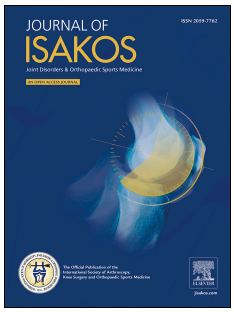

"Cannula-in-cannula" Technique for Turbulence Control and Suture Management in Arthroscopic Superior Capsular Reconstruction - A Technical Note

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"Cannula-in-cannula" Technique for Turbulence Control and Suture Management in Arthroscopic Superior Capsular Reconstruction - A Technical Note

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Abstract

Arthroscopic superior capsular reconstruction (SCR) is gaining popularity in managing irreparable rotator cuff tears in younger population without arthrosis. One of many reasons for the increasing trend is the simplification of technique using allograft and knotless technology for fixation. Despite all this, turbulence control and suture management are still the arduous undertakings. In order to improve visualization and prevent entanglement of sutures, we employed the cannula-in-cannula technique which allowed a continuous fluid management and tanglefree handling of sutures.

Technique

- Under general anesthesia and/or interscalene block.
- Beach chair position with affected limb held by a pneumatic arm holder.
- Placement of standard arthroscopic portals for diagnostic arthroscopy of gleno-humeral joint, then for subacromial scopy and instrumentation.
- Glenoid preparation - Superior surface of glenoid medial to the labrum was prepared with shaver and two double-loaded Healicoil suture anchors were placed at 1o clock and 10o clock positions.
- Greater tuberosity (GT) preparation - The footprint over the GT was prepared using the combination of aggressive shaver and burr, two Y-Knot® RC with Tape, All-Suture anchors were placed at the edges of the footprint anteriorly and posteriorly.
- Graft preparation - The measurements were done using a calibrated probe, between the glenoid anchors, GT anchors and glenoid to GT anchors. Acellular human dermal allograft was prepared by adding 5 mm to the anterior, posterior, medial side and 10 mm to the lateral side measurements. The holes were created for passing sutures for side-to-side repair.
- Graft passage
    - One set of suture strands from each double-loaded glenoid anchors and tapes from GT anchors were retrieved through lateral portal. The incision was extended to widen the lateral portal. A 12x40 mm GateWay silicone flexible cannula was inserted into the lateral portal with sutures and tapes outside to it.

- Sequentially, one set of sutures from the anterior and posterior glenoid anchors and tapes from anterior and posterior GT anchors were retrieved abutting the respective quadrants of the flexible cannula.
- Sutures and tapes were passed through the graft as per the earlier measurements, using an eyed Mayo needle.
- Graft shuttled into the subacromial space using “double-pulley” technique.

- Graft fixation
  - Sutures from glenoid anchors were tied to complete double mattress sutures over the glenoid.
  - A 7 .0 mm FOREST GREEN plastic cannula was inserted into the flexible cannula leaving the tapes outside to it.
  - The trocar of the plastic cannula was used to spread the graft and keep the cannula above the graft, and the inflow fluid line was connected to the port in the plastic cannula to inflate the subacromial space.
  - The other set of sutures from the double-loaded glenoid anchors were used for the side-to-side repair by passing one strand through the graft and other through the infraspinatus and rotator interval tissue, posteriorly and anteriorly, respectively, at the level of the glenoid.
  - Two to 3 side-to-side repairs were done posteriorly and then anteriorly.
  - Tapes from GT anchors were fixed using two CrossFT Knotless DT anchors laterally, in crisscross SpeedBridge configuration.

Advantages of Cannula-in-cannula technique
• Clear arthroscopic field through improved turbulence control. • No need of multiple percutaneous portals to park the sutures and tapes. • Better fluid management at lower pump pressures. • No crowding of the lateral working portal – Only the pertaining sutures of the respective steps were retrieved through the cannula. • Tangle-free suture management with multi-level check on suture entanglement. • Maintenance of plastic cannula above the graft without chances of backout. • Adequate working space laterally between cannula and GT.

Outline of the problem

Since the description of SCR by Mihata et al[1], there have been many modifications to the original technique with good preliminary results in selected patients[2, 3]. As the old adage goes "can't fix if you can't see", in complex surgeries like arthroscopic SCR, unobstructed visualization becomes imperative. Some surgeons prefer to pass sutures through the graft extracorporeal and some to do it intracorporeal, suture entanglement was seen irrespective of these preferences. To ease the suture management, multiple percutaneous portals were used, but it addressed the entanglement before the graft passage but not after, and created turbulence through fluid leak from multiple non-cannulated portals (Bernoulli effect)[4]. There have been reports on use of fabricated cannula made from syringe for graft passage, but with the absence of dam in these customized cannulas, turbulence control and cannula slip-out were unpreventable[5]. To address these difficulties, we used the cannula-in cannula technique, which eased the suture management and improved the visualization.

Surgical indications and contraindications

Indications for arthroscopic SCR has been in continuous change, and vary from surgeon to surgeon. The available literature suggests that it is a viable option for younger population with massive, irreparable postero-superior rotator cuff tear (RCT), with loss of forward flexion, preserved rotations, and no gleno-humeral arthritis[6,7]. Contraindications are patients with severe cuff tear arthropathy, non-functional deltoid, irreparable subscapularis tear.

Treatment options

Traditionally, the surgical options for irreparable RCTs, ranged from simple debridement, partial repair with or without tuberoplasty to complex tendon transfers, superior

capsular reconstruction and ultimately reverse total shoulder arthroplasty[8]. But particularly in younger patients, without cuff tear arthropathy, arthroscopic SCR is advantageous as it is joint preserving, relieves pain and increases forward flexion[3,6].

Outcomes of the technique

With the advent of dermal allografts, the donor site morbidity associated with fascia lata autograft has been taken care of. The preliminary results of SCR using dermal allografts are encouraging[3], making it indispensable to learn to perform this surgery. The suture management is the key to this surgery. Suture entanglement, twisting of the graft are the potential ruiners to a flawless surgery. There were multiple advantages of the cannula-in-cannula technique in handling sutures and improving the visibility during surgery. This technique enhanced the visualization of the arthroscopic field through better fluid management. The lateral working portal was kept free from sutures at every step of surgery and only the sutures for the pertaining steps were passed through the cannula, thus creating multilevel check on sutures from getting tangled and not crowding the portal while instrumentation, without the need of multiple percutaneous portals to park the sutures. With the use of a plastic cannula, there was an ease in spreading the graft and maintenance of the cannula above the graft while performing further instrumentation. The port in the plastic cannula connected to fluid inflow line kept the subacromial space inflated without the need of higher pump pressure, and with better turbulence control. This step also maintained the working space between the cannula and GT laterally and avoided the need for holding the cannula pulled laterally to increase the working space, seen when the flexible cannulas were used alone. A retrospective review of patients operated with arthroscopic SCR using cannula-in-cannula technique by the senior author (YGR) between February 2019 and December 2021 with a minimum post-operative follow-up of 12 months, was performed. A total of 42

patients with mean age of 57.2 (range, 48-69) years, including 36 male and 6 female patients and an average follow-up of 14.5 months, were analyzed. Among 42 patients, there were 26 patients with primary and 16 with secondary SCR for prior failed rotator cuff repair. The visual analogue scale (VAS) score improved pre- to post-operatively from 3.9 to 1.6 and the University of California of Los Angeles (UCLA) shoulder score from 13.4 to 29.8 points. Range of motion (in degrees) of forward flexion, scapular plane abduction improved from 120.7 and 86.6 preoperatively to 159.8 and 105.5 at final follow-up, respectively. There were 3 (7.1%) patients with retear but none required any revision surgery or reverse total shoulder arthroplasty at the time of their final follow-up. A similar technique has been in use to manage sutures in arthroscopic rotator cuff repair with patch augmentation (40 cases since 2019), reporting of which is under way.

Disadvantages

There were no complications specifically related to the cannula-in-cannula technique. However, there were some disadvantages of this technique. There was an added cost of the second cannula, but the time saved by the ease in suture management outweighed this added cost to the surgery. Occasionally, there were situations with difficulty in retrieving sutures while they were parked outside the plastic cannula (i.e., between the flexible and plastic cannula) due to friction. This was dealt by first retrieving through anterosuperolateral portal and then through the lateral portal. There were few added steps to retrieve sutures and tapes through plastic cannula before knot-tying and lateral fixation, respectively when cannula-in-cannula technique was used as compared to a single cannula, which added few extra minutes to the surgery. We believe that in surgeries like arthroscopic SCR, few extra minutes spent to simplify the complexity will always be worthwhile.

Conclusion and future perspective

Arthroscopic SCR using cannula-in-cannula technique is a simple modification with great advantages, such as improved visualization, better turbulence control and easier suture management, without any complications specifically related to it. Future clinical studies are required to establish the outcomes of arthroscopic SCR using dermal allograft and factors promoting healing of the graft.

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Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: