Technical Note

Modified Continuous Arthroscopy-Guided Suprascapular Nerve Block for Postoperative Pain Control Following Rotator Cuff Repair: Surgical Technique

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Abstract: Arthroscopic rotator cuff repair is one of the most painful surgical procedures; patients complain of pain especially during the first 48 hours postoperatively. Pain management is an essential goal to reduce the demand for analgesic agents and patient discomfort. Various methods have been introduced for arthroscopic rotator cuff repair, including continuous arthroscopy-guided suprascapular nerve blocks (SSNB) and interscalene nerve blocks. However, the aforementioned procedures have shown disadvantages such as catheter mobilization, which may cause injury to the artery, a weak analgesic effect, and Horner syndrome, as well as phrenic nerve paralysis. A modification of the continuous arthroscopy-guided SSNB has been introduced at our hospital: the modified continuous arthroscopy-guided SSNB technique. The aim of this technique is to immobilize the catheter to reduce the chance of injury and minimize postsurgical analgesic needs and patient discomfort.

Arthroscopic rotator cuff surgery is generally considered a painful procedure.[1,2] Despite the use of multimodal analgesia, patients experience severe pain within 48 hours after the operation.[3,4] Increased pain is also associated with a delayed return to work, as well as lower clinical scores after surgery at 6 weeks.[5] Wilson et al.[2] reported that patients who underwent arthroscopic shoulder surgery still experienced severe postoperative pain on the first day after arthroscopic rotator cuff repair. Controlling postoperative pain can improve patients' functional recovery, optimizing rehabilitation and allowing a short hospital stay.[6,7]

Postoperative pain can be decreased by regional and local blocks, such as interscalene nerve blocks (ISB), suprascapular nerve blocks (SSNB), and axillary nerve blocks, in arthroscopic shoulder surgery.[3,8,9] Among the regional blocks for shoulder surgery, the ISB has been shown to be one of the most effective pain management methods.[9] However, in many cases, the ISB brings about potentially severe peripheral or central nervous system complications including rebound pain, pneumothorax, brachial plexus injury, failure to block the nerve, and phrenic nerve palsy.[8-11] In recent years, axillary nerve blocks have been introduced to control shoulder pain; however, the sensory area of the axillary nerve only supplies the lateral side of the shoulder.[8,12]

Yamakado[13] used arthroscopy to place a catheter around the suprascapular nerve to improve the safety and operability of the SSNB (i.e., continuous arthroscopy-guided suprascapular nerve block [CA-SSNB]). However, in the process of implementing this technique, we found some disadvantages: In this technique, the suprascapular notch is reached through

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the skin and subcutaneous tissue by the Neviaser approach; the direction of catheter placement is vertical to the nerve; and the catheter is prone to shift during early rehabilitation exercises such as shoulder shrugging and chest enlargement after the operation and may cause injury to the suprascapular nerve and artery, thus affecting the analgesic effect. Therefore, we perform the modified continuous arthroscopy-guided suprascapular nerve block (MCA-SSNB) technique, in which the catheter is set below the posterior horn of the acromion. The catheter is immobilized and catheter swing is effectively reduced, ensuring that the local nerve block anesthetic acts directly on the nerve and improving the analgesic effect. It is hoped that in patients with rotator cuff injury, this technique can obtain better postoperative analgesic effects, improve satisfaction, allow early painless shoulder rehabilitation, and reduce the use of opioids.

Surgical Technique

Patient Positioning

Under general anesthesia combined with a brachial plexus block, the patient is placed in the lateral decubitus position. The arm is pulled longitudinally in the direction of 50° of abduction and 20° of flexion, with a traction weight of 3 kg (Fig 1B). The coracoid process, acromion, clavicle, and coracoacromial ligament are marked with a marking pen before surgery, as are the main surgical approaches (anterior, posterior, lateral, posterolateral, and Neviaser approaches) (Fig 1A).

Diagnostic Arthroscopy and Rotator Cuff Repair

Once the posterior and anterior portals have been created, a routine diagnostic arthroscopy is performed in the articular cavity. According to the size and location of the tear, arthroscopic rotator cuff repair (ARCR) is performed; depending on the size and type of rotator cuff tear, a single- or double-row anchoring technique is performed. For moderate tears, the double-row repair technique should be performed as long as the tendon edge is easily accessible to the footprint area; otherwise, the single-row technique should be performed, with the use of 1 to 4 anchors for moderate tears and 3 to 6 anchors for large to massive tears.

MCA-SSNB Technique

After ARCR, the transverse suprascapular ligament (TSL) is released. The specific operative method is as follows: The lateral approach is used as the observation approach, and soft-tissue debridement is performed through the posterior approach using a planer or radiofrequency device (Arthrex, Naples, FL) to expose the TSL. The coracoclavicular ligaments (trapezoid and conoid ligaments) are first located under arthroscopy; then, the TSL is located along the medial border of the conoid ligament at the scapular notch. An exchange rod (Arthrex) is inserted through the posterior approach, and the TSL is bluntly dissected using the exchange rod to cut this ligament from bottom to top under direct arthroscopic vision to avoid injury to the suprascapular artery and nerve. Then, the suprascapular artery and nerve are exposed by blunt dissection with the exchange rod, and an 18-gauge lumbar puncture needle is passed through the supraspinatus muscle belly

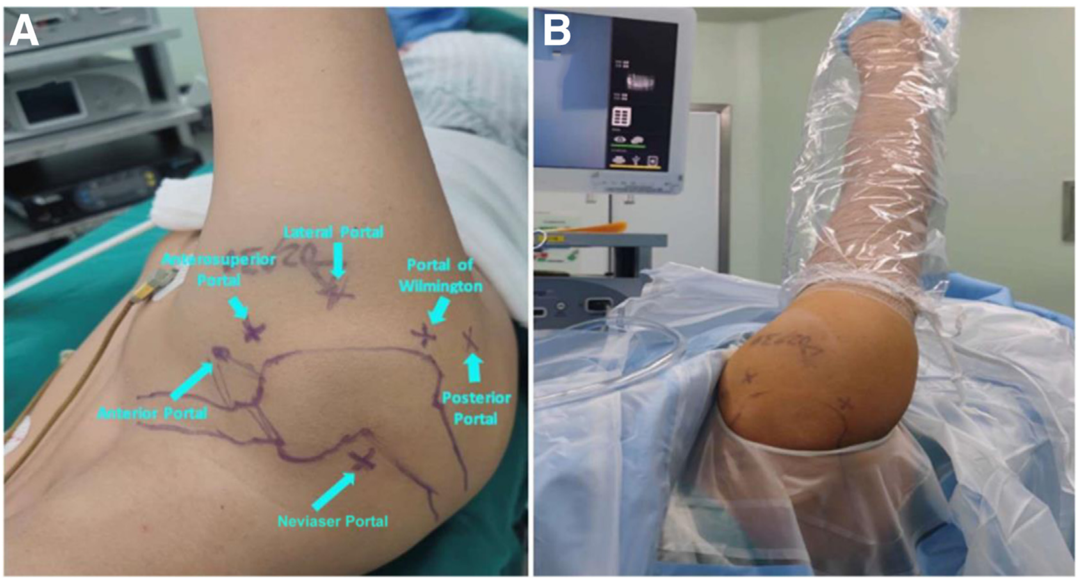

Fig 1. (A) Routine portals are used during the procedure (shown on a right shoulder): anterior portal, anterosuperior portal, lateral portal, portal of Wilmington, posterior portal, and Neviaser portal. (B) The right shoulder is positioned with the patient in the standard lateral decubitus position

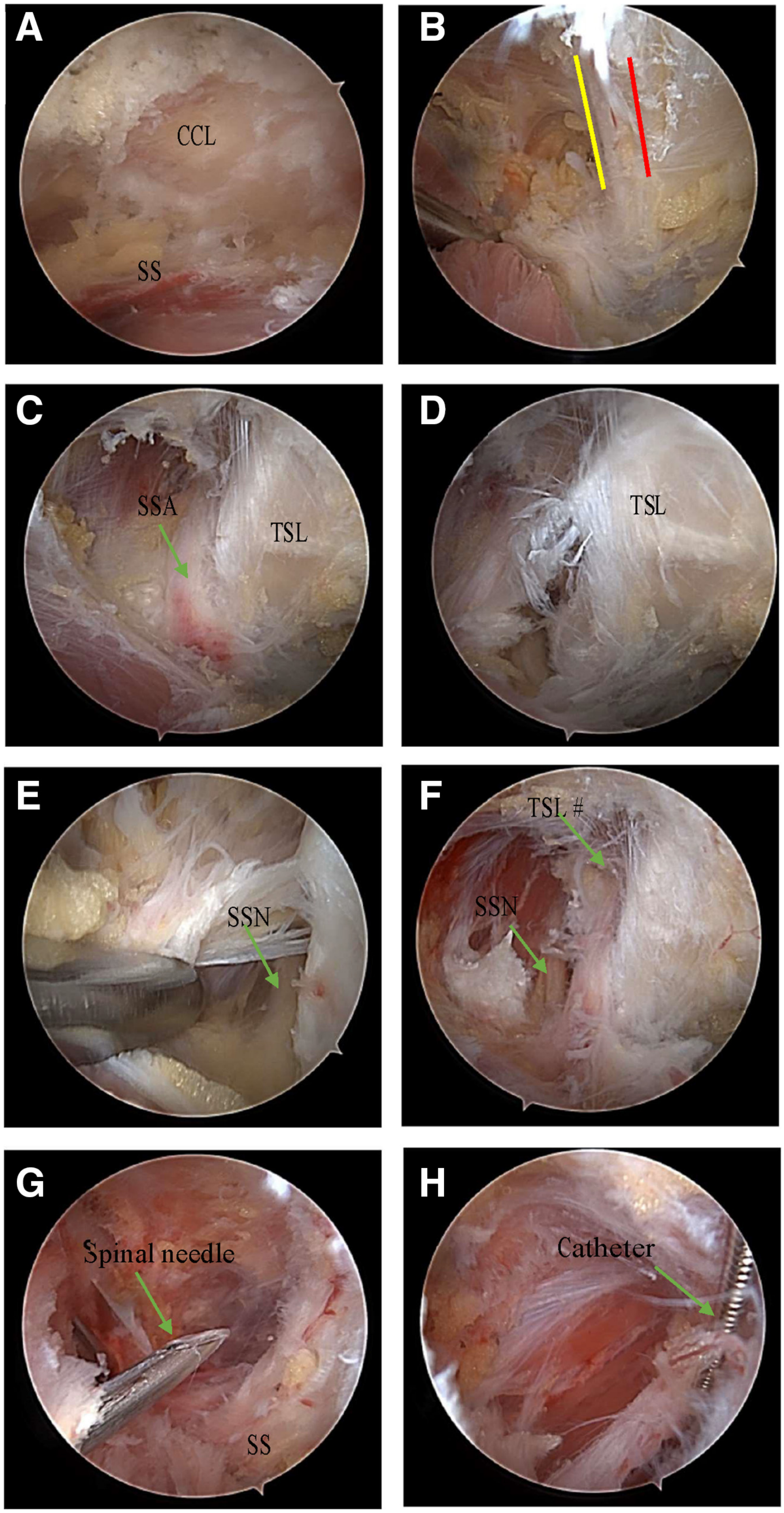

Fig 2. Arthroscopic view using 30° arthroscope from lateral portal (right shoulder with patient in lateral decubitus position). (A) The coracoclavicular ligament (CCL) and supraspinatus muscle (SS) are visible after the subacromial space has been entered. (B) The conoid ligament (yellow) and trapezoid ligament (red) are visible in this position. (C) The suprascapular artery (SSA) and transverse suprascapular ligament (TSL) are visible in this position. (D) The start of the release of the TSL is visible in this position. (E) The exchange rod is used to expose the suprascapular nerve (SSN). (F) The TSL and suprascapular nerve (SSN) are visible in this position. The TSL is released (denoted by the pound sign) under direct arthroscopic vision. (G) The spinal needle is passed through the supraspinatus muscle belly (SS). (H) The catheter is placed parallel to the direction of the suprascapular nerve.

to the side of the suprascapular nerve from the posterior approach. Attention should paid to ensure that the lumbar puncture needle is kept parallel to the suprascapular nerve. A 20-gauge epidural catheter is then placed at the proximal end of the suprascapular nerve through the lumbar puncture needle, the tip of the catheter is grasped with a wire grabber (Arthrex), and the lumbar puncture needle is slowly withdrawn. Under arthroscopy, the position of the catheter is adjusted to be parallel to the direction of the suprascapular nerve by use of wire-grabbing forceps, and the catheter is then subcutaneously fixed. A small amount of air is injected through the catheter through a 10-mL syringe to determine whether the catheter is unobstructed under arthroscopy. The catheter is then connected to an analgesic pump unit containing 200 mL of 0.2% ropivacaine at a continuous speed of 3 mL/L, and the epidural catheter is removed after 48 hours (Fig 2, Video 1).

The approach for the MCA-SSNB technique is shown in Figure 3. Table 1 shows pearls and pitfalls of the procedure.

Discussion

In patients undergoing shoulder surgery, postoperative analgesia is essential for their recovery, rehabilitation, and overall satisfaction.[1,14,15] Despite numerous popular methods, there remains a dilemma in terms of efficacy versus side effects.[16] Several studies have reported that the results of arthroscopy-guided SSNBs for moderate rotator cuff tears are better than those of blind SSNBs within 48 hours after surgery; in addition, these SSNBs have been found to be highly effective at reducing postoperative pain after shoulder surgery.[17,18] A single-injection SSNB is safe and effective, but its action is limited by its short duration, similar to other single-injection blocks.[1,19] An SSNB continuously prolongs analgesia duration. Nevertheless, this method is technically challenging, and there are few reports on this method.[20-22] Coetzee et al.[23] used a technique with an indwelling catheter placed arthroscopically from the subacromial bursa at the lateral edge of the scapular spine to decrease postoperative pain after ARCR. In contrast to our method, their method failed to identify the suprascapular nerve; moreover, their outcomes were not reported because their technique was explained in a letter to the editor.

Yamakado[13] found that a continuous SSNB using a perineural catheter inserted arthroscopically through the suprascapular notch effectively decreases postoperative pain after ARCR. The main limitation of his study is that local nerve block anesthetics should be close to the nerve to achieve the best analgesic effect. However, the direction of the catheter is perpendicular to the nerve, and the catheter is free at the lower part of the acromion, so during postoperative rehabilitation exercises, catheter swing can easily occur, which can cause damage to the suprascapular artery and nerve; the nerve block has limited range; and the analgesic effect is weak. Our technique is achieved through a different approach that uses arthroscopically placed catheters immobilized by the supraspinatus muscle through the posterior angle of the acromion to block the suprascapular nerve. The catheter is fixed under the acromion by the supraspinatus muscle, which could effectively reduce the occurrence of catheter shift, thus minimizing the risk of damage to the suprascapular nerve and artery, as well as intravascular injection,

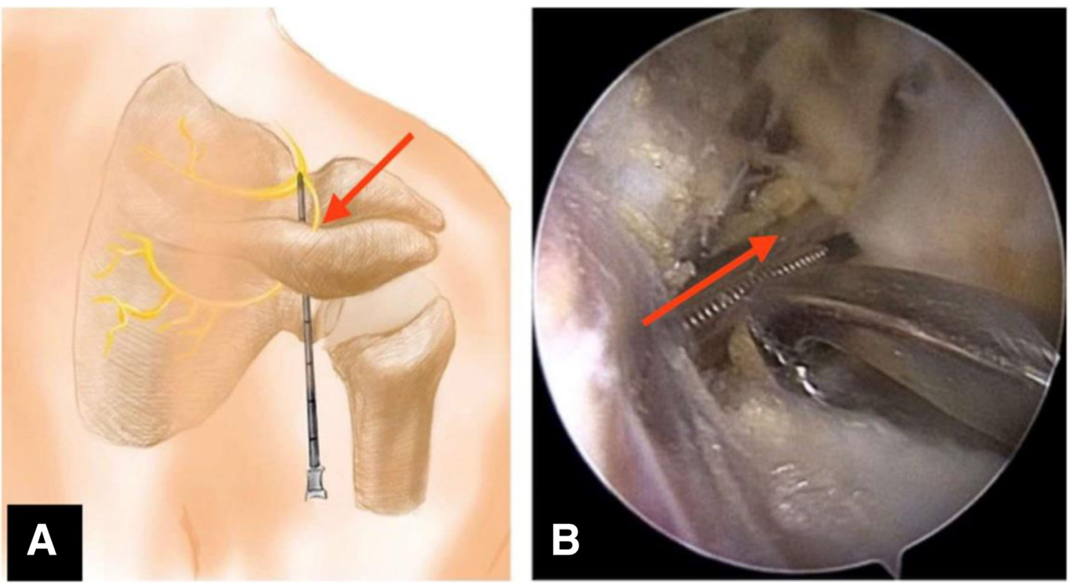

Fig 3. (A) Suprascapular nerve (red arrow) in modified continuous arthroscopy-guided suprascapular nerve block procedure. (B) An epidural catheter is set parallel to the suprascapular nerve (red arrow).

Table 1. Pearls and Pitfalls of MCA-SSNB Technique

Pearls
To improve the operative field, all soft tissue beneath the surface of the acromion and acromioclavicular joint should be cleaned.
The TSL is found medial to the base of the conoid ligament.
It is recommended to perform TSL release to increase the space for visualization during the SSNB.
TSL release makes it easier to place the indwelling catheter under direct arthroscopic vision.
The catheter is placed parallel to the direction of the nerve and as close as possible to the suprascapular nerve.
The catheter is fixed by the supraspinatus muscle belly under the acromion, which can effectively reduce the occurrence of catheter displacement.
Pitfalls
The surgeon should avoid placing the catheter before obtaining a good view of the suprascapular nerve.
Releasing the TSL requires time and experience and has a steep learning curve.

MCA-SSNB, modified arthroscopy-guided suprascapular nerve block; SSNB, suprascapular nerve block; TSL, transverse suprascapular ligament.

Table 2. Advantages and Disadvantages of Traditional CA-SSNB Technique and MCA-SSNB Technique

	Traditional Technique (CA-SSNB)	Modified Technique (MCA-SSNB)
Principal approach	Neviaser portal approach	Posterior portal approach
Advantages	The suprascapular nerve is identified arthroscopically.	The supraspinatus muscle holds the catheter in place (minimizing catheter shift). The technique ensures that the suprascapular artery and nerve are less likely to be injured. The catheter is parallel to the nerve. A better analgesic effect is achieved. The use of opioids is reduced. Patient satisfaction is improved.
Disadvantages	The catheter can shift easily. Injury to the suprascapular artery and nerve is relatively more likely. The catheter is perpendicular to the nerve. Limited range to block suprascapular nerve. A weak analgesic effect is achieved.	A longer operative time is required. The technique is technically demanding.

CA-SSNB, continuous arthroscopy-guided suprascapular nerve block; MCA-SSNB, modified continuous arthroscopy-guided suprascapular nerve block.

pneumothorax, and nerve damage, caused by the movement of the catheter. The catheter is positioned parallel to the suprascapular nerve, thus ensuring that the suprascapular artery and nerve are less likely to be injured and improving the analgesic effect. The differences between our surgical technique for arthroscopy-guided SSNB and the previously described CA-SSNB technique, as well as the advantages and disadvantages of each, are summarized in Table 2. Even though our technique reduces postoperative pain after ARCR, it is technically challenging and carries a high risk of side effects. This surgical procedure should be performed by highly skilled arthroscopic shoulder surgeons.

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