Journal of Sports Medicine & Doping Studies

Lu et al., J Sports Med Doping Stud 2016, 6:4
DOI: 10.4172/2161-0673.1000184

Research Article Open Access

A Novel Arthroscopic Mclaughlin Procedure for Rotator Cuff Repair in Patients with the Osteoporotic Major Tubercle: A Minimum of 6 Years Follow Up

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Received date: April 29, 2016; **Accepted date:** September 22, 2016; **Published date:** September 28, 2016

Abstract

0bjective: To evaluate the outcomes of rotator cuff tear repair with arthroscopic McLaughlin suture in patients with major tubercle osteoporosis.

Methods: 35 patients with rotator cuff tear were treated by arthroscopic McLaughlin suture from April 2007 to January 2009. The mean age of the cases was 63.8 (48 to 78) years. All of the cases were full thickness tear ranging 15 mm to 35 mm. The AP and the supraspinatus outlet projection of the X-rays were obtained before surgery. 11 patients had undergone MR examinations and 21 cases had MRA. All the patients underwent acromioplasty. 18 cases were treated by 1, and 17 cases were treated by 2 arthroscopic McLaughlin sutures. UCLA scoring system and MRI scan was adopted to evaluate shoulder function before operation and at the final follow-up time.

Results: 32 cases were followed up with a mean postoperative time of 7.8 years. The average UCLA score was improved from a preoperative rating of 13.3 to a postoperative rating of 33.1. The mean pain score was 3.2 vs. 8.7, for pre- vs. post-operation, the function score was 5.3 vs. 9.1, the mean forward flexion score was 3.5 vs. 4.9, the mean forward flexion strength was 4.0 vs. 4.8. The results were 22 excellent, 8 good, 2 fair. The complications encountered included development of major tubercle broken during operation in 1 case; retear in one case and 3 cases with frozen shoulder symptoms.

Conclusion: Arthroscopic McLaughlin suture fixation can provide a micro invasive, firm fixation and a large area for rotator cuff healing, without any anchor related complications. The technique is especially valid for the patient with osteoporosis.

Clinical relevance: Arthroscopic McLaughlin suture technique in the treatment of rotator cuff tear with major tubercle osteoporosis can give a fine substrate for the bone-tendon ultimate integration, it's firm, saveable, and can be a widely used technique especially the patients with humeral head osteoporosis. Level of Evidence: Level IV, therapy.

Keywords: Shoulder; Rotator cuff; Osteoporosis; McLaughlin; Arthroscopy; Outcome

Introduction

For the patients with humeral head osteoporosis, rotator cuff tear repair became a puzzle using suture anchors [1-3]. In 1994, McLaughlin described the use of open transosseous sutures to secure the rotator cufft tendons to a bone trough in the greater tuberosity. Theoretically speaking, arthroscopic McLaughlin suture is the most optimized method repairing rotator cuff tear-it combined the advantages of mini-invasive and firm fixation. But for the arthroscopic technique difficulty, few papers were seen in literature reporting arthroscopic McLaughlin procedure [2,4,5]. The goal of this article is to report the outcome using arthroscopic McLaughlin suture in the treatment of rotator cuff tear in old persons with humeral head osteoporosis.

Methods

Patient selection

Between April 2007 and January 2009, 35 arthroscopic McLaughlin rotator cuff repair were performed by one experienced surgeon. 32 cases were followed up successfully. Of these patients, male 23 cases, female 9 cases, the mean age of the cases was 63.8 year (range, 48 to 78 years). Left shoulder 16 cases, right shoulder 16 cases. 19 cases were dominance side. The main complaint of the patients was shoulder pain (night pain in 25 cases) and disability. The symptoms started insidiously and had duration of 18.4 months (range, 7 months ~11 years) 14 cases had preceding trauma. 31 cases showed positive in Neer impingement sign. 30 cases presented tenderness in the lateral edge of acromion. 27 cases had a positive sign of 60°~120°pain abductive arc. Jobe test positive in 30 cases, and snap under sub acromial in 21 cases. AP and the supraspinatus outlet projection of the X-rays were obtained before surgery. 11 patients had undergone MRI examinations and 21 cases had MRAAll patients showed variety of humeral head bone

osteoporosis, traumatic osteoporosis in 6 cases (male 2, female 4), the other patients were degenerative osteoporosis.

According to Bigliani X-ray classification, the type of the acromion was: type II in 4 cases, type III in 28 cases. All the cases were full thickness tear (ranging 15 mm to 45 mm). No irreparable tear or partial tear were included in this seriesBefore operation, the patients received conservative treatment for at least 3 months (activity modification, rest, ice, physical therapy, NSAID drugs, muscular training).

Operative procedures

The same surgical technique was used in all patients. This arthroscopic technique consisted of standard joint checking, acromial decompression, found out the torn tissue and refreshed it, bone bed preparation and bone tunnel drilling, suture pass and fix.

Gleno humeral joint routine examination and acromial decompression: All the patients were performed under general anesthesia and placed in beach chair position. Standard arthroscopic portals were established. After routine arthroscopic examination of the gleno humeral joint, turn the scope to the sub acromial space, perform arthroscopic sub acromial decompression.

Judgment of rotator cuff tears and refreshes the tissues: Take carefully view of the rotator cuff from ante-lateral, lateral and posterior portals until tears could be encountered and completely inspected. Judge the torn tendons of their shape, size, retraction or not, and how's the torn cuff connected to the humors. Separate and release adhesions, remove granulation tissue if necessary.

Debride the degenerated tendon edge back to healthy area and then mobilize the tendon: Superficially abrade the tendon insertion site, starting at the articular surface and extending laterally on the tuberosity for approximately 2 cm, till the area between the cartilage and tubercula majus was worn out to bleeding. A bur was used to make a trough lateral to articular cartilage, the trough was 5~8 mm deep, 5 mm wide, and length was 8 ~30 mm according to the size of the tears. If the bone bed is poor, a shaver can be used to make the trough.

Tunnel preparation and fixation

Adjust the shoulder, abduct and externally rotate the arm, allowing better visual access to the acromion and to the site of rotator cuff reattachment. A point to point hooked aimer of transtibial anterior cruciate ligament quide (Smith and Nephew) is passed through the lateral anterior portal, and put deep to the bottom of the trough prepared. Install the aimer arm (with its elbow angle 55°), push the guide tip to the surface of the lateral side humoral head, 2 cm to 3 cm beneath to great tubercle, a 2.4 mm Kirschner wire was drilled all the way through the guide and bone to the tip of the hooked aimer, then the diameter hollow drill was used to dilate the tunnel to 4.5 mm. Keep the hollow drill in the tunnel, a 1# PDS suture was lead in, the suture was grasped from the trough monitored by arthroscopy two or three 2# Ethiband fiberwire (Johnson and Johnson) are passed through the PDS loop. A suture passer or suture hook is used to pass the upper ends of the sutures through the rotator cuff.

The sliding knots (usually SMC) were tied through the instrumentation portal and is placed on the lateral side of rotator cuff. Another tunnel and rotator cuff fixation can be done in the same way for larger size rotator cuff tear. We usually take 3~4 sutures to fix the larger tears. More attention must be paid to the fixation tension on rotator cuff in case of suture-bone cutting failure. Postoperative care and immobilization are individualized and based on the patient's history and pathology. Interval ice compress was applied immediately. The patient's arm was placed in a slingshot brace with 30° abduction, neutral rotation. The patient was allowed to have light passive forward flexion and external rotation within 24 hrs and strengthened gradually. Limited active exercises was introduced and implemented from weeks 3 to 6. At 6 weeks to 3 months, as tolerated, the exercises could be advanced and gradually recovered to everyday life.

Outcome measures

All patients were evaluated in the office by one doctor who was not in the operative team with the UCLA score, MRI scan. UCLA index includes 5 indexes. Statistical analysis was performed using SPSS software (version 11.5; SPSS). The paired t-test was applied to compare with the pre- and post-operative data. A significance level of 0.05 (a=5%) was adopted.

Results

32 cases were followed up for at least 6 months (range 6~8.6 years, mean 7.8 years). 1 case underwent a major tubercle broken during operation, a posterior lateral tunnel was then drill as substitute for rotator cuff fixation. 1 case showed retear signals on MRI within 8 months post-operation, but the patient had no complaint. 3 cases underwent frozen shoulder symptoms 6 months postoperatively, and recovered to normal in 12~24 months. No other complications were complaint, such as bone bridge fracture or axillary nerve injury. All patients were satisfied with the results of this operation. The mean UCLA score before operation and final follow up were 13.3 ± 2.4 vs. 33.1 ± 3.2 (P=0.000). The VAS score were 3.2 ± 0.5 vs. 8.7 ± 1.0 (P=0.000) before and at final follow up time. The mean pain score was 3.2 vs. 8.7, for pre- vs. post-operation. The function score was 5.3 vs. 9.1, the mean forward flexion score was 3.5 vs. 4.9 the mean forward flexion strength was 4.0 vs. 4.8The results were 22 excellent8 good, 2 fair. The result of the items was shown (Table 1).

No pain in 21 cases, five cases of mild pain or discomfort, six cases feel pain in intensive movement or special action. 24 case of full normal activities. At the final follow up time, in this group, active flexion and abduction: >l50° in 26 cases, 90°~l20° in 6 cases. Postoperative flexion and abduction strength: grade V in 25 cases, grade IV in 7 cases. 32 cases restored daily life and movement, and satisfied with operation.

Discussion

Nowadays, suture anchors have widely used for shoulder disorders, especially in rotator cuff repairs. But suture anchors can fail many ways: anchor pullout, in which the anchor comes out of the bone intact, including the suture, especially in osteoporosis patients; suture breakage, and eyelet breakage. Biomechanically, with the tension placed on a rotator cuff repair, the suture anchor backs out if not fixed securely or if bone failure occurs especially in osteoporosis patients [6,7]. Since McLaughlin reported his excellent technique and outcome in 1994, this technique has since become standard practice for securing effective tendon-to-bone fixation at the shoulder. But until recently, few papers describes arthroscopic trans osseous rotator cuff suture [8]. Fleega [9] reported arthroscopic trans humeral rotator cuff repair using the giant needle technique. In his study, a giant needle is passed

through the skin and deltoid muscle in front of the acromion, through the torn tendon, a hole in the trough, and out through the lateral cortical surface through the deltoid and skin. The suture limbs are pulled out through the instrumentation portal and close the defect with a sliding knot. Shea and Jennings [10] and Boszotta and Prunner [11] also used different kinds of way to perform arthroscopically assisted trans osseous technique, with good outcomes, but they all do this on healthy humeral head.

Items	Total (35)	Pain (10)	Function (5)	Forward (5)	Forward (5)	Satisfaction (5)
				Flexion	Strength	
Before OP	13.3 ± 2.4	3.2 ± 0.5	5.3 ± 1.5	3.5 ± 0.4	4.0 ± 0.6	0
Post OP	33.1 ± 3.2	8.7 ± 1.0	9.1 ± 2.5	4.9 ± 1.1	4.8 ± 0.2	5
T Value	-20.32	-21.9	-11.03	-4.709	-5.51	
P Value	0	0	0	0	0	

Table 1: The UCLA score before and post-operation in 32 cases ($\bar{x} \pm s$).

In this study, we use a relatively simple arthroscopic assisted McLaughlin suture in osteoporosis patients. As we know, the average distance from the axillary nerve to the proximal humeral was 6.1 ± 0.7 cm (range, 4.5-6.9 cm) and 1.7 ± 0.8 cm (range, 0.7-4.0 cm) from the surgical humeral neck, that's near the branches of axillary nerve [12]. In our practice, we found that drilling straight trans osseous hole without a trough on the insertions can be too superficial to dig into bone cortex, or the lateral outlet would be too low damaging to the axillary nerve. Instead, we practiced on cadaver to drill a guide wire to the trough bottom, were not only easy to make the tunnel, but much more simple. Surgeons can drill tunnels according to the shape and size of the tears at ease without worry about axillary nerve. Other advantages of this technique are that the strength of cuff fixation does not rely on the quality of the bone in the greater tuberosity; it offers the same fixation fastness as the traditional open repair.

Conclusion

The long-term follow up show that it is a concise, save, reliable, effective procedure, and easy to perform. Moreover, it may be considered a surgical option in following conditions: 1. If an inserted suture anchor on the greater tuberosity is pulled out with a small amount of tension, or during arthroscopic rotator cuff repair in osteoporotic patients.

2. If the patient had no medical insurance or not want to let hardware internal fixation in his body.

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