SURGICAL TECHNIQUE

Arthroscopic Rotator Cuff Repair with Augmentation: The V-sled Technique

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Numerous techniques have been described for patch positioning in rotator cuff shoulder arthroscopic surgery. These techniques seem to be difficult challenges for the majority of arthroscopic surgeons, and because of that they are called “highly demanding” techniques. Without the use of dedicated instruments and cannulas, the authors propose a V-sled technique that seems to be more reproducible, quicker and less difficult to perform for arthroscopic shoulder surgeons. The patient is placed in the lateral position. All arthroscopic procedures are performed without the use of cannulas. The standard posterior portal is used for the glenohumeral (GH) joint arthroscopy with fluid inflowing through the scope. After an accurate evaluation of the GH space, the scope is then introduced into the subacromial space. With the use of a spinal needle, a lateral portal is performed. The great tuberosity is prepared with a bur to place two 5.5 mm triple-loaded radiolucent anchors. In addition, two free high strength sutures are passed through the muscle, respectively. The repair is performed using two high strength sutures from each anchor. The third wire from each anchor is retrieved out of the accessories portals used for the insertion of the anchors. In addition, two free high strength sutures are passed through the muscle, and the patch sizing is done using a measuring probe introduced through the lateral portal. Next, the patch is then prepared and is introduced into the subacromial space, and then the patch is stabilized, and the free sutures are tied.

Key words: Arthroscopy; Rotator cuff; Transdermal patch

Introduction

Rotator cuff tears (RCT) are among the most frequently registered causes of pain and dysfunction in the shoulder, especially in patients performing overhead working activities and sports¹. Symptomatology is variable and surgery often represents a successful treatment, reattaching the tendon to bone at the original site of insertion². Re-tear rate is still high in spite of the significant improvement of surgical techniques and it varies between 39% (in case of an isolated tear of the supraspinatus) to 89% (in case of a tear of three tendons)³. Regardless of the technique used, the rates of re-tear seem to be the same and there is no general consensus as to the causes of re-tear⁴. The inability to obtain high rates of healing has encouraged surgeons to find better techniques of rotator cuff suturing, such as the double-row technique, but with no

success. Various researches were promoted to study bioengineered augmentations to improve re-tear rates⁵: periosteal patches, freeze-dried rotator cuff, Gore-Tex, extracellular matrices and several polymers patches⁶ have been studied as scaffolds for augmentation procedures. The goal of patch augmentation is to stabilize the repair, improve healing processes or even bridge a small defect when only partial repair is possible⁷. To our knowledge, there is not a standardized technique, open or arthroscopic, to fix augmentation; the limitation in the use of these biomaterials is due to difficulties of surgeons to implant them, especially during arthroscopic surgery, because it counts as a highly-demanding surgery^{7,8}.

The aim of this article is to propose a new method to apply augmentation through an all-arthroscopic technique for rotator cuff repair.

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Fig. 1 Two 5.5 mm triple-loaded radiolucent anchors are laterally positioned on the great tuberosity.

Technique

Arthroscopic Procedure

A pre-surgery interscalene block is given to the patient that is placed in the lateral position with the glenoid parallel to the floor. The operative arm is placed in traction at 45° of abduction with 4–5 kg of weight, depending on the patient's size. All arthroscopic procedures are performed without the use of canulas. The standard posterior portal is used for the glenohumeral (GH) joint arthroscopy with fluid inflowing through the scope. After an accurate evaluation of the GH space, if necessary a biceps tenotomy is performed through an anterior portal. The scope is then introduced into the subacromial space. With the use of a spinal needle a lateral portal is performed. Bursectomy should be done to improve the visualization. Cuff is debrided and mobilized hence the torn edge is resected to refresh the margin. The great tuberosity is prepared with a bur to place two 5.5 mm triple-loaded radiolucent anchors (Fig. 1). The first anchor to be placed is the antero-lateral (antero lateral anchor, abbreviated as ALA) leaving the second anchor to be the postero-lateral (postero lateral anchor, abbreviated as PLA). The repair is performed using two high

strength sutures from each anchor. The sutures are placed through the cuff with the use of a penetrator; they are grabbed with a grasper and are then tied proceeding in an antero-posterior order. The third wire from each anchor is retrieved out of the accessories portals used for the insertion of the anchors. In addition, two free high strength sutures are passed through the muscle antero-medially (AM) and postero-medially (PM) in line with the ALA and PLA, respectively (Fig. 2). The two free sutures should be about 3 cm medially from anchors, while the distance between the AM and PM wire should be the same as that of the ALA from the PLA. The patch sizing is done using a measuring probe introduced through the lateral portal.

Fig. 2 Cuff repair is performed using two sutures from each anchor. The third suture from each anchor is passed out from the accessories portals used for the insertion of the anchors. In addition, two free sutures are passed through the muscle antero-medially and postero-medially in line with the antero lateral anchor (ALA) and postero lateral anchor (PLA) respectively. The two free sutures should be about 3 cm medially from anchors, while the distance between the antero-medial (AM) and postero-medial (PM) sutures should be the same as that of the ALA from the PLA.

Fig. 3 (a) Using a free suture needle the posterior limb of the antero-medial (AM) wire (posterior limb [PL]-AM) is passed through the medial edge of the patch with an antero-posterior direction moving from top to bottom. The conclusion of this passage is obtained when the suture reaches the midpoint of the medial edge of the patch. Similarly, the anterior limb of the PM suture (AL-PM) is passed through the medial edge of the patch but this time moving in a posterior-anterior direction. Therefore the posterior limb (PL)-AM and AL-PM suture are tied together on the patch. The third suture from each anchor (antero lateral anchor [ALA] and postero lateral anchor [PLA]) is now passed through the antero-lateral and postero-lateral corners of the patch, respectively. (b) Pulling at the suture, the patch folds and slides through the lateral portal entering the subacromial space.

Outside Articulation Procedure

The patch is then prepared. It is rinsed in saline water and cut to fit the measurement. All the sides of the patch are marked with a surgical pen appropriately (A: anterior; P: posterior; L: lateral; M: medial). All the remaining sutures are placed outside the articulation from the lateral portal.

Using a free suture needle and instruments to hold the patch, the posterior limb of the AM suture (PL-AM) is passed through the medial edge of the patch with an antero-posterior direction moving from top to bottom. The passage is complete when the suture reaches the midpoint of the medial edge of the patch. Similarly, the anterior limb of the PM suture (AL-PM) is passed through the medial edge of the patch but this time moving in a posterior-anterior direction. Therefore the PL-AM and AL-PM sutures are tied together on the patch.

The third suture from each anchor (ALA and PLA) is now passed, respectively, through the antero-lateral and postero-lateral corner of the patch (Fig. 3a).

By pulling the posterior limb of the AM suture and the anterior limb of the PM sutures, the patch folds and slides through the lateral portal easily entering the subacromial space (Fig. 3b).

Arthroscopic Procedure

With the use of a probe, the patch will unroll, recovering its original shape (Fig. 4). The free portion of AM and PM sutures are then loaded in a knotless anchor that is placed approximately 1.5 cm distal to the edge of the repaired cuff. In this way the two sutures will be stretched on the patch, which stabilizes and compresses it with a V-shape bridge. The remaining third suture of each anchor is then tied (Fig. 5).

Discussion

Literature shows that numerous techniques have been described for patch positioning in shoulder arthroscopic surgery. These techniques seem to be challenging for the majority of arthroscopic surgeons, and because of that they are also called “high demanding” techniques.

The V-sled technique seems to have some advantages, in particular if compared with the published techniques^{7,8}. In fact, the V-sled technique appears to be less difficult to perform. The

Fig. 4 With the use of a probe, the patch will unroll, recovering its original shape.

Labbé's⁷ and Bond's⁸ techniques need the use of one to three anchors to perform the primary arthroscopic rotator cuff repair, and the use of at least two cannulas to manage a high number of stitches used to secure the scaffold on its anterior, posterior and medial aspects. Particular care must be taken to ensure that the sutures have no twists and are not wrapped around one another, which is very time-consuming.

The V-sled technique appears to be quicker. After performing a standard primary rotator cuff repair with two anchors, the scaffold is secured by using only two medial sutures and one lateral anchor. The risk of sutures twist is significantly reduced, especially if different colours of sutures are used. The management of a moderate number of stitches with a reduced risk of twist decreases the operating time. In our practice, the additional time for arthroscopic graft placement using the V-sled technique is approximately 30–45 min.

All of these features allow the V-sled technique to be more cost-effective (without the use of dedicated instruments, cannulas and only three anchors and two free sutures) and more reliable for arthroscopic shoulder surgeons compared with the current published techniques^{7,8}.

The authors recommend the use of radiolucent anchors in order to perform MRI evaluation and follow accurately the evolution of the rotator cuff healing and integration of the scaffold.

Finally, even if this technique is less demanding, the arthroscopic augmentation of the rotator cuff repair is still an advanced procedure, and should be performed only by well prepared arthroscopic shoulder surgeons.

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Fig. 5 The free portion of antero-medial (AM) and postero-medial (PM) sutures are now pre-loaded through the eyelet of a 4.5-mm knotless anchor that is placed approximately 1.5 cm below the edge of the repaired cuff. In this way the two sutures will be stretched on the patch stabilizing it with a V-shape suture. The remaining third wire of each anchor is then tied.

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