Technical Note

How to Maximize Suture Tension in Double-Row Suture-Bridge Rotator Cuff Repair?

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Abstract: Double-row suture-bridge technique for rotator cuff repair has been used for rotator cuff tears. In large tears that require 2 or more lateral row anchors, loosening of the suture bridges could occur because of tightening sequence. By retightening suture limbs before deploying the first lateral row anchor, premature loosening could be prevented and enhance the tension of the construct.

Arthroscopic rotator cuff repairs have been widely used for rotator cuff injuries.[1] The double-row technique for rotator cuff repair shows a better outcome compared with the single-row technique, especially in larger tears.[2] The transosseous-equivalent suture-bridge rotator cuff repair technique is commonly used to increase contact area of the rotator cuff to the bone, decrease gap formation, with high stiffness, and load to failure.[3-5] The transosseous-equivalent suture-bridge technique demonstrates a high healing rate on magnetic resonance imaging.[6] A lateral row could be achieved using knotless suture anchors, which will allow manual tensioning before anchor fixation. In large tears that require 2 or more lateral row anchors, loosening of the suture bridges could occur because of tightening sequence. We found that the first group of sutures became loose when we tightened the second group of medial row suture to the lateral anchor. The following technique will help maximize the suture limbs tension for the lateral row suture anchors of the double-row repair in complete supraspinatus tear (Fig 1).

Surgical Technique (With Video Illustration)

The patient is placed in a beach chair position. After the patient is prepped and draped, anatomical bony landmarks are identified and drawn. An arthroscopic examination is done from the established posterior portal. Once the rotator cuff tear has been identified, reduction of the cuff is done with a tissue grasper to approximate and determine the mobility of the rotator cuff (in this case, the supraspinatus is completely torn) from established lateral portal. Two medial (1 anterior and 1 posterior) and 2 lateral row anchors for transosseous-equivalent suture-bridge rotator cuff repair are used. The anatomical footprint onto which the cuff will be reattached with the medial anchors is decorticated with an arthroscopic burr.

Repair of the rotator cuff starts with medial row anchor placement through the lateral portal. A double-loaded bioabsorbable screw (CrossFT; CONMED, Utica, NY) is applied just lateral to the articular edge of the humeral head at the anterior half of the tendon footprint. The anterior half of the cuff is then repaired by 2 horizontal mattress sutures, with the suture limbs retained for creating suture bridge to the lateral row. Another anchor for the medial row is then applied in the same manner but at the posterior half of the footprint. Both anterior and posterior medial anchor are spread out equally to allow adequate repair of the cuff anteroposteriorly. After the anterior and posterior medial row repair is completed, the first lateral row is done with an all-PEEK (polyether ether ketone) knotless suture anchor (PopLok; CONMED). The position to which the PopLok will be applied is at the same coronal plane with the anterior medial anchor.

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Fig 1. Coronal T2-weighted fat suppression image of the right shoulder demonstrates a complete supraspinatus tear (arrow).

The 2 suture limbs from the anterior medial row and 2 suture limbs from the posterior medial row (total of 4 suture limbs) are retrieved to the lateral portal and loaded into a PopLok anchor (2 suture limbs for each side of the PopLok insertion loop), creating a linked double-row repair construct. Detach the loading tab from the PopLok and the limbs are seated within the PopLok. A clamp is applied at the distal end of the suture limbs to avoid slippage of the suture. The lateral row anchor is placed at the lateral aspect of the greater tuberosity. The suture limbs are tightened, with the first PopLok in placed, but not yet deployed. The second lateral row anchor is loaded with the remaining sutures and applied posteriorly to the first anchor. This anchor is inserted by creating another portal posterior to the lateral portal previously used to insert the first anchor. The second lateral row anchor is prepared and inserted in the same manner. After tightening of the suture limbs of the posterior lateral row anchor, the suture bridge of the anterior lateral row is examined again arthroscopically (Fig 2). Loosening of the suture bridge usually occurs after tightening of the suture limbs of the posterior lateral row anchor (Fig 3). The suture limbs of the anterior lateral row anchor are then retightened again until desired tension of the bridge is achieved (Fig 4, Video 1). Next, performing an arthroscopic view from the posterior portal to check once again the desired tension of the suture bridge. The suture bridges are now firmly compressed to the repaired tendon (Fig 5). Finally, deploy the anterior lateral anchor (Fig 6); the posterior lateral anchor is deployed in the same manner. The final suture construct of the repair is examined through the lateral portal (Fig 7). The sutures are then cut. The skin is closed in routine fashion.

Postoperative Protocol

The postoperative protocol includes limited shoulder abduction, forward flexion, and external rotation 2 weeks postoperatively, with an arm sling applied. Light pendulum exercise could be started post-operatively. The patient is encouraged to move the ipsilateral elbow, wrist, and hand. Assisted active range of motion exercise of the shoulder can be initiated at the third to sixth week postoperatively. At the seventh

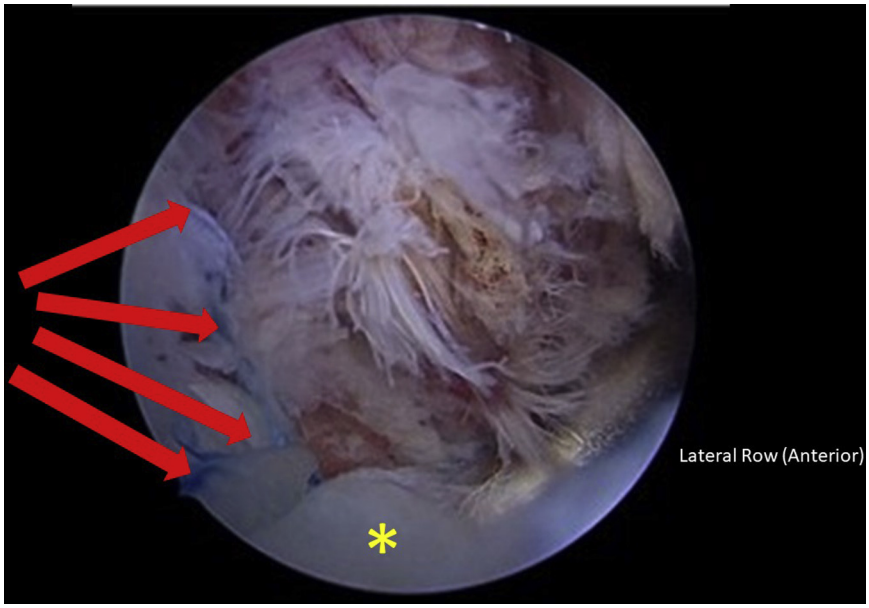

Fig 2. An arthroscopic view of the right shoulder in the subacromial space from the posterior portal shows loosening of the suture bridges of the anterior lateral row (arrows) above the supraspinatus (asterisk). This happened right after tensioning of the posterior lateral row.

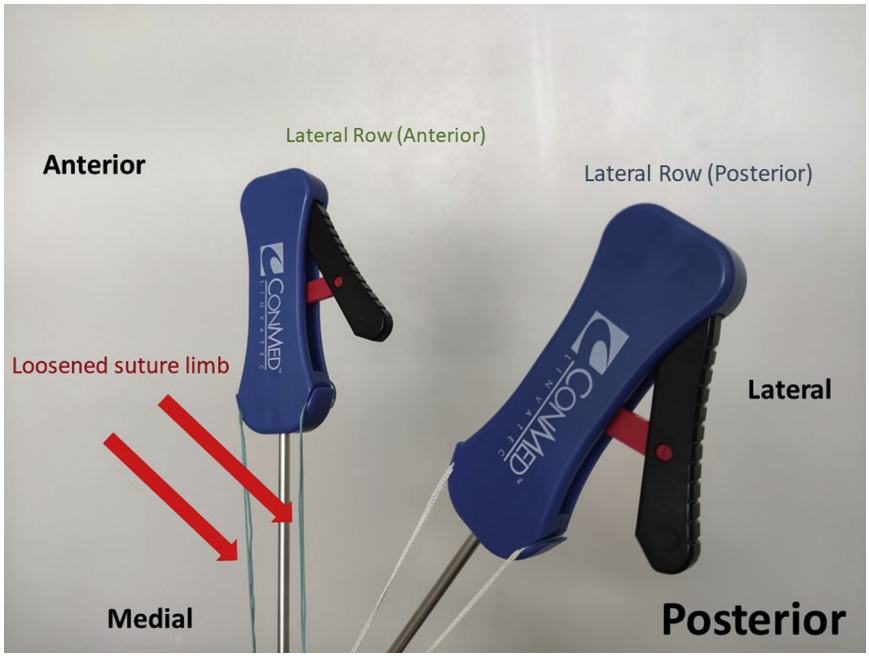

Fig 3. A demonstration view from the posterior, outside of the right shoulder joint, shows loosened suture of the remaining limb of the anterior lateral row (arrows).

week postoperatively, active range of motion exercise can be done as tolerated, with the aim to restore full motion. Return to sport is possible 6 months after the operation. Advantages, disadvantages, pearls, and pitfalls are described in Table 1.

Discussion

Despite the many techniques of the transosseous-equivalent suture-bridge repair of the rotator cuff, less attention is paid to the tension of the suture bridge after the cuff has been repaired. Kummer et al.[7] stated that

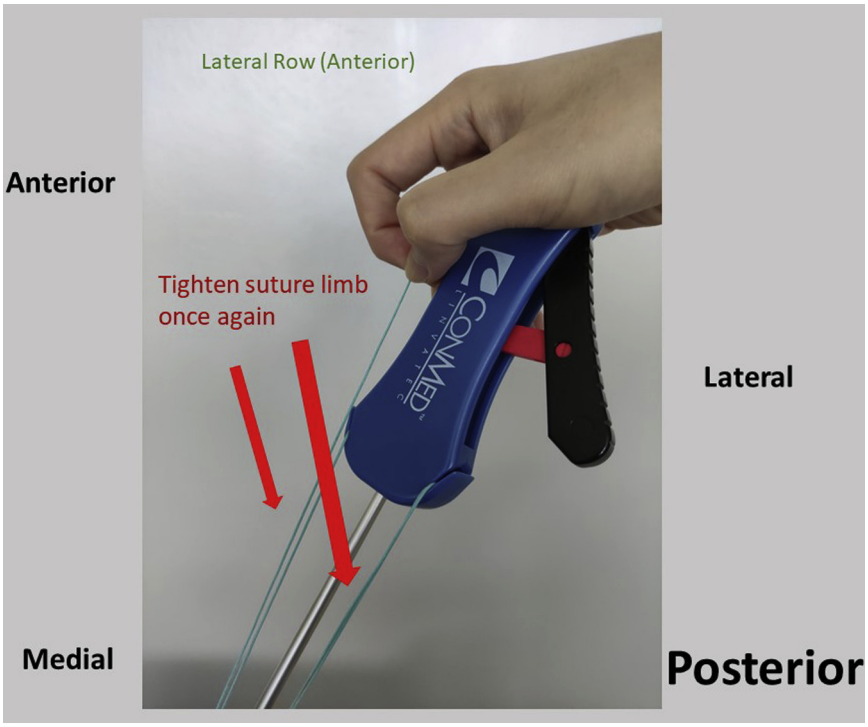

Fig 4. A demonstration view from the posterior, outside of the right shoulder joint, shows retensioning of the suture limbs of the anterior lateral row (arrows).

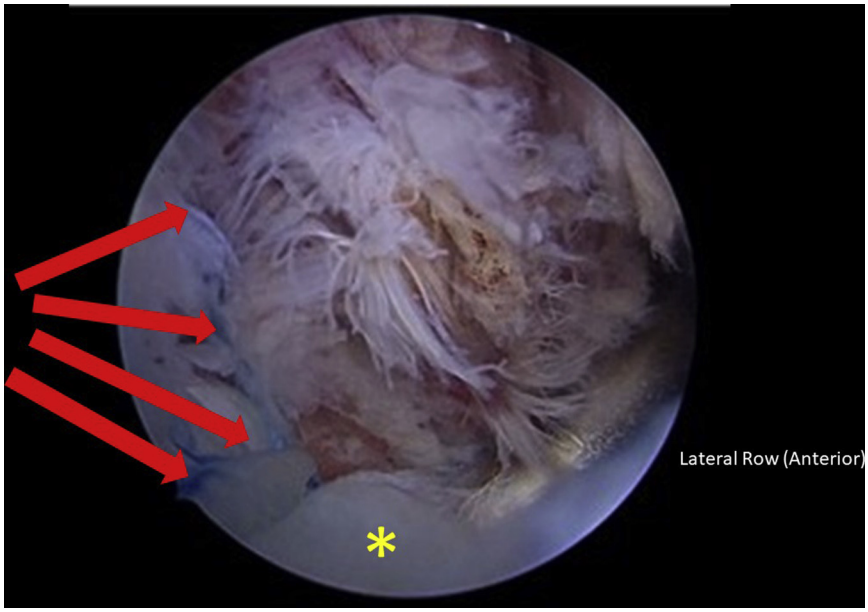

Fig 5. An arthroscopic view of the right shoulder in the subacromial space from the posterior portal shows tightened suture bridges (arrows), compressing the repaired supraspinatus tendon (asterisk).

loosened suture limbs would result in loss of compression of the cuff tendon against the bone. If the suture bridges are loosened, the overall construct of the sutures will depend solely on the knots at the medial anchor. Mall et al.[8] conducted a systematic review on the biomechanical importance of tying the medial row. Gap formation, stiffness, load to failure, and contact area in knotted medial row is better than knotless repair. Loosening of the suture limbs may result in marked decrease in strength of the overall suture construct of the knotless repair, since the medial row does not have a fixation between the suture and the

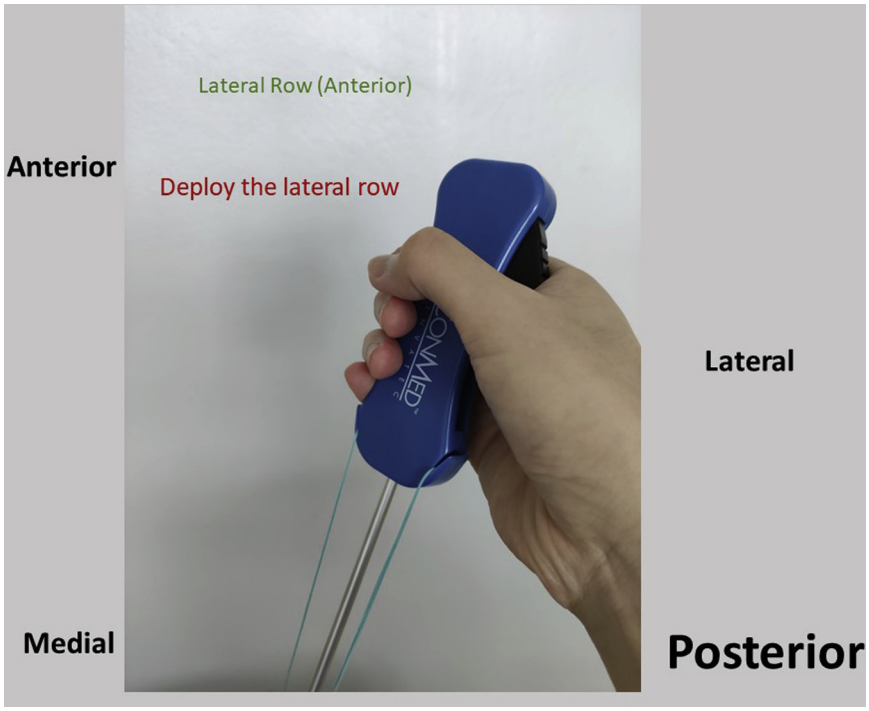

Fig 6. A demonstration view from the posterior, outside of the right shoulder joint, shows deployment of the anterior lateral row after retightening all of the suture limbs.

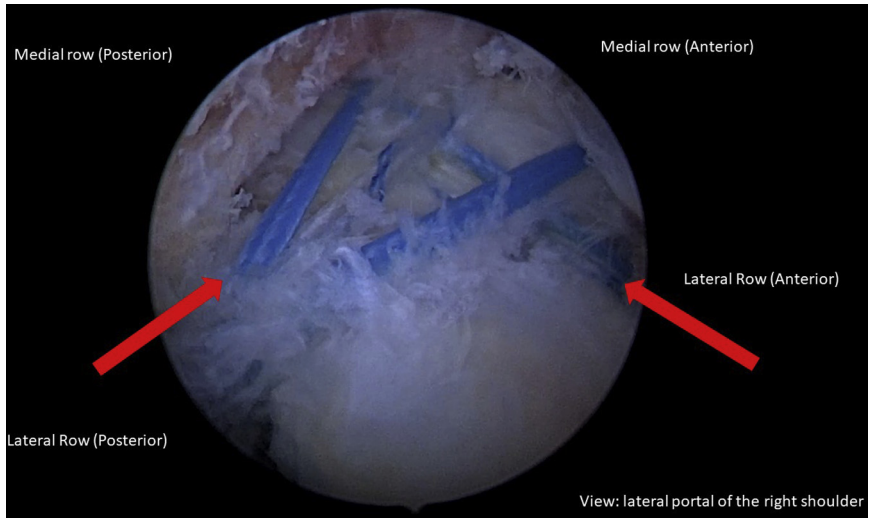

Fig 7. An arthroscopic view of the right shoulder from the lateral portal shows transosseous-equivalent double-row repair configuration is checked through the lateral portal. Note the tensioned suture bridges without loosening (arrows).

anchor. Nevertheless, Pogorzelski et al.[9] did not find a difference in mid- to long-term results between knotted and knotless medial row repair.

On the contrary, a retrospective study by Burns et al.[10] found that knotted technique for rotator cuff repair required more surgical time than knotless technique, and in another study, Elbuluk et al.[11] found that the rate of tendon failure in knotted repair could be the cause of failed rotator cuff repair. However, Sheean et al.[12] suggested that the authors of some studies need to be cautious when interpreting results regarding failure of the knotted technique because of the variety of techniques of knot-tying. However, Kunze et al.[13] found that both knotless and knotted technique have similar location and incidence rate of retear.

By retightening suture limbs before deploying the first lateral row anchor, premature loosening could be prevented and enhance the tension of the construct. Further studies regarding the amount of initial suture loosening and strength decreased from the loosed construct are needed.

Table 1. Advantages, Disadvantages, Pearls, and Pitfalls of the Technique

Advantages
Maximize the tension of the suture limbs
Able to adjust the suture limbs until desired before deploying the lateral rows
Disadvantage
Increase operative time
Slightly crowded surgical field
Pearls
Suture tension of the first group of sutures should be rechecked since loosening could occur
Retightening of the suture limbs should be done to assure good tension of the suture
Deployment of the PopLoks should be done after the sutures are tensioned again
Pitfalls
Cut the first lateral sutures before proceeding to the second lateral row
Loosened suture limbs of the lateral rows

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