Journal of Clinical Orthopaedics and Trauma 10 (2019) 241–243

Contents lists available at ScienceDirect

Journal of Clinical Orthopaedics and Trauma

journal homepage: www.elsevier.com/locate/jcot

Mid-term clinical outcome following rotator cuff repair using all-suture anchors

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ARTICLE INFO

Article history:
Received 15 September 2017
Received in revised form 17 February 2018
Accepted 24 February 2018
Available online 26 February 2018

Keywords:
Suture
Anchor
Rotator cuff
Arthroscopy
Shoulder

ABSTRACT

Background: Symptomatic rotator cuff tears can cause significant pain and functional disturbance, with associated financial ramifications. Non-surgical management should always be considered initially, however if recalcitrant to these measures surgical intervention may involve open, arthroscopic-assisted mini-open or arthroscopic rotator cuff repairs. The use of trans-osseous sutures and suture anchors has been reported with good results, with no significant differences if the repair remains intact or recurrent tears occur. The role of traditional suture anchors has been assessed clinically and biomechanically, however there have been reports of pull out, anchor material found within joint and concerns with the amount of bone loss. The all suture anchor (ASA) is proposed to address these concerns with encouraging cadaveric, biomechanical results to date.
Methods: The two senior authors performed 31 arthroscopic rotator cuff repairs using ASA with a double row technique at the two study centres'. The patients were reviewed in clinic at one month, three months, 6 months and a year postoperatively. The patients were assessed with the Constant score and clinical range of motion of the shoulder in abduction, forward flexion, external rotation and internal rotation. The surgical technique and rehabilitation was the same for both surgeons.
Results: At a mean follow up of 10.2 months (range 3–12 months) the mean constant score was 77.1 (range 35–90), with a mean abduction of 139.6° (range 30–180°), external rotation of 43.4° (range 20–80°), and internal rotation to lumbar vertebrae 3–4 (range buttock to lumbar vertebra 1). There has been one re-rupture to date.
Conclusions: The functional and clinical results in our study are comparable to those reported in literature using standard anchors.

1. Introduction

The rotator cuff covers the posterior, superior and anterior aspects of the shoulder joint. It is a combination of the tendons of the supraspinatus, infraspinatus, teres minor and subscapularis muscles inserting into the proximal humerus. These are the short muscles of the shoulder and are involved in; abduction (supraspinatus), internal rotation (subscapularis) and external rotation (infraspinatus and teres minor). Ruptures of the rotator cuff are associated with pain, functional deficit and financial implications.

Tears of the rotator cuff can be managed non-surgically (physiotherapy and analgesic regimes) or surgically (direct repairs, delayed reconstruction or arthroplasty). Management of these injuries is dependent on patient factors, the tear pattern, chronicity of the tear and surgeon factors. Repair techniques for rotator cuff tears vary from open repair with trans-osseous sutures, arthroscopic assisted mini-open repairs, or arthroscopic repair using either single row or double row suture anchor techniques.[1] There is still no consensus, regarding which technique results in best clinical and functional results, with numerous conflicting studies.[2–5] Advocates of arthroscopic repair suggest there is reduced postoperative morbidity, pain and deltoid dysfunction,[6] however higher re-rupture rates have been reported with arthroscopic techniques.[7]

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https://doi.org/10.1016/j.jcot.2018.02.014
0976-5662/

Suture anchors used for tendon re-insertion into the humeral footprint may be metal, absorbable or polyetheretherketone (PEEK), that may be screwed or impacted.[8]These anchors require preparation at the insertion site, with traditional anchors being of a size (up to 6.5 millimetres (mm)) that can cause bone loss and limit the number of anchors that can be used in the proximal humerus. The use of all suture anchors (ASA) were proposed to reduce potential bone loss as well as prevent complications of loose bodies, seen with some anchors. Goschka et al. [9] performed cyclical biomechanical testing of ASA and traditional suture anchors in a cadaveric model using a double row technique. They found no significant difference in biomechanical properties, with the advantage of reduced bone loss, however there remains limited clinical evidence in the literature.

This multi-centre prospective study looked at the short- to mid-term results of 31 patients undergoing arthroscopic rotator cuff repair using ASA.

1.1. Patient privacy concerns

The authors confirm that this was a retrospective study and all patients were consented for the operative procedures that were performed.

1.2. Methodology

Between August 2013 and April 2014, 31 patients underwent arthroscopic rotator cuff repair using ASA with a double row technique at the two study centres. The two senior authors performed all the surgeries. All the patients had magnetic resonance imaging (MRI) confirmed full thickness rotator cuff tears, presenting with pain and reduced range of motion. The patients were reviewed in clinic at one month, three months, 6 months and a year postoperatively. The patients were assessed with the Constant score [10] and clinical range of motion of the shoulder in abduction, forward flexion, external rotation and internal rotation.

The surgical technique and rehabilitation was the same for both surgeons. Surgery was performed in a beech chair position, under general anaesthesia and suprascapular nerve block, with one dose of second-generation cephalosporin intravenous antibiotic administered during anaesthetic induction. A three-portal arthroscopic technique was used (anterior, posterior and posterolateral) initially, however if further access was required a fourth portal as added (anterolateral). A routine diagnostic arthroscopy and subacromial decompression was required in all patients. The size of anchor and number of anchors to be used was determined intra-operatively, based on the size and pattern of the tear, as well as the size of the footprint and bone stock. After the rotator cuff had been released the footprint was prepared and tunnels pre-drilled (in eight cases a 1.4 mm drill was used and 2.3 mm in the rest). The ASA was inserted in the tunnels, and with gentle traction there is a bunching effect of the suture anchor that can be visualized under arthroscopy. The sutures are then passed through the rotator cuff in a configuration that is determined by the tear pattern and repaired to the footprint.

All patients had a simple arm sling for six weeks, with passive and active assisted elbow, wrist and hand movements allowed immediately. Pendular shoulder movements and supine anterior elevation was initiated under supervision after two weeks. Active range of motion and strengthening was permitted after six weeks once out of simple sling.

2. Results

Of the 31 patients, eight did not attend their one-year follow-up and failed to respond to telephone or written correspondence. Ten of the patients were classified as acute rotator cuff tears (defined as

Table 1
Patient demographics and outcome scores.

Patient	Age	Sex	Abduction	External Rotation	Internal Rotation	Constant Score	Follow up (Months)
1	75	Male	80	30	Buttock	65	6
2.	62	Female	140	30	L5	75	12
3	78	Female	30	20	Buttock	35	3
4	57	Male	140	60	L5	75	6
5	52	Female	140	60	L5	75	6
6	60	Female	170	80	L4	80	12
7	74	Male	170	45	L4	75	12
8	58	Female	100	45	L5	70	6
9	56	Female	60	30	L5	55	6
10	59	Male	60	20	L5	60	6
11	57	Female	80	30	L5	70	6
12	64	Female	170	60	L4	80	12
13	35	Female	170	45	L3	90	12
14	41	Female	170	50	L2	87	12
15	43	Male	170	50	L2	87	12
16	51	Male	160	40	L2	90	12
17	52	Male	160	60	L4	80	12
18	55	Male	160	40	L3	85	12
19	31	Male	170	50	L1	90	12
20	32	Male	160	50	L2	87	12
21	48	Male	180	40	L3	87	12
22	52	Male	160	45	L3	87	12
23	34	Male	150	45	L3	80	12
24	41	Male	130	30	L4	57	6
25	54	Male	170	50	L1	87	12
26	43	Male	160	40	L3	87	12
27	29	Male	150	50	L3	80	12
28	55	Female	110	30	L4	70	12
29	57	Female	120	30	L4	70	12
30	54	Female	180	50	L1	87	12
31	44	Male	150	40	L4	87	12

diagnosis made within six weeks of onset of symptoms) and 21 were chronic tears. There was a total of 47 ASA applied in the 31 patients. The mean age of the sample was 51.7 years (range, 29–78 years). At a mean follow up of 10.2 months (range 3–12 months) the mean constant score was 77.1 (range 35–90), with a mean abduction of 139.6° (range 30–180°), external rotation of 43.4° (range 20–80°), and internal rotation to lumbar vertebrae 3–4 (range buttock to lumbar vertebra 1) (Table 1).

There has been one re-rupture to date, which was noted at 3 months follow up and confirmed with MRI, and there were two cases where the ASA pulled out intra-operatively (both patients had a diagnosis of osteopenia) and this was revised with further ASA. Three patients developed adhesive capsulitis in the postoperative period, which was managed with hydro-distension by the fourth postoperative month. Another patient had severe pain at one month follow up that has been managed with specialist pain team management.

3. Discussion

The incidence of rotator cuff tears increases with age, however whilst many are asymptomatic, if they have symptoms it is associated with significant pain and functional deficit. Non-surgical management, such as physiotherapy and analgesic regimes, should always be considered prior to surgical approaches. A systematic review by Slabaugh et al. [1] concluded that healed rotator cuff repairs following arthroscopic techniques can probably expect better strength and function. However, due to the included studies having heterogeneous populations and low level of evidence no significant conclusions could be drawn. Nho et al. [11] performed a systematic review that concluded that there was no significant difference in clinical and functional outcomes between arthroscopic suture anchor repair and mini-open repair techniques. However, the mini-open technique did appear to be associated with greater complications. The advantages of arthroscopic repair include improved visualization and assessment of the tear, with reduced morbidity, pain and deltoid dysfunction.[6,11]

ASA were proposed to reduce bone loss associated with traditional anchors, reduce loose body complications and potentially increase strength of fixation. Galland et al. [8] found no significant difference in pullout strength and mean elongation at rupture between ASA and standard screw anchors in a biomechanical model. In this study, the ASA had a diameter of 1.4 mm and the standard anchor diameter was 5.5 mm. Whilst the initial osseous tunnel required for ASA insertion is smaller than for traditional anchors, once deployed the ASA concertinas resulting in a greater diameter potentially increasing its fixation strength. As there is reduced bone loss at the footprint, there is greater tendon-bone contact area for healing.[12]

Mazzocca et al. [13] compared the biomechanical performance of ASA with a classic solid suture anchor in cadaveric shoulders with simulated labral tears. No statistical difference was seen between the two suture anchors when assessing ultimate load to failure and displacement at ultimate failure. However, the solid anchor did have a significantly higher ultimate load to produce 2 mm of labral displacement at the repair site, compared to the ASA. The authors suggested this difference was due to micromotion of the ASA.[13]

The functional and clinical results in our study are comparable to those reported in literature.[14,15] Kim et al. [16] reported on 79 patients who underwent arthroscopic suture bridge repair, with a minimum follow of two years. The mean Constant score at final follow up was 74.7, however clinical outcomes were no different whether the tear was healing or not.[16] Carbonel et al. [17] looked at the outcome after large and massive rotator cuff repairs using the double row technique, with a reported postoperative mean Constant score of 76.1. Our postoperative range of motion and mean Constant score of 77.1 is consist with those reported using standard anchors.

The clinical and functional results of our study support the use of ASA for rotator cuff repairs, with current literature suggesting satisfactory results with the arthroscopic double row suture anchor technique.

Conflict of interest and funding

No authors have no conflict of interest to declare, nor funding associated with this study.

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