SUBSCAPULARIS TENDON TEARS: SOLUTIONS FOR REPARABLE AND IRREPARABLE TEARS

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SUMMARY
The authors claim, that all subscapularis tendon tears are possible to be repaired arthroscopically. The aim of this report is to show how the repair techniques differ each other depending on the type of rupture. Some tip and tricks are presented to show that an arthroscopic repair is not so difficult as it was supposed.

Keywords: subscapularis tear, rotator cuff, arthroscopic repair

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Introduction and aim
Isolated subscapularis tears (SUBS) are rare, with incidence about 5% of rotator cuff tears. Together with superior – posterior rotator cuff pathology, SUBS rupture incidence is up to 35%. Nowadays all subscapularis tendon tears are possible to be repaired arthroscopically. One of the most popular classification systems was proposed by Lafosse et al. (2007). This classification is easily understandable and allows choosing the right procedure, portals, but the agreement still is poor on the classification and treatment options between surgeons (Smutcny et al. 2016). The aim of this review is to show how the repair techniques differ depending on the type of rupture. Some tips and tricks are presented to show that the arthroscopic repair is not so difficult as it was thought earlier as well as its reproducibility is high.

Material and methods
In the light of the anatomic data and arthroscopic lesion-related findings, in 2007 Lafosse and his co-workers (2007) proposed a 5-type classification of SUBS tendon lesions. Type I lesions are the simple erosions of the superior third, without the tendon...
detachment. Type II lesion is restricted to the superior 1/3. Type III involves the entire height of the tendon insertion (2/3 of SUBS), but without the muscular detachment of the inferior third, with a limited tendon retraction. Type IV is the complete subscapularis detachment from the lesser tuberosity of the humerus, but humeral head remains well centered, without contact with the coracoid on the internal rotation of CT-scans or MRI-scans. Type V represents the complete rupture, but with the antero-superior migration of the humeral head, with an associated fatty infiltration.

Portals
The number of portals depend on size of SUBS lesion, but typically four portals as for standard cuff tear repairs are enough. For type III, IV and V, always additional supra-pectoral (sP) portals are made (Figure 1).

The posterior portal (P) allows the intra-articular view or superior 1/3 of the subscapularis region, but if greater extension of tear is suspected (types III, IV, V), the antero-lateral portal (AL) is used for visualization.

Type I. In can be observed on the superior part of SUBS tendon. To evaluate the integrity of bone tendon junction, an internal rotation maneuver is used. Without any traction, the patient’s palm lies on a belly and a gentle elevation of elbow is performed. This maneuver is mandatory to rule out any SUBS tendon ruptures. Type II can be justified when superior 1/3 of SUBS is ruptured. A traction 3–5 kg is simply used. In most cases, the superior glenohumeral ligament (SGHL) remains intact, covering the real extension of lesion (Figure 2).

This SUBS damage is called “a hidden lesion”. Removal of SGHL shows the real situation, and sometimes reveals III type SUBS lesion. Aiming the quick repair, a resection of rotator interval (RI) is warrant together with a resection of bursa anterior to SUBS tendon. Coracoid tip, conjoined tendon and CA ligament should be then clearly visible. A lesser tuberosity preparation with VAPR and burying are made through AS portal. The same portal and RI window are utilized to insert an anchor just anteriorly to the bicipital groove. A lasso loop technique (Lafosse et al. 2006) allows a tendon strong fixation to lesser tuberosity, with continuing work through AS portal, and still looking through the posterior (P) portal (Figure 3).

Type III. Superior 2/3 of SUBS is ruptured. If tear extends to the lower part of tendon, the slight flexion and adduction of hand improves a visualization. It could be done easily by placing a stretched patient's hand between patient's legs. Someone should hold a hand still if it doesn’t remain stable. The antero-lateral (AL) portal guided by the spinal needle is performed. If the lateral superficial part of SUSB tendon is still intact, a spinal needle could be used to elevate the inferior SUBS part for better visualization. These type III SUSB tears allows putting the inferior anchor transtendinously, and to manage sutures through AS portal without changing viewing portal to AL. However, in majority of cases, SUBS tendinous part is completely ruptured, and better visualization is achieved by looking through AL portal. At this stage, two techniques could be used for SUBS inferior part repair. Originally by placing the inferior anchor first (Lafosse et al. 2010), or by placing the superior anchor first. The last mentioned technique has some advantages, because the first superior anchor and its suture management are easily done with looking still through the posterior (P) portal. Secondly, a lasso-loop suture from the superior anchor allows the control of SUBS tendon and by pooling on free end of this suture, it is possible to increase a space between inferior part of lesser tuberosity and inferior SUBS tendon. Supra-pectoral portal (SP) with a spinal needle is done and its location is just superior to axillar fold aiming
the needle to space between SUBS and conjoined tendon and just superior to pectoralis major tendon (Jermolajevas and Kordasiewicz 2015). To obtain the tension-free repair, it is necessary to perform superior, posterior and anterior releases. The superior part is released from any adhesions as far as to the medial side of coracoid base. More medially lies the suprascapular nerve. Posteriorly to SUBS, any capsule adhesions are resected. Anteriorly subcoracoid bursa and space between SUBS and conjoined tendon are tensioned. The anterior side of SUBS is then exposed as much as possible. Behind the conjoined tendon, the anterior side of the SUBS often adheres to the conjoined tendon, and requires to be released to reveal the axillary vessels. After the release is completed and the tendon mobility is good enough for a tension-free repair, an anchor is inserted in inferior-medial part of the lesser tuberosity. Sutures are managed through the supra-pectoral (sP) portal by using “cleverhook” technique. Inspection is performed through AL portal. Suture tails are left in SP portal if later the “suture bridge” technique is planned.

Type IV. It is applied in cases of the complete tear of SUBS including superior 2/3 tendinous part and 1/3 muscular part. Same technique as described for type III lesions are used, but more extensive release is necessary. The tendon is always retracted more medially, traction sutures in inferior part of tendon are performed and used for step by step release and the definitive fixation with anchors. At least three anchors, two medially and the third laterally in a biceps groove or just posterior to it are used.

Type V. A complete tear of SUBS with the antero-superior humeral head subluxation are performed. Direct repair is always impossible or SUBS tendon is a very delicate and non-mobile even after the complete mobilization. Sick tendon is always accompanied with a fatty infiltrated SUBS muscle, and even if repair would be accomplished, a muscle will not generate enough contraction to centralize a humeral head. In this situation, a muscle tendons transfers are performed to substitute at least partially SUBS function. The contraindication to perform transfers is an irreparable supraspinatus muscle (Jost et al. 2003). Nowadays, the most popular is a transfer of sternal part of pectoralis major tendon (Valenti et al. 2015). It could be done arthroscopically utilizing the same portals. Then decision is undertaken to proceed with a transfer, AS portal is used as the viewing portal, aiming to look inferiorly, AL and sP portals are used to clean up all tissues up to the pectoralis major tendon. The spaces between conjoined tendon and pectoralis major tendon are enlarged. Utilizing shaver and blunt trocar, the sternal and clavicular parts are separated until the inferior border of sternal pectoralis major tendon is reached (Figure 4).

In this spot, the additional portal for suture instruments is applied at the level of the anterior axillar fold. Spectrum (Linvatec) suture instruments are used. Two or three different color sutures are tied up. The sternal part release from clavicular pectoralis major part is performed by VAPR. Then a pectoralis major tendon release from coracoid is made. A care is taken not to damage the musculocutaneous nerve and other nerves of brachial plexus. Sutures from tendon are wrapped under conjoined tendon and fixed on the upper part of greater tuberosity or biceps groove with two Versalok anchors.

Between January and December of 2015, a hundred and fifteen patients with subscapularis tears underwent the arthroscopic repair as described above. Diagnosis of SUBS was performed clinically using Belly press, Bear Hug, Lift tests and using the portative ultrasound devise. All patients had MRIanalysis before the surgery to confirm a rupture and to evaluate SUBS and other rotator cuff fatty infiltrations as well as the atrophy. All patients were operated by single surgeon with the beach chair position. General and interscalene block anesthesia were used in all cases.
Results
Operated patients had two superficial lesions without a detachment from the bone (Lafosse 1 L1-2). Superior 1/3 part of SUBS was ruptured in majority of cases (Lafosse 2 L2-95) and required only one anchor for the repair. Lafosse 3 SUBS rupture occurred in 11 patients (L3-11), and full detachment was found in 7 patients (L4-7). All ruptures were possible to be fully repaired with the techniques mentioned above. In one patient, the arthroscopic sternal part of pectoralis major transfer was performed to augment the partially repaired SUBS, to reinforce the internal rotation and it was classified as type V.

Discussion and conclusions
SUBS rupture was treated arthroscopically as the most difficult rotator cuff ruptured tendon. Using the knowledge and improved instrumentations this is now the first method of choice in treatment. In majority of treated cases 1/3 of SUBS was ruptured and repair could be done in few minutes still looking from the posterior portal and working through the anterior portal. Additionally, AL portal was necessary for significant tears. Supra-pectoral (sP) portal was required for some types III and all types IV, V ruptures. Irreparable isolated SUBS tears are rear.
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