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ORIGINAL STUDY

Radiological and clinical outcome of arthroscopic labral repair with all-suture anchors

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Purpose : **The aim of this study was to assess radiological and clinical outcome after arthroscopic all-suture anchor labral repair.**

Methods : **20 patients treated for anterior and superior labral instability (mean age 29, range 14-51 years) were assessed at a minimum follow-up time of 1 year (mean 19 months ; range, 12-28 months). Postoperative MRI scans were assessed by 3 independent radiologists. The radiological appearance of bone at the anchor-site was judged by the presence of cyst formation, tunnel widening (> 2 mm) or bone edema. Clinical outcome analysis included standard follow-up and the Disabilities of the Arm, Shoulder and Hand score (DASH), Constant Shoulder score and the Western Ontario Shoulder Instability Index (WOSI).**

Results : **All patients were available for follow-up. In total, 58 all-suture anchors were implanted. None of the patients displayed large cyst formation. Small cysts were found in two patients (2 anchors). Tunnel widening was apparent in 3 patients (3 anchors) with an average widening of 3.3 mm (range 3-4 mm). Bone edema at the anchor-site was seen in 6 patients (8 anchors). The remaining 9 patients (45 anchors) did not display reactive bone changes. Clinical outcomes showed a WOSI of 70.6, a DASH of 18.9 and a Constant score of 89.3, and no recurrence of instability.**

Conclusion : **Satisfying radiological and clinical outcome was observed after arthroscopic instability surgery using all-suture anchors. Imaging revealed good labral healing without important bony reactions or the formation of large cysts at early follow-up.**

Level of evidence : IV Case series.

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The authors report no conflict of interests.

Keywords : shoulder instability ; labral repair ; all-suture anchors.

INTRODUCTION

Arthroscopic treatment of recurrent glenohumeral instability by capsulolabral repair has become equivalent to open techniques (*2,5,14*). This is due, in part, to improvements in surgical instruments and implants. Nevertheless, some concerns remain

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about anchor-related complications such as secondary cartilage damage, bone cyst formation and implant migration (*1,4,7,9,13*). Newer generation all-suture anchors do not contain rigid components and may therefore minimize invasiveness and avoid complications related to standard metallic or bioabsorbable anchors. However, the radiological and long-term clinical outcome of these novel implants is unknown. The aim of this prospective cohort study was to assess early radiological and clinical outcome after labral repair using all-suture anchors with specific consideration for bony reactions at the anchor-site. It is hypothesized that all-suture anchors cause minimal bone reaction due to their comparably compliant material properties.

METHODS

A consecutive series of 20 patients treated with arthroscopic labral repair were included in this study. The study population contained patients undergoing Bankart repair as well as superior labral anterior to posterior (SLAP) tear repair or a combination of both. Thirteen men and 7 women, 13 right and 7 left shoulders, were included in the series. The mean age of the cohort was 29 years (range, 16-52 years) at the time of operation. None of the patients had associated glenoid cartilage or bony lesions, cuff pathology or a history of previous shoulder surgery. Mean follow-up was 19 months with a minimum of 1 year (range, 12-28 months).

Surgical technique

Labral repair was performed according to standard arthroscopic procedure. Patients were positioned in lateral decubitus with double traction on the involved arm. Depending on the location and type of labral tear, standard posterior, antero-superior and antero-inferior portals were used. Fixation of the labrum was carried out using all-suture anchors (Juggerknot, Biomet, Inc. Warsaw, IN, USA). This technique required predrilling a 12 mm deep pilot hole with a 1.4 mm Kirschner-wire. Subsequently a soft all-suture anchor was introduced through a dedicated guide. The anchor was pre-loaded with a single Maxbraid™ suture which was passed through the labrum and capsule by mattress or single stitch using a standard shuttle technique (Fig. 1). The number and location of anchors per procedure depended on the type of lesion. Bankart repairs required a minimum of 3 anterior anchors while SLAP repairs typically needed 2 postero-superior anchors depending on the size of the lesion. Postoperatively, patients were immobilized in a sling for 4 weeks with only gentle passive range of motion (ROM) exercises allowed. Formal physical therapy with active ROM began after 4 weeks.

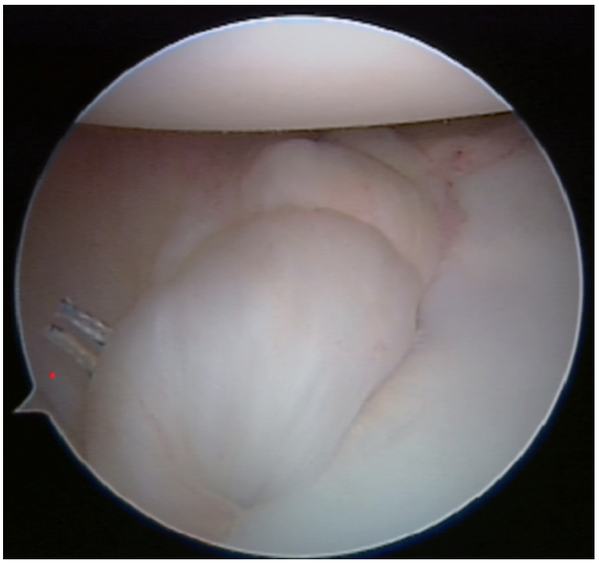

Fig. 1. — Arthroscopic image of an anterior labral repair performed in a right shoulder using 3 all-suture suture anchors. The anterior glenoid rim is viewed from superiorly. The red asterisk marks the suture ends of the most superior anchor.

Postoperative assessment

At final follow-up, all patients underwent Magnetic Resonance Imaging (MRI) utilizing a 1.5 Tesla high-field scanner (1,5 Tesla Siemens Symphony Tim-upgrade, Siemens, Munchen, Germany). Gradient-echo axial, proton density and T2-weighted oblique coronal and sagittal, fat suppressed coronal images as well as sagittal T1 series were acquired with a dedicated shoulder coil. Three musculoskeletal, fellowship-trained, radiologists reviewed the images. Reviewers were blinded to the specific details of the procedure. The radiological appearance of bone reactions at the anchor-site was judged as no changes (grade 0) ; bone edema (grade 1) ; tunnel widening of more than 3 mm (grade 2) or cyst formation (grade 3). In addition, labrum appearance was described as either displaced or non-displaced. Clinical outcome analysis included standard follow-up and the following shoulder scores : Disabilities of the Arm, Shoulder and Hand score (DASH) (*10*), Constant Shoulder score (*6*) and the Western Ontario Shoulder Instability Index

Table I. — Different grades of bone reaction and the associated number of anchors

	Grade 0 (No Bone reaction)	Grade 1 (Bone oedema)	Grade 2 (Tunnel widening)	Grade 3 (Cyst)
Number of Anchors (total = 58)	45	8	3	2

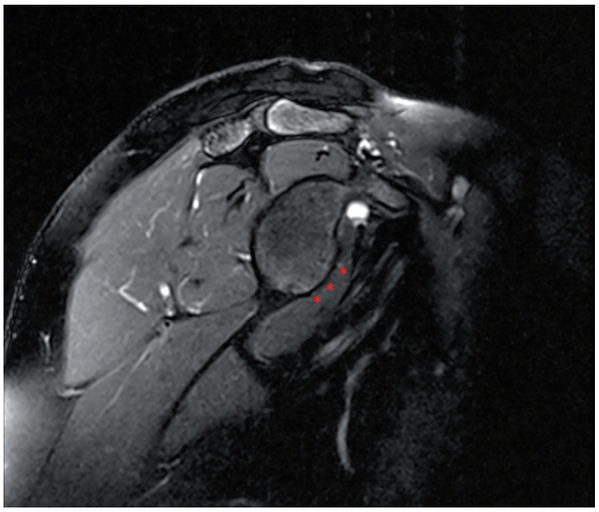

Fig. 2. — Sagittal fat-supressed T2 image view of a right glenoid viewed from laterally. The red asterisks demonstrates the anchor locations on the anterior glenoid rim. There are no apparent bone reactions.

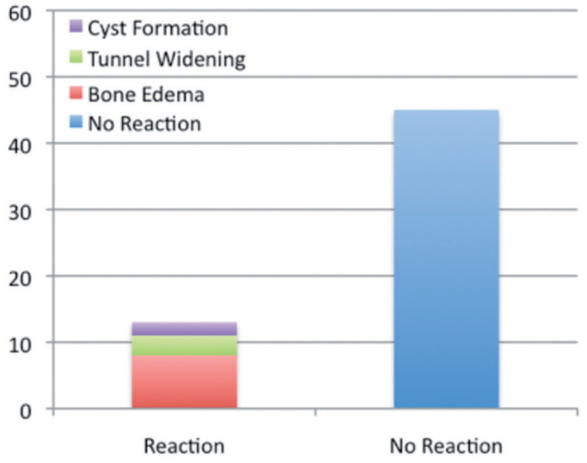

Fig. 3. — Bar chart indicating the number of cases with and without reactive bony changes. Different types of reaction are grouped per color as shown in the figure legend.

(WOSI) (*16*). The local ethical committee approved this study.

RESULTS

All patients were available for follow-up (mean 19 months, range 12-28 months). In total, 58 all-suture anchors were implanted. The number and location of the anchors depended on the size and location of the labral tear (41 anterior and 17 postero-superior). The implants did not hinder diagnostic imaging. Radiological appearance of the anchors is summarized in table I.

Nine patients (45 anchors) did not display any reactive bone changes (grade 0) (Fig. 2). In the remaining 11 patients bone reactions around the anchors (13 anchors) were seen (Fig. 3). Bone edema around a suture anchor (grade 1) was seen in 6 patients (8 anchors - 5 anterior, 3 postero-superior) (Fig 4). A grade 2 reaction (tunnel widening > 3 mm) was seen in 3 patients (3 anchors ; 2 anterior, 1 postero-superior) (Fig. 5). The mean tunnel diameter was 3.3 mm (range, 3-4 mm). A grade 3 reaction with cyst formation was seen in 2 patients (2 postero-superior) with subchondral cysts measuring 5 mm and 7 mm respectively (Fig. 6). Labrum position was assessed as non-displaced in 19 patients and displaced in 1 patient. Clinical outcome was satisfactory. The WOSI score averaged 70.6 (SD 20.3), the DASH score had a mean value of 18.9 (SD 13.8) and the Constant score was 89.3 (SD 14.0). There were no reports of early clinical failures (dislocation or subluxation).

DISCUSSION

This prospective cohort study shows promising early radiographic and clinical outcome after arthroscopic glenohumeral labral repair using all-suture anchors. In this cohort of 20 patients with 58 anchors and a mean follow-up of 19 months

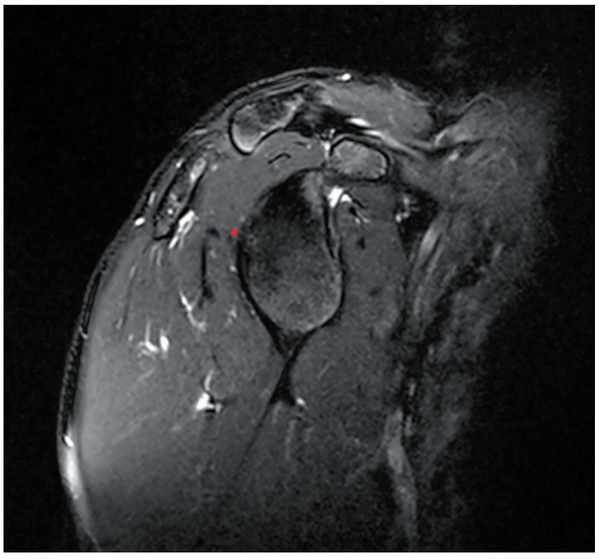

Fig. 4. — Sagittal fat-supressed T2 image view of a right glenoid viewed from laterally. The red asterisk indicates bone edema seen around 1 of 2 used postero-superior anchors.

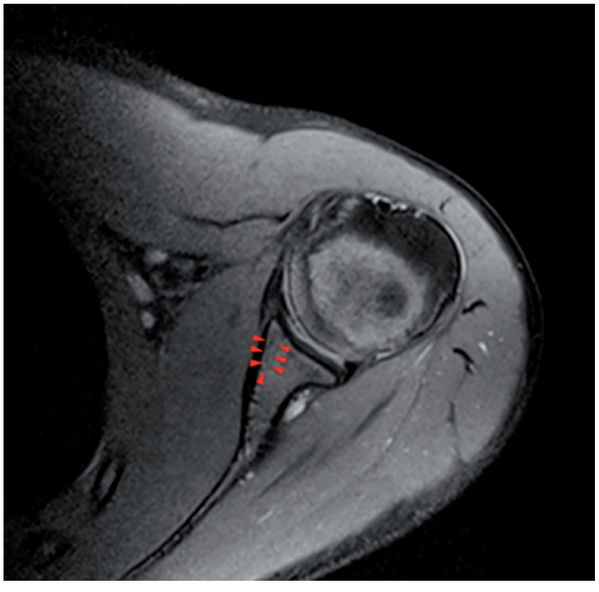

Fig. 5. — Axial fat-supressed T2 image view of a left glenoid viewed from laterally. The red arrows indicates tunnel widening (3 mm) around an anterior anchor.

(range 12-28 months), bone reactions were few and low-grade on the postoperative MRI, independent of anchor position. Clinical scores demonstrate satisfactory functional outcomes without recurrence of subluxation or dislocation.

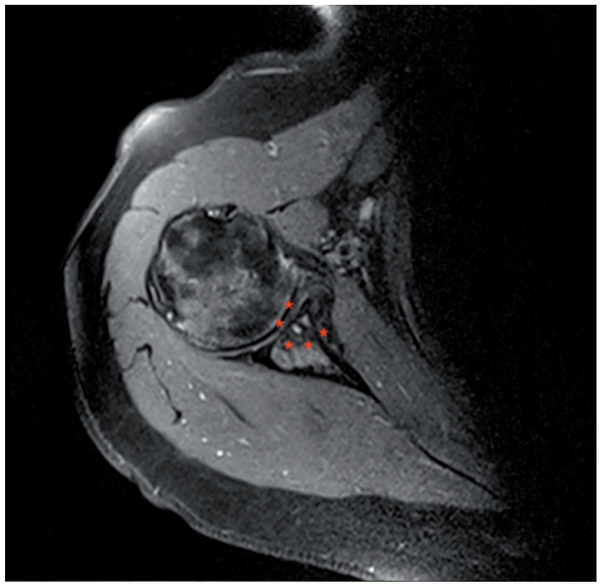

Fig. 6. — Axial fat-supressed T2 image view of a left glenoid viewed from laterally. The red asterisks indicate cyst formation around an anterior anchor.

All-suture anchors for soft tissue fixation have recently been introduced in the treatment of shoulder instability. Due to their material properties, these implants may be less invasive then standard implants. This could minimize hardware complications such as seen with metallic or bio-absorbable anchors. Additionally, the implantation of the all-suture anchors requires a significantly smaller bone tunnel than classic suture anchors (1.4 mm vs. 3 mm). Less aggressive bone tunnels reduce the risk of glenoid rim fracture and anchor pullout. Moreover, achieving soft tissue fixation without the use of solid metallic or absorbable anchors limits the risk of secondary joint damage in case of proud implant position or anchor migration into the glenohumeral joint. It is important to note that the minimal invasive character of all-suture anchors does not come at the expense of fixation strength. Recent biomechanical studies have shown that the ultimate load-to-failure of soft tissue anchors compares favorably to standard solid anchors for labral repairs (*3,11*). Contrarily, some animal studies have suggested all-suture anchors cause cyst formation, resulting in micromotion and earlier failure (*15*). Cyst formation around bio-absorbable anchors has

been reported as a potential cause of clinical symptoms and complications (*1,4,7,9,13*). Bone edema and tunnel widening are probably less worrisome if no progression is seen over time (*12*). Of the 58 all-suture anchors implanted in this study, the majority of anchors (77.6%) showed no signs of bone reaction at radiological follow up. Some form of reaction was observed in half of the patients. Most often (61.5%) this was merely grade 1 bone edema, although 2 cases of cyst formation and 3 cases of tunnel widening were also noted. Although some patients (25%) exhibited a more severe bone reaction, this rate remains lower than observed with standard solid anchors and larger drill holes (*7,8*). Large cysts were not observed in any of the cases.

Labral healing is not ideally assessed on MRI without intra-articular contrast dye injection. However, in this series labral healing was described in all patients by the radiologists. After a minimum follow-up of one year, satisfactory clinical scores were obtained and there were no reports of recurrent instability. Nevertheless, this study has several shortcomings. It remains a relatively small cohort of patients. This may result in a sampling error. Secondly, clinical follow up remains short, albeit long enough for bone reactions to manifest around metallic and bio-absorbable anchors (*7,8*). Thirdly, we did not have a control group for comparison.

CONCLUSIONS

We observed satisfying radiological and clinical outcomes after arthroscopic shoulder instability surgery with all-suture anchors. This study supports that, although some bone changes can occur, all-suture anchors can be used without undue concern for abnormal bone reactions and with good clinical results.

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