



# Full-Thickness Rotator Cuff Tear in a Female Adolescent Judoka: A Case Report

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### Abstract

Rotator cuff tear is a condition characterized by rotator cuff degeneration, which commonly occurs in elderly people over 50 years old and is rarely noted in teenagers. In cases of adolescent shoulder joint trauma, a delayed diagnosis may shorten the period during which athletes can play an active role. Thus, we report a case of complete rotator cuff tear in a female adolescent judo player due to a traumatic right shoulder injury during practice. Magnetic resonance imaging revealed a complete tear of the supraspinatus and infraspinatus tendon. An arthroscopic repair was performed for type II superior labral tear from anterior to posterior. Moreover, a mini-open cuff repair with suture bridge technique was performed for the complete tear of the supraspinatus and infraspinatus tendons. After 1 month of postoperative sling rest, an active range-of-motion exercise was started. Four months post-operation, the patient was able to perform "Randori" exercise. Two years post-surgery, she returned to competing in judo without restrictions and complications. This paper highlights that although rotator cuff tears are uncommon in younger age groups, this should still be considered as a differential diagnosis in high-energy trauma patients engaging in contact sports. Due to the risks brought about by various comorbidities, an accurate and early diagnosis is crucial for effective surgical treatment.

**Keywords:** Adolescent; Full thickness; Rotator cuff tear

**Abbreviations:** SLAP: Superior Labral Tear from Anterior to Posterior; MRI: Magnetic Resonance Imaging; MMT: Manual Muscle Testing; ASES: American Shoulder and Elbow Surgeons; CMS: Constant-Murley Score; UCLA: University of California, Los Angeles

### Introduction

Rotator cuff tear is a condition common in middle-aged and elderly patients due to their inherent tendon degeneration [1]. In adolescents, this disease is rare [2] since the epiphyseal growth plate is weaker than their tendons. Cuff tears in adolescents have been reported to be caused by high-energy trauma such as dislocation and repetitive stress such as overhead movements in throwing sports. Hence, several incomplete rotator cuff tears have been reported previously [3]. To the best of our knowledge, only a few papers have described complete tears. If the diagnosis is delayed, cuff muscle atrophy may progress and shorten the athlete's life.

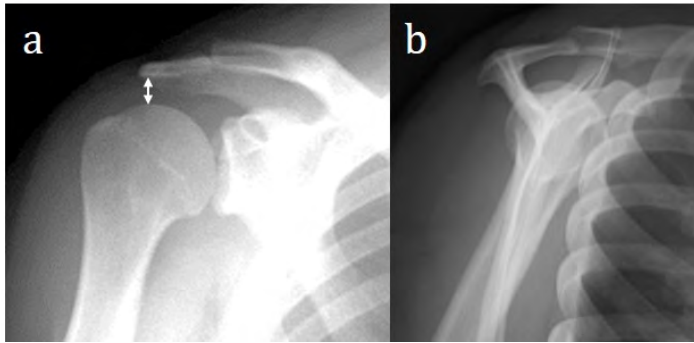
Here, we report the successful surgical treatment of complete traumatic rotator cuff tear in a teenage female judoka.

### Case Report

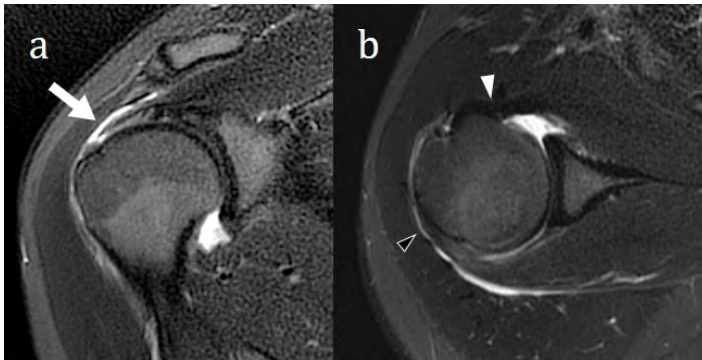
An 18-year-old right-handed female college judo player presented with a 1-month history of severe persistent right shoulder pain following an injury during "Randori" training (free practice in judo). She was right-handed and injured on the "Tsurite" side (lapel or collar grip of the opponent's uniform for lifting motion) [4]. She was in the < 58 kg weight category. For 1 month after injury, she felt right shoulder pain and muscle weakness during judo practice.

Physical examination revealed a restricted shoulder range of motion due to pain. She demonstrated forward elevation of 70°, external rotation at 40°, and internal rotation at L1. Moreover, she reported experiencing nocturnal pain. Both empty can and full can tests were positive. Manual muscle testing (MMT) revealed weakness in both shoulder abduction and external rotation, with a rate of 4/5. The anterior, inferior, and posterior apprehension tests were negative, and no instability on the right shoulder joint was observed. Furthermore, plain radiography revealed no fractures or dislocations (Figure 1). Magnetic resonance imaging (MRI) showed a complete tear from the supraspinatus to the infraspinatus tendon with no Bankart lesion (Figure 2). These findings were

consistent with a traumatic complete rotator cuff tear diagnosis.



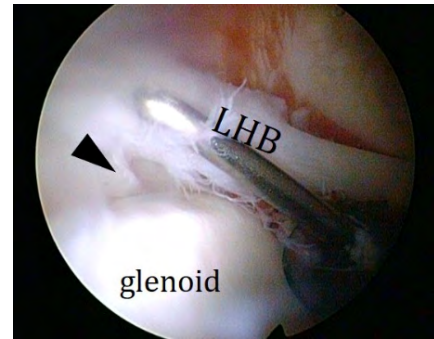
**Figure 1:** Plain radiographs of the shoulder joint taken at (a) AP and (b) Y views revealing no fractures and dislocations. The acromiohumeral interval is 9.3 mm (white arrow).



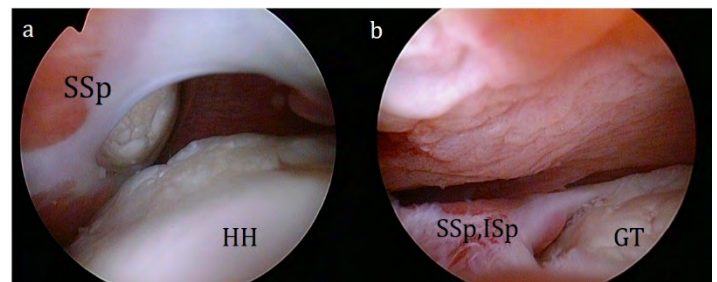
**Figure 2:** (a) Coronal and (b) axial magnetic resonance images of the shoulder showing full-thickness tears of the supraspinatus and infraspinatus tendons (white arrow). There are no Bankart and Hill-Sachs lesions. Tears of the subscapularis (white arrowhead) and teres minor (black arrowhead) are not observed.

A mini-open rotator cuff repair with arthroscopic repair was performed 2 months after the injury. The surgery was done under general anesthesia with additional interscalene nerve blocks. The patient was positioned in a beach chair position. Arthroscopy revealed a type II superior labral tear from anterior to posterior (SLAP) lesion [5] (Figure 3) and a complete tear of the supraspinatus and infraspinatus tendons measuring 30 mm × 20 mm (Figure 4). No Bankart lesion, subscapularis tendon tear, or joint capsule rupture was observed. The type II SLAP lesion was repaired using a single labrum suture anchor (Gryphon® BR anchor, Depuy Synthes, USA) (Figure 5). Open repair was performed using a mini-open deltoid splitting approach. The rotator cuff tendon was mobilized, and the footprint was gently decorticated using a rasp. The repair was performed using the suture bridging method with two additional double-loaded bioabsorbable anchors

(Healix Advance® BR Anchor, Depuy Synthes, USA) and two outer anchors (Versalok® Anchor, Depuy Synthes, USA) (Figure 6). After sufficient irrigation, the wound was closed and the operation was completed.



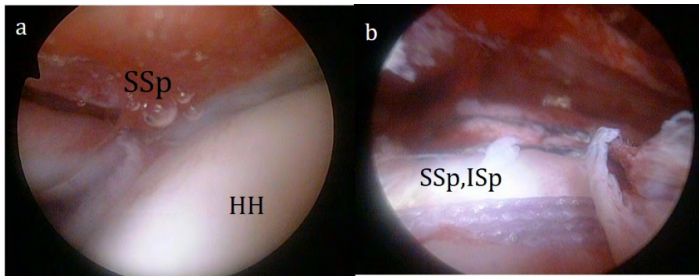
**Figure 3:** Arthroscopic image showing the SLAP type II lesion (black arrow) near the attachment of the long head of the biceps (LHB).



**Figure 4:** (a) Arthroscopic image of the glenohumeral joint showing a complete tear of the supraspinatus (SSp) and infraspinatus (ISp) tendon. A connection with the subacromial bursa was observed. (b) Arthroscopic image of the subacromial bursa revealing that the supraspinatus (SSp) and infraspinatus (ISp) tendon are torn at the greater tuberosity (GT). Synovitis was found in the synovial bursa.



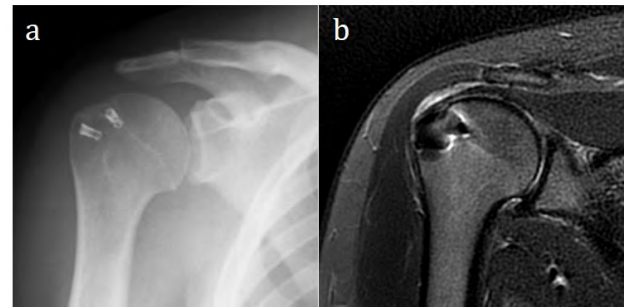
**Figure 5:** The SLAP lesion was repaired with a suture anchor (black arrow). LHB, long head of the biceps.



**Figure 6:** (a) Scapulothoracic arthroscopy after repair revealing that the supraspinatus (SSp) and infraspinatus (ISp) tendon tears have been repaired medial to the footprint. (b) Subacromial bursal endoscopy after repair showing that the supraspinatus (SSp) and infraspinatus (ISp) tendon tears are repaired using the suture bridging method. HH, humeral head.

Four weeks post-operation, the ipsilateral arm was held at a 30° abduction using a sling and immobilizer. During this period, passive-assisted and pendulum exercises were recommended for early recovery of range of motion and mobility despite the pain. Following the active and assisted motion exercises, rotator cuff strengthening exercises were started 7 weeks post-surgery. Weight training and freestyle practice was allowed at the third and fourth postoperative month, respectively. Six months after muscle strength recovery, the patient returned to her pre-injured state and was allowed to engage in vigorous athletic activity.

Two years after surgery, her shoulder range of motion improved. Shoulder elevation increased to 160°. External and internal rotation improved to 60° at the level of the tenth thoracic vertebra. Plain radiography showed that the acromiohumeral interval was maintained with no secondary arthritic changes. MRI revealed the continuity of the repaired rotator cuff (Sugaya classification type II) [6] (Figure 7). The patient had UCLA shoulder score, CMS, and ASES shoulder score of 33, 89, and 95, respectively. She returned to competing in judo without restrictions.



**Figure 7:** (a) Plain radiograph of the postoperative right shoulder joint showing that the acromiohumeral interval is maintained with no arthritic change. (b) Coronal MRI of the postoperative right shoulder joint showing that the repaired rotator cuff is continuous (Sugaya type II).

## Discussion

Among the cases of rotator cuff tear surgery at all ages, the rates of teenage cuff tears were reported to be 0.3% (9/2727 shoulders) [7], 0.8% (3/379 shoulders) [2], and 1% (1/103 shoulder) [8]. At our department, there were only four cases of teenage cuff tears (0.5%, 4/788) in 20 years. Furthermore, it has been reported that adolescent rotator cuff tears are often incomplete tears and due to greater tubercle avulsion fractures [2,9]. To the best of our knowledge, complete tears are extremely rare.

**Table 1** shows a list of preoperative and postoperative results from studies involving teenage complete tear [2,3,7,10-15]. High-energy trauma due to direct external force or dislocation and repetitive movements in overhead throwing athletes were among the several mechanisms of adolescent rotator cuff injury [10]. Among these selected studies, 83% (10/12 shoulders) were caused by direct external force or dislocation. Although there was no history of dislocation in the present case, it is probable that when the right shoulder was struck, a direct external force was applied

to the anterior and superior shoulder joint, causing a rotator cuff tear and SLAP lesion. Moreover, we have previously reported cases of massive rotator cuff tears in high school male judokas [15]. It is necessary to recognize judo, a martial art, as a sport in which rotator cuff tears are likely to occur even at a young age. In addition, 58% (7/12 shoulders) of rotator cuff tears were related to contact sports (Table 1). Azzam et al. [9] reported that 45% of traumatic rotator cuff tears were seen in American football such as a representative of contact sports. Horsley et al. [16] reported that shoulder joint trauma was often seen by tackles in rugby, and cuff tears were noted in 43% of cases. This implies that the risk of rotator cuff tear increases with shoulder joint trauma caused by contact sports.

Study	Age	Sex	Time from injury to treatment	Type of tear	Inciting event	Outcomes
Itoi E, et al. [2] Orthop 1993	19	M	2 mo	Full-thickness (pinhole)	Motorcycle accident	Full recovery with return to sport, job
Tateiwa T, et al. [15] Jpn J Clin Sports Med 2004	17	M	3 mo	Full-thickness (SSp, ISp, SSc, TM)	judo	75% recovery with return to sport
Rickert M, et al. [13] Z Orthop I G 2000	14	M	4 mo	Full-thickness (SSp, ISp)	fall from bicycle	Full recovery with return to sport
Tarkin IS, et al. [14] AJSM 2005	12	M	>3 mo	Full-thickness (SSc)	skateboarding	Full recovery with return to sport
Tarkin IS, et al. [14] AJSM 2005	14	M	>6 mo	Full-thickness (SSc)	wrestling	Full recovery with return to sport
Tarkin IS, et al. [14] AJSM 2005	14	M	>2 y	Full-thickness (SSc)	hockey	Return to usual activities
Turman KA, et al. [3] Sports Health 2010	16	M	1 w	Full-thickness (SSp, ISp, SSc, TM)	football	Full recovery with return to sport
Alley MC, et al. [10] Orthop 2016	12	M	3 w	Full-thickness (SSp, ISp)	football	Full recovery with return to sport
Fitzpatrick A, et al. [12] J Orthop Case Reports	18	M	10d	Full-thickness (ISp)	football	Full recovery with return to sport
Burns TC, et al. [11] JSES 2009	15	F		Full-thickness (SSp)	softball	Full recovery with return to sport
Burns TC, et al. [11] JSES 2009	14	F		Full-thickness (SSp)	softball	Full recovery with return to sport
current	18	F	2 mo	Full-thickness (SSp, ISp)	judo	Full recovery with return to sport
Dilisio MF, et al. [7] Orthop. 2015	19.1	M 3 F 6	6.6 mo	Full-thickness (SSp) 4 Partial-thickness (SSp> 50%) 5	Ski, softball, baseball, volleyball, fall on ice, football, gymnastics, Motorcycle accident	Full recovery with return to sport, job

**Table 1:** SSp, supraspinatus; ISp, infraspinatus; SSc, subscapularis; TM, teres minor.

Rotator cuff tears among adolescents are often overlooked in adolescents because of three main reasons. First, it mainly affects middle-aged and elderly people due to concomitant tendon degeneration. Second, shoulder joint diseases in adolescents often present with fractures, impingement, and instability. Lastly, full-thickness rotator cuff tears in adolescents are extremely rare. Dilisio et al. [7] stated that over 50% of patients under the age of 25 were misdiagnosed on initial examination and on MRI by both orthopedic surgeons and diagnostic radiologists. In addition, adolescent traumatic rotator cuff tears are likely to have various complications. Zbojniewicz et al. [17] reported that combined joint capsule and articular labral injuries were noted in 36% (9/25 shoulders) of adolescent rotator cuff tears. SLAP lesions are often associated with rotator cuff tears, as in the present case [18]. The results were similar to those reported previously. Dilisio et al. [7] revealed that all cases (9/9 shoulders) had supraspinatus tendon tears. Azzam et al. [9] showed that tears from the supraspinatus to the teres minor tendon accounted for 78% (25/32 shoulders). Moreover, it was noted that the rotator cuff tear sites were comparable to those seen in adult-onset cases.

In previous reports, all patients with adolescent rotator cuff tears, even complete tears, were able to return to sports and physical labor after surgery. However, Tarkin et al. [14] reported that one case in which the waiting period from injury to surgery was 2 years or more showed improvements in the level of activities of daily living. Therefore, in cases of traumatic complete tears, it is crucial to perform surgical treatment at an early stage, even in young active patients.

Complete full-thickness rotator cuff tear in adolescents is a rare condition. Furthermore, although diagnosis may be difficult in adolescents with an immature skeleton, complete full-thickness rotator cuff tear is a condition that should be noted in shoulder joint diseases caused by contact sports. In cases of complete tears, good postoperative results can be expected with early rotator cuff repair surgery.

#### Conflict of interest

There were no conflicts of interest in the writing of this case report.

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