Arthroscopically assisted repair of massive full-thickness rotator cuff tears: an analysis of 2-year postoperative follow-up

Taher A. Eid, Yasser S. Hannout, Amro S. El-Sayed, El-Sayed Morsi

Department of Orthopedics and Traumatology, Faculty of Medicine, Menoufia University, Menoufia, Egypt

Correspondence to Taher A. Eid, MD, Department of Orthopedics and Traumatology, Faculty of Medicine, Menoufia University, Menoufia, 32817, Egypt. Tel: +20 100 663 9362; fax: 0482317502; e-mail: tahereid1@yahoo.com

Received 5 June 2018
Accepted 22 June 2018

The Egyptian Orthopaedic Journal 2018, 53:77–82

Objectives
The aim of this work was to evaluate the clinical results of arthroscopically assisted massive full-thickness rotator cuff repair.
Background
The treatment modalities of massive rotator cuff tears (as formal open, mini-open 'arthroscopically assisted,' and all-arthroscopic repair) show wide variability in terms of the technical prerequisites, the clinical results, and the reported complications. However, arthroscopically assisted repair offers the advantages and avoids the disadvantages of both formal open and all-arthroscopic repair.
Patients and methods
The clinical results of 12 patients (12 shoulders) with massive full-thickness rotator cuff tears managed by arthroscopically assisted repair were evaluated by the University of California, Los Angles (UCLA) scoring system and with the active range of motion of the affected shoulder.
Study type
Interventional, prospective.
Study design
Clinical case series. Primary purpose: treatment.
Results
Using the UCLA scoring system, the final assessment (at a mean of 27.4 months postoperatively) revealed satisfactory (good and excellent) results in 11 (91.7%) patients and unsatisfactory (poor) results in one (8.3%) patient. Also, the mean value of overall UCLA score significantly improved from (8.8±1.2) preoperatively to (32.4±2.4) postoperatively ($P<0.05$). In addition, there was a significant improvement in the active range of motion of the operated shoulders ($P<0.05$).
Conclusion
Favorable clinical outcomes can be anticipated in the majority of patients with massive full-thickness rotator cuff tears after arthroscopically assisted repair. Overall, ~92% of patients will be able to successfully return to the previous level of daily living activity and occupational tasks. In addition, the procedure is relatively simple and takes less time, and does not need high technical skills. Recovery is faster with minimal postoperative complications and accelerated rehabilitation (no deltoid detachment).

Keywords:
arthroscopically assisted rotator cuff repair, massive rotator cuff tears, shoulder arthroscopy

Egypt Orthop J 53:77–82
© 2018 The Egyptian Orthopaedic Journal
1110-1148

Introduction

In 1972, Neer [1] reported on an open rotator cuff repair recommending anteroinferior acromioplasty, mobilization and repair of the torn rotator cuff tendons, meticulous repair of the released deltoid origin, and early restoration of passive motion of the operated shoulder.

Such principles of open repair were applied by other authors who reported satisfactory results despite the reported deltoid–detachment-related complications as deltoid avulsion, postoperative pain, delayed rehabilitation, stiffness, and delayed recovery that may prolong up to 18 months [2–8].

The increased use of shoulder arthroscopy and the reported deltoid–detachment-related complications have urged the trend toward a more minimally invasive management of rotator cuff tears. Levy and colleagues and later, Paulos and Kody reported on a mini-approach for rotator cuff repair; in which arthroscopic subacromial decompression was followed by open rotator cuff repair through a lateral deltoid split; pointing out that such mini-approach is applicable for most of rotator cuff tears with

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

the advantage of deltoid origin preservation; thus decreasing the postoperative pain and allowing accelerated rehabilitation; in addition to the advantages of; arthroscopic gleno-humeral (GH) examination for intra-articular assessment of cuff tear geometry and detection of associated GH pathology, less blood loss, and shorter hospital stay [8–10].

Nevertheless, the advances in shoulder arthroscopic techniques and instrumentations have allowed performing rotator cuff repair all-arthroscopically with results comparable to open and mini-open repair; however, all-arthroscopic repair is a technically demanding procedure [11,12].

Patients and methods

Between September 2009 and March 2011, this prospective study was conducted in Department of Orthopedic and Traumatology, Faculty of Medicine, Menoufieya University Hospital; including 12 patients of arthroscopically evident massive rotator cuff tears (>5 cm). Patients with diabetes mellitus, previous orthopedic operation of the ipsilateral shoulder, medical problems that may interfere with the follow up, history of recurrent shoulder dislocation, Bankart lesion, advanced GH arthritis, or known cervical pathology (e.g. spondylosis); were all excluded from this study. The study was approved by Ethical Committee of Faculty of Medicine, Menoufia University; and consent was taken from each patient.

The included patients were eight (66.7%) males and four (33.3%) females with an average age of 52.3±2.6 years (range, 47–62 years), all (100%) with initial complaint of shoulder pain and weakness especially with overhead activities. The average duration of preoperative complaint was 7.2±6.5 months (range, 3–14 months). The right shoulder was involved in 12 (100%) patients; also, the dominant side was involved in 12 (100%) shoulders.

The mechanisms of injury included; 10 (83.3%) patients with definite history of acute trauma [three cases due to falling on outstretched hand, five cases of direct blow to the shoulder due to falling downstairs, and two cases of road traffic accident (RTA)]; in addition to two (16.7%) patients with repeated overhead activities (two manual workers).

Ten (83.3%) patients received preoperative physiotherapy for variable durations; 1–3 months with mean of 1.3±0.4 months, and six (50%) patients received subacromial corticosteroid injection for one, two, or three times.

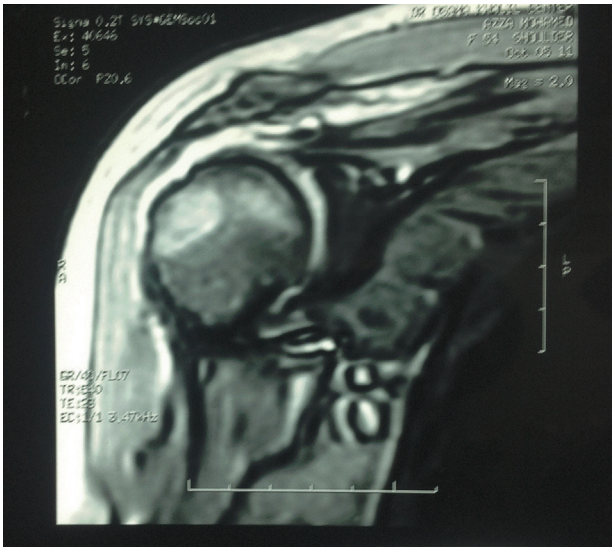
The preoperative evaluation included complete shoulder examination [especially the active range of motion (ROM) and the provocative tests for subacromial impingement syndrome, acromioclavicular (AC) joint arthritis, biceps tendon and superior labrum anterior to posterior (SLAP) lesions and rotator cuff tears], and University of California, Los Angles (UCLA) scoring system. It is noteworthy that three (25%) patients had preoperative frozen shoulder.

In addition (anteroposterior, axillary, and supraspinatus outlet) plain radiograph views and MRI were also used for the preoperative evaluation of the included patients. Preoperative MRI imaging studies revealed the following (Fig. 1). Subacromial bursitis in 12 (100%) patients, biceps tendenitis in nine (75%) patients, full-thickness rotator cuff tear in 12 (100%) patients, osteoarthritic changes of AC joint in 10 (83.3%) patients, suspected SLAP lesion in one (8.3%) patient, and glenoid cartilage abnormality in one (8.3%) patient.

Surgical techniques

The included patients were managed by standard operative techniques including general anesthesia, beach-chair positioning, examination under anesthesia for shoulder ROM and stability, manipulation of frozen shoulders, diagnostic GH arthroscopy for intra-articular assessment of cuff tear geometry, and detection of associated GH pathology, and arthroscopic subacromial decompression (entailing debridement of inflamed subacromial bursa, anterior acromioplasty, and resection of the osteophytes from the undersurface of the AC joint).

Figure 1

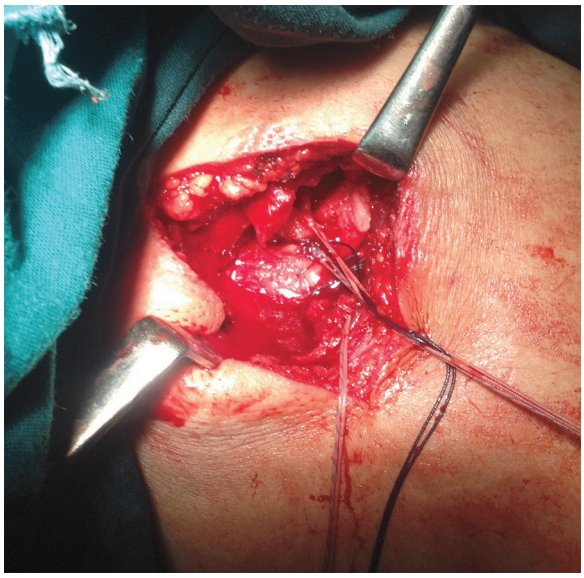


MRI of massive rotator cuff tear.

Then, cuff tear reparability was assessed based on tear geometry, tendon retraction, and tendon tissue quality.

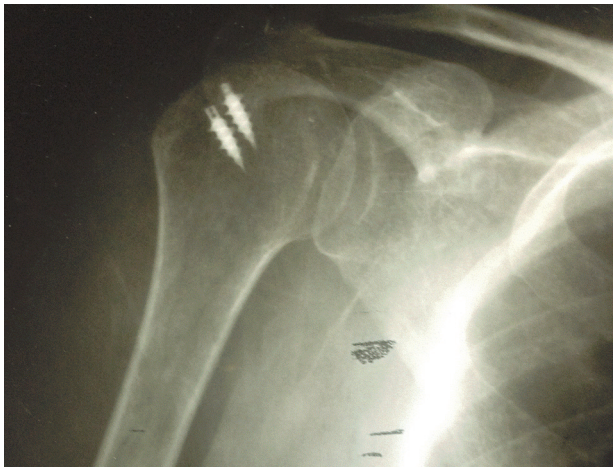
Cuff mobilization was carried out arthroscopically following the standard rules of intra-articular and extra-articular release (e.g. release of the cuff undersurface from the anterosuperior, superior and, postero-superior glenoid-labrum, release of the subacromial cuff adhesions from the acromion and deltoid muscle and coraco-humeral ligament release) till having the tendon back to its anatomic or medialized-anatomic foot print (within 5–10 mm). This foot print was decorticated arthroscopically by shaver blades.

Figure 2



Deltoid split approach.

Figure 3



Postoperation radiograph of suture anchors.

Then, through a deltoid-split approach (starting from the lateral acromial border and extending laterally for 3–4 cm), the tear was repaired using suture anchors (usually two to three anchors) as a single row inserted laterally into the greater tuberosity (Figs 2 and 3).

The diagnostic GH arthroscopy revealed the following:

(1) Rotator cuff tears: these included 12 tears that were massive (>5 cm) including supraspinatus and infraspinatus tendons. Of these 12 massive tears, five (41.7%) tears showed marked retraction up to the glenoid and were managed by medialized repair (within 5–10 mm of the anatomic foot print).
(2) SLAP lesions: there were one type-I SLAP lesion and two type-II SLAP lesions; all were managed by debridement.
(3) Biceps tendon lesions: there were three (25%) massive tears associated with biceps tendon fraying (<30%) of the tendon and one (8.3%) tear associated with partial tearing (20%) of the tendon; all were managed by debridement.
(4) Arthritic changes of the GH joint: there were two (16.7%) patients with glenoid cartilage fraying and degeneration and one (8.3%) patient with glenoid chondral lesion; all were managed by debridement.

Postoperatively, patients had 6 weeks of passive ROM, followed by another 2–6 weeks of assisted active exercises, followed finally by 6–10 weeks of strengthening exercises.

The included patients were evaluated at 1.5-, 3-, 6-, 12-, 24-month postoperatively by both the shoulder active ROM and UCLA scoring system.

Results

Using UCLA scoring system, the final assessment (at a mean of 27.4 months postoperatively; range, 25–42 months) revealed poor results in one (8.3%), good results in seven (58.3%), and excellent results in four (33.4%) patients. As a result, the final overall results were satisfactory (good and excellent) in 11 (91.7%) and unsatisfactory (poor) in one (8.3%) patient.

Also, the mean value of overall UCLA score, pain score, function score, active forward flexion score, and strength of active forward flexion score significantly improved from (8.8±1.2, 2.1±0.5, 1.8±2.1, 2.4±1.1, and 2.3±2.3) preoperatively to (32.4±2.4, 9.3±2.8, 9.1±4.1, 4.6±3.2, and 4.4±1.6) postoperatively ($P<0.05$), respectively.

In addition, the mean value of active range of forward flexion, abduction, external rotation at 0° of abduction, external rotation at 90° of abduction, and internal rotation at 90° of abduction significantly improved from (102.5±11.3, 96.4±12.8, 41.6±8.1, 51.5±7.3, and 29.1±8.3) preoperatively to (166.3±10.7, 161.5 ±11.1, 71.7±9.1, 82.1±6.8, and 68.4±10.1) post-operatively ($P<0.05$), respectively.

Discussion

Rotator cuff tears have received much attention over the last few decades. In 1972, Neer [1] reported on open rotator cuff repair recommending anteroinferior acromioplasty, mobilization and repair of the torn rotator cuff tendons, meticulous repair of the released deltoid origin, and early restoration of passive motion of the operated shoulder [8].

However, in spite of the reported satisfactory results of formal open repair of rotator cuff tears, deltoid–detachment-related complications (as deltoid avulsion, postoperative pain, delayed rehabilitation, stiffness, and delayed recovery that may prolong up to 18 months) remained a point of much concern [2–8].

Accordingly, the reported deltoid–detachment-related complications in concurrence of increased use of shoulder arthroscopy have urged the trend toward a more minimally invasive management of rotator cuff tears. In 1990, Levy and colleagues were the first to describe the arthroscopically assisted repair of rotator cuff tears. Later in 1994, Paulos and Kody reported on a mini-approach for rotator cuff repair; in which arthroscopic subacromial decompression was followed by open rotator cuff repair through a lateral deltoid split; pointing out that such mini-approach is applicable for most of rotator cuff tears with the advantage of deltoid origin preservation; thus decreasing the postoperative pain and allowing accelerated rehabilitation; in addition to the advantages of; arthroscopic GH examination for intra-articular assessment of cuff tear geometry and detection of associated GH pathology, less blood loss and shorter hospital stay [8–10].

Nevertheless, the advances in shoulder arthroscopic techniques and instrumentations have allowed performing rotator cuff repair all-arthroscopically with results comparable to open and mini-open repair; however, all-arthroscopic repair is a technically demanding procedure, with a relatively long learning curve, and also, it may be not suitable for all cuff tears especially retracted massive ones [8,11,12].

On the basis of the previous debate, this study was conducted to evaluate the clinical results of arthroscopically assisted repair of massive full-thickness rotator cuff tears in 2-year postoperative follow-up.

The current study had some positive points. The data were collected in a prospective fashion. Patients were managed with standardized operative techniques. The patients were evaluated with the assessment of active ROM of the affected shoulder and with the use of a validated outcome measurement specific to shoulder disorders (the UCLA scoring system). The duration of postoperative follow up was adequate for such type of procedures. For consistency of the outcomes, the final assessment was performed by an independent examiner for all patients, so reducing the bias that may be introduced into the current study due to the interobserver variability of different examiners.

It is recognized that this study had some limitations. The study did not include comparison groups of either formal open or all-arthroscopic rotator cuff repair.

Objectively, the small number of included patients might have affected the statistical analysis and the clinical significance of this study.

Also, the small number of included patients has limited the possibility to study the associated pathological findings of massive rotator cuff tears.

It is admitted that the current study had not considered the total area or the shape of the cuff tear, or the amount of fatty degeneration of the cuff muscles (as diagnosed on MRI) with respect to their impacts on the clinical outcomes.

A possible final criticism of the current study is the inclusion of patients with associated another shoulder pathology (such as SLAP lesion, biceps tendon lesions, arthritic changes of the GH joint, and frozen shoulder), which have added some inconsistency to the outcomes. This could be justified by three points. First, there is a high frequency of association of massive rotator cuff tears with other shoulder pathologic conditions. Second, by this study design, the patients were prospectively included on the basis of a primary diagnosis of massive rotator cuff tears; however, the definite court of such diagnosis was arthroscopically based. Any associated shoulder pathology was

considered a part of the primary diagnosis. Finally, if the associated shoulder pathology was highly likely to affect the standardized management, postoperative rehabilitation program, or clinical outcome (e.g. GH instability or lesions of biceps tendon necessitating biceps tenodesis), the patient was definitely excluded from this study.

Regarding the overall incidence of massive rotator cuff tears; 47 shoulder arthroscopies were performed in the period between September 2009 and March 2011; for subacromial procedures 'including both decompression and rotator cuff repair' in 42 (89.4%) patients and for Bankart lesion repair in five (10.6%) patients.

Of these 47 shoulder arthroscopies, massive rotator cuff tears were arthroscopically diagnosed in 12 (25.5%) patients; all were managed by arthroscopically assister repair and all were included in the current study.

There was no statistically significant difference in the final results; among the different age groups (as categorized into decades) ($P>0.05$); between the male and female patient groups ($P>0.05$), among the patient groups of different durations of preoperative complaint (as divided into 6-month intervals) ($P>0.05$), and also, among the patient groups of different mechanisms of injury ($P>0.05$). This could be explained by the small number of patient included in the different groups of age, gender, duration of preoperative complaint, and mechanism of injury.

There was no statistically significant difference in the final results among the patient groups based on the association versus nonassociation with the other shoulder pathology ($P>0.05$).

The most common preoperative signs were positive painful arc of motion, Neer impingement sign, Hawkins-Kennedy test, and Jobe supraspinatus test [all were positive in 12 (100%) patients] [1,13–16].

Massive rotator cuff tears were diagnosed on MRI in all 12 (100%) patients with sensitivity of (100%). Such sensitivity was consistent with those reported in literature; ranging from 90 to100%. Meanwhile, SLAP lesion was suspected on MRI in one (33.3%) of three patients with arthroscopically diagnosed SLAP lesions; this was somewhat consistent with other reports. In addition, there might be overestimation of biceps lesions; as of nine patients with suspected biceps lesions on MRI, only four (44.4%) were arthroscopically evident. Besides, the only patient with glenoid chondral lesion was both MRI evident and arthroscopically evident [17–20].

There was a statistically significant difference in the final results among the patient groups based on the degree of tendon retraction up to the glenoid ($P<0.05$); with a significant high incidence of unsatisfactory results of (20%) in patients with tendon retraction up to the glenoid.

Using UCLA scoring system, the final assessment (at a mean of 27.4 months postoperatively) revealed unsatisfactory (poor) results in one (8.3%) patient and satisfactory results in 11 (91.7%) patients [good results in seven (58.3%), and excellent results in four (33.4%) patients]. Such case of poor result could be explained by the relatively long duration of preoperative complaint (14 months), associated pathology (including biceps tearing, glenoid chondral lesion, and frozen shoulder), the tendon retraction up to the glenoid and poor compliance with the postoperative rehabilitation program; so complicated by postoperative shoulder stiffness.

The satisfactory results of the current work were comparable to those reported by other authors for open, mini-open or all-arthroscopic repair.

Boszotta and Prünner [21] reviewed 84 patients of arthroscopically assisted repair of rotator cuff tears of different sizes and reported that their preoperative average overall UCLA score significantly improved from 11.3 to 31.1 points postoperatively at a mean follow-up of 35 months ($P<0.001$); revealing that the duration of preoperative complaint, tear size, and condition of the long biceps tendon were found to have significant influence on results ($P<0.05$); and attributing the significantly worse results of patients with extensive tears to a residual strength deficit.

Musil *et al.* [22] conducted a prospective study of 51 patients of massive rotator cuff tears managed by arthroscopically assisted repair and pointed out that at a mean postoperative follow up of 51.6 months, the average overall UCLA score significantly improved from 13 points preoperatively to 29.1 points postoperatively (with 15.7% excellent and 54.9% good results).

Severud *et al.* [23] compared 50 patients of mini-open repair versus patients of all-arthroscopic repair and concluded that shoulders in the all-arthroscopic group showed greater motion at 6 and 12 weeks postoperatively and slightly better motion at final review, however, final motion difference was not statistically significant despite that four (14%) patients in the mini-open group developed frozen shoulder.

In a retrospective study of 60 patients of all-arthroscopically-repaired large or massive tears, Jones and Savoie [24] reported that at a mean follow-up of 32 months, 88% of patients had good or excellent outcome based on UCLA scoring system.

Meanwhile, Ide *et al*. [25] reported 82.4 and 76.9% satisfactory results for all-arthroscopic and open repair for large-to-massive tears, respectively.

(1) Statistical analysis of the current study revealed that the improvement in overall UCLA score 'whether from the perspective of the number and percent of patients or the perspective of (mean±SD)' was time-dependent.
(2) The postoperative complications in this study included scar at the site of deltoid-split approach in one (8.3%) patient, superficial infection in one (8.3%) patient managed by antibiotics and local dressings, and finally, postoperative shoulder stiffness in one (8.3%) patient.
(3) The planned reoperation rate was estimated as (8.3%); one of 12 patients; with poor result was the candidate for manipulation under general anesthesia, arthroscopic release, and biceps tenodesis.

Conclusion

On the basis of the findings of this study, favorable clinical outcomes can be anticipated in the majority of patients with massive full-thickness rotator cuff tears after arthroscopically assisted repair. Overall, ~92% of patients will be able to successfully return to the previous level of daily living activity and occupational tasks. In addition, the procedure is relatively simple and short-timed, and does not need high technical skills with accelerated rehabilitation (e.g. no deltoid detachment); so reducing the risk of postoperative shoulder stiffness. Finally, the complications are minimal with low reoperation rate.

However, such advantages of the arthroscopically assisted rotator cuff repair practiced in the current study must be weighed against those of all-arthroscopic repair when selecting the proper technique for managing a patient with a massive rotator cuff repair.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1 Neer CS II. Anterior acromioplasty for the chronic impingement syndrome in the shoulder. A preliminary report. J Bone Joint Surg Am 1972; 54-A:41–50.
2 Hawkins RJ, Misamore GW, Hobeika PE. Surgery for full-thickness rotator-cuff tears. J Bone Joint Surg Am 1985; 67:1349–1355.
3 Adamson GJ, Tibone JE. Ten-year assessment of primary rotator cuff repairs. J Shoulder Elbow Surg 1993; 2:57–63.
4 Kronberg M, Wahlstrom P, Brostrom LA. Shoulder function after surgical repair of rotator cuff tears. J Shoulder Elbow Surg 1997; 6:125–130.
5 Kirschenbaum D, Coyle MP, Leddy JP, Katsaros P, Tan F, Cody RP. Shoulder strength with rotator cuff tears. Pre- and postoperative analysis. Clin Orthop Relat Res 1993; 288:174–178.
6 Rokito AS, Cuomo F, Gallagher MA, Zuckerman JD. Long-term functional outcome of repair of large and massive chronic tears of the rotator cuff. J Bone Joint Surg Am 1999; 81:991–997.
7 Rokito AS, Zuckerman JD, Gallagher MA, Cuomo F. Strength after surgical repair of the rotator cuff. J Shoulder Elbow Surg 1996; 5:12–17.
8 Yamaguchi K. Mini-open rotator cuff repair: an updated perspective. Instructional course lecture. J Bone Joint Surg Am 2001; 83:764–772.
9 Levy HJ, Uribe JW, Delaney LG. Arthroscopic assisted rotator cuff repair: preliminary results. Arthroscopy 1990; 6:55–60.
10 Paulos LE, Kody MH. Arthroscopically enhanced 'mini-approach' to rotator cuff repair. Am J Sports Med 1994; 22:19–25.
11 Gartsman GM. Arthroscopic management of rotator cuff disease. J Am Acad Orthop Surg 1998; 6:259–266.
12 Gartsman GM, Brinker MR, Khan M. Early effectiveness of arthroscopic repair for full-thickness tears of the rotator cuff: an outcome analysis. J Bone Joint Surg Am 1998; 80:33–40.
13 Neer CS II. Impingement lesions. Clin Orthop 1983; 173:70–77.
14 Hawkins RJ, Kennedy JC. Impingement syndrome in athletes. Am J Sports Med 1980; 8:151–158.
15 Codsi M, McCarron J, Brems JJ. Clinical evaluation of shoulder problem. In: Rockwood CA Jr, Matsen FA III, editors. The shoulder. 4th ed. Philadelphia, PA: Saunders 2009. 1 165–166.
16 Reider B, Arcand MA. Shoulder and upper arm. In: Reider B, editor. The orthopedic physical examination. 2nd ed. Philadelphia, PA: Saunders 2005. 17–66
17 Zlatkin MB, Hoffman C, Shellock FG. Assessment of the rotator cuff and glenoid labrum using an extremity MR system: MR results compared to surgical findings from a multi-center study. J Magn Reson Imaging 2004; 19:623–631.
18 Needell SD, Zlatkin MB. Comparison of fat-saturation fast spin echo versus conventional spin echo MRI in the detection of rotator cuff pathology. J Magn Reson Imaging 1997; 7:674–677.
19 Chang D, Mohana-Borges A, Borso M, Chung CB . SLAP lesions: anatomy, clinical presentation, MR imaging, diagnosis and characterization. Eur J Radiol 2008; 68:72–87.
20 Mohana-Borges AVR, Chung CB, Resnick D. Superior labral antero-posterior tears: classification and diagnosis on MRI and MR arthrography. Am J Roentgenol 2003; 181:1449–1462.
21 Boszotta H, Prünner K. Arthroscopically assisted rotator cuff repair. Arthroscopy 2004; 20:620–626.
22 Musil D, Sadovský P, Stehlík J. Massive tears of rotator cuff: comparison of mini-open and arthroscopic techniques: part-1, Mini-open technique. Acta Chir Orthop Traumatol Cech 2006; 73:387–393.
23 Severud EL, Ruotolo C, Abbott DD, Nottage WM . All-arthroscopic versus mini-open rotator cuff repair: a long-term retrospective outcome comparison. Arthroscopy 2003; 19:234–238.
24 Jones CK, Savoie FH III. Arthroscopic repair of large and massive rotator cuff tears. Arthroscopy 2003; 19:564–571.
25 Ide J, Maeda S, Takagi K. A comparison of arthroscopic and open rotator cuff repair. Arthroscopy 2005; 21:1090–1098.