-of-plane if the surgical team feels the catheter insertion interferes during surgery. In this series, we used 12 mL of local anesthetic for CCB. We need to explore subsequently whether a lesser volume of local anesthetic would be equally efficacious. Thus, we propose that a US-guided CCB with a retrograde stimulating catheter is a feasible alternative regional anesthesia technique for postoperative analgesia for shoulder surgery.

Conflict of interest

The authors declare no conflicts of interest.

References

1. Li JW, Songthamwat B, Samy W, et al. Ultrasound-guided costoclavicular brachial plexus block: sonoanatomy, technique, and block dynamics. Reg Anesth Pain Med. 2017;42:233–40.
2. Sala-Blanch X, Reina MA, Pangthipampai P, et al. Anatomic basis for brachial plexus block at the costoclavicular space: a cadaver anatomic study. Reg Anesth Pain Med. 2016;41:387–91.
3. Tran DQ, Layera S, Bravo D, et al. Diaphragm-sparing nerve blocks for shoulder surgery, revisited. Reg Anesth Pain Med. 2019, http://dx.doi.org/10.1136/rapm-2019-100908 [ahead of print].
4. García-Vitoria C, Vizuete J, López Navarro AM, et al. Costoclavicular space: a reliable gate for continuous regional anesthesia catheter insertion. Anesthesiology. 2017;127:712.
5. Aldwinckle R. Costoclavicular approach to the supraclavicular fossa: journey behind the dark side of the moon (Clavicle). Anesthesiology. 2018;128:1259.