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What are the anatomical predictive factors of degenerative superior labrum anterior to posterior lesion in rotator cuff tear?☆

Joong-Bae Seo*, Jae-Sung Yoo, Joon-yeul Lee, Kyoo-Hong Han

Department of Orthopedic Surgery, Dankook University College of Medicine, Cheonan, Republic of Korea

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ABSTRACT

The purpose of this study was to evaluate the influence of anatomical factors degenerative superior labrum anterior to posterior lesion in rotator cuff tear. The study included 421 middle-aged patients treated using arthroscopic surgery for rotator cuff tears. Patients were divided into two groups based on the superior labrum anterior-to-posterior (SLAP). Glenoid inclination, glenoid length, humeral head diameter, acromio-humeral distance (AHD) head-glenoid difference (HGD), head glenoid angle (HGA), size and retraction of rotator cuff tears were evaluated in both groups. In conclusion, a HGD exceeding 10 mm could be anatomically predictive of degenerative SLAP.

Level of evidence: Case series, Level IV.

1. Introduction

Tears of the superior glenoid labrum and the origin of the long head of the biceps tendon were first described by Andrews et al.[1] They can lead to shoulder pain and highly impaired shoulder function. The first classification and the designation as superior labrum anterior-to-posterior (SLAP) lesion, was presented by Snyder et al.[22]

The incidence of SLAP lesion surgery has increased in the United States in the past decade.[17,24] An appreciable proportion of patients undergoing SLAP lesion surgeries are middle-aged.[17,24] Recent studies have demonstrated that combined lesions in the shoulder are very common and that rotator cuff tears are frequently associated with concomitant labral lesions.[4] One study found that 74% of individuals with full-thickness rotator cuff tears had associated intra-articular lesions, with labral tears being the most commonly associated disorder.[15]

Snyder et al.[21,22] originally described that the etiology of SLAP lesions is traumatic. Several injury mechanisms for SLAP lesions are described in the literature.[1,10,23] However, there has been no evaluation concerning the influence of anatomical factors to degenerative SLAP lesion diagnosed by arthroscopic findings.

The purpose of this study was to evaluate anatomical predictive factors of superior labrum anterior to posterior lesion through the diagnosis by arthroscopic findings in the rotator cuff tears of people 40 and 60 years of age. The hypothesis was that higher glenoid inclination, humeral head diameter, head-glenoid difference (HGD) and head glenoid angle (HGA), and lower glenoid length and acromio-humeral distance (AHD) are related with degenerative SLAP.

2. Methods

2.1. Patients

Following Institutional Review Board exempt approval (Dankook University Medical IRB: 2017-05-009), a total of 421 patients with rotator cuff tears (267 males, 154 females) were enrolled retrospectively from February 2005 to March 2017. Only middle-aged (mean age 52.45 years; range 40–60 years) patients were included. Trauma history within 1 year before the surgery was excluded to define degenerative SLAP. The inclusion criterion was arthroscopic surgery diagnosed as rotator cuff tear. Exclusion criteria were poor radiologic images, athletes of any level, neuromuscular disease, suprascapular nerve palsy, shoulder instability, acromioclavicular joint arthritis, humeral head arthritis, adhesive capsulitis, bilateral shoulder disease and previous surgery on the affected shoulder. Furthermore, large to massive

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* Corresponding author at: Department of Orthopaedic Surgery, Dankook University College of Medicine, 119, Dandae-ro Dongnam-gu, Cheonan-si, Chungnam 330-715, Republic of Korea.
E-mail address: ssjb1990@dku.edu (J.-B. Seo).

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tears were excluded to permit the evaluation of the influence of bony anatomical factors.

Patients were divided into two groups based on the SLAP. Group A comprised combined degenerative SLAP type I and II (n = 146 cases). Group B comprised intact labrum (n = 275). Only type I and II SLAP lesions were included in group A; the other types of SLAP lesions were excluded. Subjects were also allocated to two other groups based on HGD ≥ 10 mm (group I, n = 184) and <10 mm (group II, n = 237).

All patients were diagnosed using the same magnetic resonance imaging (MRI) protocol so that they could be evaluated under the same conditions. The 421 rotator cuff tears comprised 296 right rotator cuff tears and 125 left rotator cuff tears, with 303 in the dominant arm and 118 in the non-dominant arm (Table I).

2.2. Radiological evaluation

Magnetic resonance imaging protocol included oblique coronal proton density-weighted and T2-weighted fat saturated spin-echo images (3300/14–95 [repetition time ms/echo time ms]; section thickness, 4 mm; intersection gap, 0.8 mm; field of view, 16 cm), oblique coronal T1-weighted fat saturated spin echo images (777/12 [repetition time ms/echo time ms]; section thickness, 3 mm; intersection gap, 0.6 mm; field of view, 16 cm); oblique sagittal T1-weighted spin echo images (images(600/12 [repetition time ms/echo time ms]; section thickness, 4 mm; intersection gap, 1.2 mm; field of view, 16 cm) and transverse T1-weighted spin echo images (images (600/12[repetition time ms/echo time ms]; section thickness, 3 mm; intersection gap, 0.9 mm; field of view, 16 cm).

The size of the rotator cuff tear was measured using the maximum diameter of the tear in the oblique sagittal T2-weighted images. When the width of a tear was too large to measure with one straight line over the convex humeral head, more than one straight line was drawn. The patients were divided into 6 groups reflecting the diameter: group A (< 10 mm), group B (≥10 mm, <15 mm), group C (≥15 mm, <20 mm), group D (≥20 mm, <25 mm), group E (≥25 mm, <30 mm) and group F (≥30 mm).[20]

The retraction of the rotator cuff tear was measured using the maximum diameter of the tear in the oblique coronal T2-weighted images. When the retraction of a tear was too large to measure with one straight line over the convex humeral head, more than one straight line was drawn. The patients were divided into 6 groups reflecting the diameter: group a (< 10 mm), group b (≥10 mm, <15 mm), group c (≥15 mm, <20 mm), group d (≥20 mm, <25 mm), group e (≥25 mm, <30 mm) and group f (≥30 mm).[20]

All radiologic measurements were evaluated on scapular anteroposterior radiography except for AHD. The glenoid inclination was determined the angle between the line from the most superior to inferior points of the glenoid and the line from the most inferior point of the scapula to the most superior point of the glenoid (Fig. 1). The humeral head diameter was determined as the diameter largest circle in the humeral head (Fig. 2). The glenoid length was measured the distance of connecting the most superior and inferior points of the glenoid (Fig. 2). The HGA was determined the angle between the line from the center of humeral head to the center of glenoid length and the line connecting the perpendicular line from the center of glenoid length (Fig. 3).

The AHD was evaluated on the Rockwood view. The distance was measured between a radio-dense line on the inferior acromial cortex and a line parallel to it tangent to the humeral head. (Fig. 4)

All measurements of distance or areas described below were performed electronically on the simple radiography and MRI using the measurement software of a picture archiving and communication system. All images were measured by consensus readout of two blinded observers (L.J.Y and H.K.H). Measurements were performed independently, and the results were not disclosed to the other surgeon. The mean value of the duplicate scores was used as the representative value.

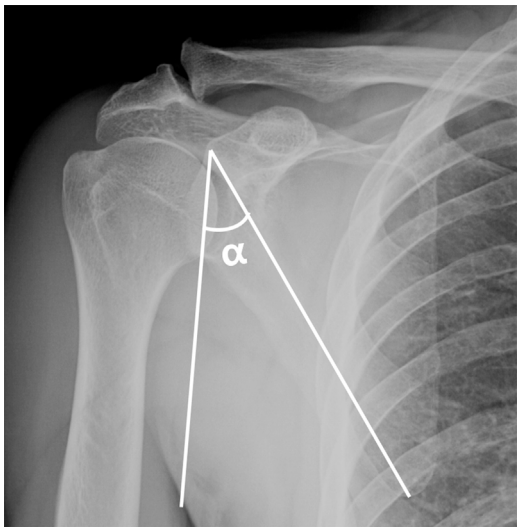

Fig. 1. Measurement of glenoid inclination on scapula anteroposterior radiography. The angle (α) between the line from the most superior to inferior points of the glenoid and the most superior point of the glenoid to the line from the most inferior point of the scapula are depicted.

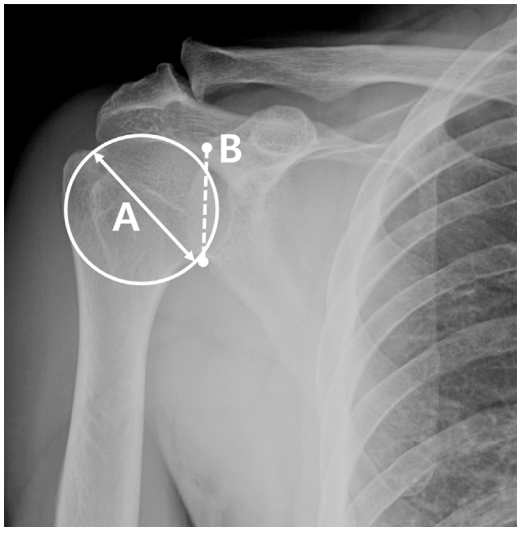

Fig. 2. Scapula anteroposterior radiography. Measurement of humeral head: the diameter (A, arrow line) of largest circle in the humeral head, measurement of glenoid length: The distance (B, dotted line) of connecting the most superior and inferior points of the glenoid.

2.3. Arthroscopic evaluation

Under general anesthesia, all patients were prepared in the beach chair position. Through standard posterior and anterior portals the glenohumeral joint, articular cartilage and rotator cuff were examined. If a SLAP lesion was detected during the arthroscopy, a careful evaluation of the supraglenoid tubercle, long head of the biceps tendon, insertion of the biceps anchor, anterior and posterior parts of the labrum and the joint capsule was done arthroscopically in a standard fashion. Type I and II SLAP lesions comprised group A, with the other type of SLAP lesions excluded in this study according to the modified Snyder