

Arthroscopic treatment of massive rotator cuff tears involving subscapularis

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Abstract—*Introduction.* Massive rotator cuff tears represent a major challenge in shoulder surgery. Contemporary arthroscopic techniques allow for repair in majority of cases. In the setting of a massive rotator cuff tear, engagement of subscapularis plays a significant role in function deterioration and is a risk factor for pseudoparalysis.

Materials and methods. We present our experience and clinical results with arthroscopic repair of massive rotator cuff tears engaging subscapularis in 32 patients, followed for 12,5 months.

Results. Complete repair was performed in 25 (78.1%) and partial repair in 7 (21,9%) of the cases with significant improvement in active forward flexion and good to excellent functional result in 68,8%, according to Constant score. Acute pseudoparalysis was successfully reversed in 8 out of 9 cases (88,8%). Transient neurologic complication was observed in 1 case (3%).

Conclusion. Subscapularis plays an important role in massive rotator cuff tears and should always be repaired. Arthroscopic repair of massive rotator cuff tears engaging subscapularis is safe and efficient with good clinical results during one year follow up. While complete repair of all torn tendons with secure reattachment to the tuberosities is the preferred surgical treatment, repair of subscapularis and lower portion of infraspinatus is crucial for normal rotator cuff function. Careful patient selection and individually tailored surgery is important for successful treatment.

Keywords—massive rotator cuff tears, subscapularis tear, arthroscopic repair

1. Introduction

Massive tears comprise up to 40% of all rotator cuff ruptures and represent a major challenge in reconstructive shoulder surgery due to bad quality of musculo-tendinous units, high rate of re-tears and non-healing and poor clinical outcomes ^{4,12}. Furthermore they are characterized by substantial variability in clinical presentation with common presentation of pseudoparalysis. Multiple options have been proposed for the treatment of massive rotator cuff tears with no clear evidence-based guidelines. Part of the controversies regarding this type of rotator cuff disease is probably due to the lack of uni-

versally accepted definition. While earlier definition was based on size (> 5 cm), currently a rotator cuff tear is considered massive when engaging two or more tendons with significant retraction of at least one of them and exposure of 67% of greater tuberosity^{15,19,20}. Apart from that massive tears can vary in chronicity, tear configuration and tissue quality. Massive tears should not be automatically considered irreparable. Although there are commonly accepted preoperative criteria for irreparability (severe muscle fatty atrophy, severe retraction, reduced tendon length, reduced acromio-humeral distance, chronic pseudoparalysis and lag signs) reparability is finally determined arthroscopically and with evolution of arthroscopic techniques the limits for arthroscopic repair are continuously evolving and currently the majority of massive rotator cuff tears can be completely or partially arthroscopically repaired¹⁸. Numerous surgical options have been proposed for irreparable massive rotator cuff tears with no high quality data to support one treatment over another⁹.

Subscapularis tears are present in 70% of massive rotator cuff tears. As subscapularis plays an important role in compensation for posterosuperior cuff tears, its integrity is crucial for functional deterioration of the shoulder and pseudoparalysis occurrence. A large clinical trial by Collin et al. clearly demonstrates that the risk for pseudoparalysis is significantly increased with involvement of entire subscapularis or with involvement of 3 rotator cuff tendons with engagement of at least upper half of subscapularis⁸.

The aim of this study is to present our experience with arthroscopic treatment of MRCT involving subscapularis, to underline key surgical steps and to present clinical results.

2. Materials and methods

32 patients (26 men and 6 women) operated on between April 2019 and April 2023 were retrospectively reviewed. Mean follow-up was 12,6 months (6-42). Mean age was 59, 6 yrs (35-75). All of them underwent arthroscopic repair of massive rotator cuff tear engaging subscapularis in lateral decubitus or beach chair position. According to Lafosse subscapularis engagement was classified as grade I in 2 patients, grade II in 18 patients, grade III in 11 and grade IV in 1. LHBT was addressed in all cases, if present, by tenotomy or tenodesis. Clinical evaluation was performed preoperatively and at final follow-up using Constant score and active forward flexion measurement.

First surgical step is arthroscopic evaluation of tear pattern, tendon mobility and quality, with special attention paid to subscapularis insertion site involvement. If a retracted subscapularis tear is present, then a thorough three sided release is performed – posteriorly from the glenoid neck and capsule, superiorly from the coracoid base and coracohumeral ligament and anteriorly in the subcoracoid space where sometimes it is necessary to dissect adhesions from the brachial plexus. Capsular release is performed posterosuperiorly and a release in continuity of the anterosuperior cuff, preserving the comma tissue. Then subscapularis repair is performed using intraarticular or combined intra and extraarticular approach depending on tear size using one or two suture anchors and combination of simple and mattress sutures (fig. 1).



Fig. 1 Subscapularis repair in the setting of a massive rotator cuff tear.

After subscapularis repair the rest of the posterosuperior cuff is usually easily repositioned and repaired in an anatomic fashion using double row or single row configurations according to tendon length, delamination and tissue quality (fig. 2)

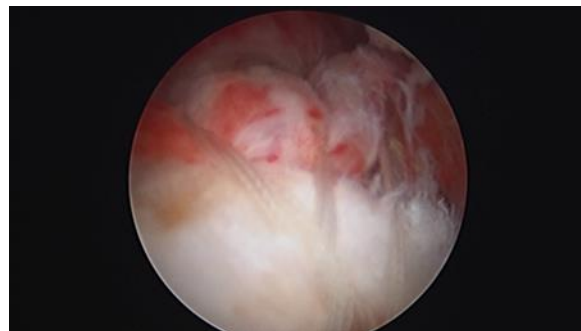


Fig. 2 Complete double-row repair of posterosuperior rotator cuff.

When complete repair is not possible, subscapularis repair and lower infraspinatus repair to restore the rotator cable is performed. In three cases subacromial spacer was inflated over the partial repair, and in one case – augmentation with long head of the biceps tendon. Minimal acromioplasty is usually performed only after successful anterosuperior cuff repair.

3. Results

Complete repair of massive tear was achieved in 25 cases (78,1%) with 13 cases of double row and 12 cases of single row configuration. Partial repair was performed in 7 cases (21,8%) of which resorbables subacromial spacer was added in 3 cases and long

head of the bicipes tendon augmentation - in one case. Reversal of acute pseudoparalysis was achieved in 8 of 9 cases (88,8%). In both complete and partial repair group of patients a significant increase of active forward flexion and functional result according to Constant score was achieved (Table 1). At final follow up good and excellent results, according to Constant score was registered in 68,8 of cases, mediocre - in 25%, and poor in 6,2%. Transient musculocutaneous injury in one patient (3%) was the only complication recorded.

Table 1

group of patients	preoperative Constant score	postoperative Constant score	preoperative forward flexion	postoperative forward flexion
complete repair	38,6	82,2 (p< 0, 05)	118,4°	146,2° (p< 0,05)
partial repair	37,8	69,4 (p< 0,05)	106,6°	132,3° (p< 0,05)

4. Discussion

The main finding of the current study was that arthroscopic complete or partial repair of massive rotator cuff tears engaging subscapularis gains good clinical results in the majority of patients leading to significant functional improvement of the shoulder. Recent studies demonstrate that up to 80%-85% of MRCT are repairable with advanced arthroscopic techniques. Complete arthroscopic repair is the best surgical option for the massive tears, with good functional results reported in the long term, low complication rate, high patient satisfaction and low rate of revision to reverse shoulder arthroplasty, despite re-tear rate reaching 40%-53%^{7,10}. We did not evaluate re-tear and non-healing rate with imaging modalities in our series due to the retrospective design of the study and the well-known lack of correlation between structural integrity of the repair, functional results and patient satisfaction. We consider that even partial healing of a complete repair can provide functional rotator cuff and well balanced shoulder. Furthermore an intact subscapularis is a prerequisite for good functionality of a future muscle transfer or reverse shoulder arthroplasty if needed. Although tendon reparability depends on multiple factors and many of them should be analyzed preoperatively final estimation is done during arthroscopy with evaluation of tendon configuration tissue quality and mobility after release. Advanced releases and subscapularis repair can an irreparable tear into repairable¹.

Double row repair demonstrates lower re-tear rates in massive rotator cuff tears and significantly improves long term functional outcome but is usually possible when more than 75% tendon coverage of the greater tuberosity is achieved^{10,17}.

Subscapularis tear is a frequent finding in massive rotator cuff tears, with its upper 1/2 most commonly affected. It has been demonstrated in several studies that involvement of lower ½ of subscapularis in a massive tear is predictive of active forward flexion and occurrence of pseudoparalysis^{5,14}. It is our experience also, that in acute in chronic cases propagation of a well-compensated massive tear anteriorly into the subscapularis leads to deterioration of function and it is often that moment when patients seek special orthopaedic care. Furthermore, repair of subscapularis contributes to higher percentage of complete repair of massive rotator cuff tears and reversal of pseudoparalysis¹¹.

Partial repair of the rotator cuff aims to restore force couples of the shoulder in vertical and horizontal plane and provide functional rotator cuff. In such scenario reinsertion of subscapularis in the front and lower part of infraspinatus is executed and the posterosuperior defect in the cuff is left unrepaired. Partial repair can effectively restore function or prevent extension of the tear and further loss of function. It is reported as effective in pain reduction, function improvement and patient satisfaction but is also prone to high structural failure rate and the results tend to worsen with time^{2,3,21}.

Although a number of joint-preserving surgical procedures like superior capsule reconstruction, subacromial spacer and muscle transfers have been proposed for the treatment of irreparable massive rotator cuff tears and improved functional shoulder scores have been reported in the short- and mid-term, none of them has proved superior to partial repair and there are no clear treatment guidelines. All of those treatment modalities are prone to high failure rate and deterioration of functional results in the long term^{2,9,16}. Nevertheless, intact or reparable subscapularis is a fundamental prerequisite for the success of each of these reconstructive procedures, so subscapularis repair is always beneficial if further surgery is needed.

Patient selection and individualized surgery is very important in the lack of treatment algorithm. Limitations for arthroscopic repair of massive rotator cuff tears include chronic pseudoparalysis, lag signs and osteoarthritic changes, where usually superior capsule reconstruction or muscle transfer is indicated in younger patients and reverse shoulder arthroplasty is the preferred treatment for elderly patients^{12,13}.

5. Conclusion

Subscapularis plays an important role in massive rotator cuff and should always be repaired. Arthroscopic repair of massive rotator cuff tears with subscapularis involvement is safe and effective with good clinical results despite potential high structural failure rate. Complete arthroscopic repair of all torn tendons with secure reattachment to the tuberosities is the preferred surgical approach. If not possible partial arthroscopic repair with subscapularis and infraspinatus priority gains good results. Acute pseudoparalysis can be successfully reversed with arthroscopic repair of the massive tears engaging subscapularis. Proper patient selection and individually tailored surgical strategy are crucial for successful treatment.

6. References

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