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ORIGINAL ARTICLE

The outcomes and affecting factors after arthroscopic isolated subscapularis tendon repair

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Background: This study evaluated clinical outcomes for isolated subscapularis tendon tears treated by arthroscopic repair, the factors affecting clinical outcomes, and changes in tendon structural integrity using magnetic resonance imaging.

Methods: Between 2005 and 2013, 45 patients with isolated subscapularis tendon tears were enrolled from two institutions. Clinical outcomes were assessed using the pain visual analog scale, American Shoulder and Elbow Surgeons, and Simple Shoulder Test scores. We evaluated factors affecting clinical outcomes: trauma history, tear classification, sex, age, symptom duration, preoperative fatty infiltration grade, cross-sectional area (CSA), cranial-transversal diameter, and caudal-transversal diameter. Subscapularis tendon integrity and fatty infiltration grade were evaluated using magnetic resonance imaging.

Results: No complications occurred except for tendon rerupture in 1 patient. No significant changes in tendon structural integrity occurred except for those related to CSA. Tendon structural integrity was significantly different between tears less than one-fourth of the entire subscapularis tendon and those exceeding one-fourth. However, there were no statistically significant differences in clinical outcomes between the 2 types of tear. Age was significantly associated with clinical outcomes, including Constant, American Shoulder and Elbow Surgeons, and Simple Shoulder Test scores. Men experienced better outcomes than women in Constant and Simple Shoulder Test scores. As the postoperative period progressed, the difference in CSA, cranial-transversal diameter, and caudal-transversal diameter decreased to the point of no statistical significance.

Conclusion: Arthroscopic repair of isolated subscapularis tear provided significant functional improvements with a low rerupture rate. Age was significantly associated with clinical results.

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The study was approved by the Institutional Review Board at the Sungkyunkwan University College of Medicine, Samsung Medical Center (No. SMC 2016-01-062) and Kyung Hee University Hospital (No. KMC 1605-09).

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Level of evidence: Level IV; Case Series; Treatment Study

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The subscapularis muscle has an important role in shoulder stability and function and is an anterior stabilizer of the shoulder joint.^{17,25} However, the subscapularis has been known as the “forgotten rotator cuff tendon” in the past.²¹ Subscapularis tears may present as part of a massive anterosuperior rotator cuff tear^{5,27,29} or as isolated lesions.^{9,14,15}

Isolated subscapularis tendon tears are uncommon and account for 4% of rotator cuff tears.¹⁰ A great portion of subscapularis tears are degenerative tears because of the impaired vascularity and intrinsic tendon degenerative change that take place with aging. However, diverse forms of impingement have also been involved in the etiology of subscapularis tears.²¹ Isolated subscapularis tendon tears are most usual in young patients and are generally caused by traumatic injuries.⁹ Enforced external rotation,¹⁵ hyperextension and external rotation,⁹ and abduction of the shoulder during maximal external rotation¹⁶ have all been the cause of traumatic subscapularis tendon tear.

Bennett et al,⁶ Adams et al,¹ and Lafosse et al²² all reported postoperative clinical results of arthroscopic repair of isolated subscapularis tears, and Bartl et al⁴ recently reported some clinical results in structural integrity. This small number of articles demonstrates the dearth of published research concerning isolated subscapularis tendon tears treated by arthroscopic repair.^{1,6,19,22} However, a few articles have described the methods of repair and postoperative integrity with relative large numbers of patients. There are a number of important questions related to this issue, namely:

- Is one anchor enough?
- What is the optimal location for the anchors in the first facet?³¹
- Where should the stitches be placed?
- Is a single row enough?

This study had 3 purposes: First, we aimed to evaluate clinical outcomes of isolated subscapularis tendon tears treated by arthroscopic repair. Second, we wanted to evaluate the factors affecting clinical outcomes. Finally, we aimed to identify changes in tendon structural integrity during the postoperative period using magnetic resonance imaging (MRI). We had 2 hypotheses: first, that the arthroscopic isolated subscapularis repair would provide significant functional improvements, and second, that age would be significantly associated with clinical outcomes.

Materials and methods

Between 2005 and 2013, 51 patients with an isolated subscapularis tendon tear underwent arthroscopic repairs methods at 2

institutions. Informed consent was given by all of the patients. Inclusion criteria were patients who underwent arthroscopic repair for a clinically symptomatic isolated subscapularis tendon tear and minimal clinical follow-up of 24 months. The patients experienced pain for at least 6 months, which was persistent despite conservative treatment with medication. Further, they tested positive in at least 1 of the 3 preoperative specific assessments of subscapularis function and showed abnormal magnetic resonance image (MRI) findings. We excluded open repairs, tears combined with the supraspinatus or infraspinatus tendon, any tear combined with other acute or chronic diseases, such as infection, shoulder fractures, osteoarthritis, rheumatoid arthritis, or systemic lupus erythematosus, and revision surgery.

The study group comprised 45 patients (28 men and 17 women) who were monitored for the minimum 2-year period. The average age was 56.2 years (range, 23-76 years) at the time of surgery. The dominant shoulder was repaired in 42 patients (93.3%), and 21 patients had a traumatic history. The interval from symptom onset to surgery averaged 14.1 months (range, 0-84 months). The average follow-up period was 49.4 months (range, 24-119 months).

During the follow-up period, 8 of 45 patients (17.8%) answered a telephone survey, which investigated pain visual analog scale (PVAS) and American Shoulder and Elbow Surgeons (ASES) score. The telephone survey was conducted because these 8 patients were not available to undergo physical examination, including specific tests of subscapularis function, during the minimum 2-year follow-up period.

Clinical evaluation

Operative reports and clinic notes were reviewed. We evaluated PVAS, ASES,²⁶ Constant,⁸ and Simple Shoulder Test (SST) scores in addition to a range of motion (ROM) examination, including forward flexion, abduction, external rotation with the arm at the side, and internal rotation behind the back. Internal rotation was determined by the amount of the vertebral spinous process that could be reached with the tip of the patient's thumb and was converted into contiguously numbered groups: thoracic vertebrae 1-12 to 1-12, lumbar vertebrae 1-5 to 13-17, buttock to 18, and greater tubercle of the proximal femur to 19.²³ For specific assessment of subscapularis function, patients performed the lift-off test,³⁰ belly-press test,⁶ and bear-hug test² during preoperative and postoperative physical examinations.

Intraoperative evaluation

We evaluated intraoperative subscapularis tear classification. We classified tears according to the results of a previous study that reported the use of 3-dimensional anatomic footprints to classify subscapularis tendon tear patterns.³¹ We retrospectively reviewed operative reports and arthroscopic images and videos to classify the different isolated subscapularis tear patterns: type I, fraying or longitudinal splitting of the subscapularis leading edge tendon; type IIA, less than

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