

Jermolajevs V, Kemzuraitė N. Subscapularis tendon tears: solutions for reparable and irreparable tears. *Issue Rehabil. Orthop. Neurophysiol. Sport Promot.* 2016; 15: 31–38.

## 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

*Date received: February 17, 2016*

*Date accepted: February 23, 2016*

### 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 (Smutcný *et al.* 2016). The aim of this

## USZKODZENIE ŚCIĘGNA MIĘŚNIA PODŁOPATKOWEGO: MOŻLIWE ROZWIĄZANIA DLA USZKODZEŃ NAPRAWIALNYCH I NIENAPRAWIALNYCH

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### STRESZCZENIE

Autorzy tego doniesienia zakładają, że wszystkie uszkodzenia ścięgna mięśnia podłopatkowego są możliwe do wyleczenia z wykorzystaniem artroskopii. Celem tego doniesienia było zaprezentowanie jak techniki naprawcze różnią się w zależności od typu uszkodzenia. Zaproponowano niektóre wskazówki oraz rozwiązania w celu udowodnienia, że leczenie techniką artroskopową nie jest tak trudne jak to uprzednio prezentowano.

**Słowa kluczowe:** uszkodzenie ścięgna mięśnia podłopatkowego, pierścień rotatorów, artroskopia barku

*Data otrzymania: 17 luty, 2016*

*Data zaakceptowania: 23 luty, 2016*

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

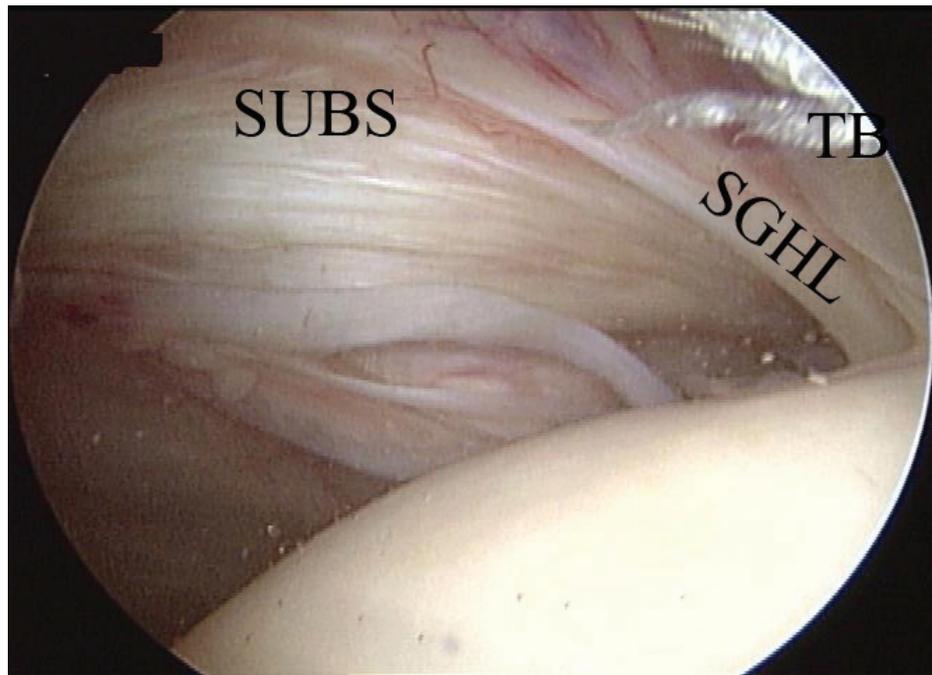
of tear is suspected (types III, IV, V), the antero-lateral portal (AL) is used for visualization.

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. The anterior-superior (AS) portal is applied aiming the needle visualization strictly laterally to the coracoacromial (CA) ligament. A debridement through AS portal and a rotator interval is good enough. If any signs of biceps instability or tendinopathy are found, tenotomy or tenodesis are performed.

Type II. It 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).



**Figure 1.** Portals. A-Right shoulder view from side. B-Frontal view. Abbreviations: P – posterior, PL – postero-lateral, AL – antero-lateral, AS – antero-superior, sP – supra-pectoral, G – suprascapular portals.



**Figure 2.** Type II subscapularis “hiding tear”. Abbreviations: SUBS – subcapularis tendon, SGHL – superior glenohumeral ligament, TB – biceps tendon piles.

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 warranted 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 SUBS tendon is still intact, a spinal needle could be used to elevate the inferior SUBS part for better visualization. These type III SUBS tears allow 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 axillary fold aiming

the needle to space between SUBS and conjoined tendon and just superior to pectoralis major tendon (Jermolajevs 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.

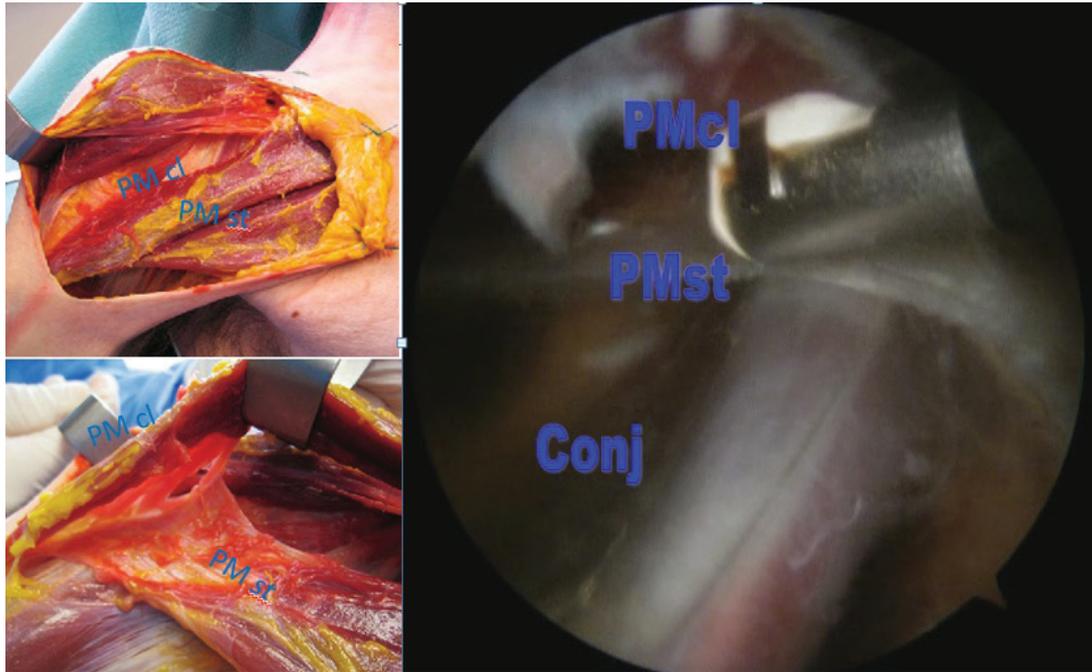
Type IV. It is applied in cases of the complete tear of SUBS including superior 2/3 tendinous part and 1/3 muscular part. Same technique as described for type III lesions are used, but more extensive release is necessary. The tendon is always retracted more medially, traction sutures in inferior part 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 subscapular tears underwent the arthroscopic repair as described above. Diagnosis of SUBS was performed clinically using Belly press, Bear Hug, Lift tests and using the portable ultrasound device. All patients had MRI analysis 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.



**Figure 4.** Anatomy and arthroscopic view of pectoralis major tendons. Abbreviations: PMcl – clavicular part of pectoralis major, PMst – sternal part of pectoralis major, Conj-conjoined tendon.

### 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 rare.



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*Authors reported no source of funding.  
Authors declared no conflict of interest.*

*Autorzy nie zgłosili źródła finansowania.  
Autorzy nie deklarowali konfliktu interesów.*

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