의학 석사 학위 논문

Superior labral dimension of the glenohumeral joint on direct MR arthrography (MRA): Relationship with presence of SLAP

직접 자기 공명 견관절 조영술 상에서 상부 관절순의 크기 : 상부 관절순 전후방 파열과의 관계

2014년 2월

서울대학교 대학원
의과대학 임상의과학과
임태성

	Superior labral dimension of the glenohumeral joint on direct MR arthrography (MRA): Relationship with presence of SLAP	2014		임태성	

의학 석사 학위 논문

Superior labral dimension of the glenohumeral joint on direct MR arthrography (MRA): Relationship with presence of SLAP

직접 자기 공명 견관절 조영술 상에서 상부 관절순의 크기 : 상부 관절순 전후방 파열과의 관계

2014년 2월

서울대학교 대학원
의과대학 임상의과학과
임태성

Superior labral dimension of the glenohumeral joint on direct MR arthrography (MRA): Relationship with presence of SLAP

지도 교수 최 정 아

이 논문을 의학석사 학위논문으로 제출함
2013년 12월

서울대학교 대학원
의과대학 임상의과학과
임태성

임태성의 의학석사 학위논문을 인준함
2013년 12월

위 원 장 강 홍 식 (인)
부위원장 최 정 아 (인)
위 원 김 태 균 (인)

학위논문 원문제공 서비스에 대한 동의서

본인의 학위논문에 대하여 서울대학교가 아래와 같이 학위논문 저작물을 제공하는 것에 동의합니다.

1. 동의사항

①본인의 논문을 보존이나 인터넷 등을 통한 온라인 서비스 목적으로 복제할 경우 저작물의 내용을 변경하지 않는 범위 내에서의 복제를 허용합니다.

②본인의 논문을 디지털화하여 인터넷 등 정보통신망을 통한 논문의 일부 또는 전부의 복제.배포 및 전송 시 무료로 제공하는 것에 동의합니다.

2. 개인(저작자)의 의무

본 논문의 저작권을 타인에게 양도하거나 또는 출판을 허락하는 등 동의 내용을 변경하고자 할 때는 소속대학(원)에 공개의 유보 또는 해지를 즉시 통보하겠습니다.

3. 서울대학교의 의무

①서울대학교는 본 논문을 외부에 제공할 경우 저작권 보호장치(DRM)를 사용하여야 합니다.

②서울대학교는 본 논문에 대한 공개의 유보나 해지 신청 시 즉시 처리해야 합니다

논문제목 : 초음파 검사상 보이지 않는 간세포암의 투시 유도 고주파절제술: 초음파 유도 고주파절제술과의 후향적 비교

학위구분 : **석사 ■ · 박사 □**

학 과 : 의과대학 임상의과학과 전공

학 번 : 2012-22724

연 락 처 : 분당서울대학교병원 영상의학과

저 작 자 : 임 태 성 (인)

제 출 일 : 2014년 2월 4일

서울대학교총장 귀하

ABSTRACT

PURPOSE

To evaluate the relationship between superior labral dimension of the glenohumeral joint on direct MRA and presence of SLAP lesion

MATERIALS AND METHODS

Direct MRA of the shoulder was performed in 296 patients (300 shoulders) for chronic pain or instability, who underwent arthroscopic shoulder surgery. Arthroscopic operation records of all patients were reviewed. MR images were analyzed by two radiologists; superior labral dimension was measured on coronal T1-weighted images, at the plane where long head of biceps tendon disappeared and labrum appeared the largest. Transverse and longitudinal dimensions were measured as base and height of the inverted triangular-shaped superior labrum and compared between patients who had SLAP on arthroscopy (SLAP group) vs. those who did not (non-SLAP group). Statistical analysis was done using unpaired t-test.

RESULTS

17 patients were excluded due to immeasurable image quality. Among 279 patients (283 shoulders), 122 patients (43.1%) had SLAP lesions, whereas 161 patients (56.9%) did not. The mean base/height of superior labrum in SLAP and

non-SLAP patients measured on T1-weighted MR image were 8.8mm / 5.2 mm and 8.5mm / 4.9mm for radiologist 1, 8.2mm / 4.9mm and 8.1mm / 4.5mm for the session 1 of radiologist 2, 8.0mm / 4.8mm and 7.6mm / 4.3mm for the session 2 of radiologist 2. In the SLAP group, the mean labral height tended to be larger than that of non-SLAP group with statistically significant difference.

CONCLUSION

In SLAP patients, the height of the superior glenoid labrum on oblique coronal image of MR arthrography was significantly larger than that of non-SLAP patients, and thus larger superior labral dimension could be predisposing factor of SLAP.

Keywords : Labrum, Dimension, Glenohumeral joint, SLAP, Magnetic resonance imaging (MRI)

Student number: 2012-22724

Contents

List of Tables

List of Figures

INTRODUCTION

The glenoid labrum of the shoulder is a fibrous rim that surrounds and deepens the glenoid fossa and attaches confluently with the glenohumeral ligaments and the long head of biceps tendon to the peripheral glenoid. It has variable shape, size, and thickness, but along the superior part tends to be meniscus-like with mobile attachment (1). Several different anatomic variations of the glenoid labrum have been identified. Variations of the superior labrum are thought to occur due to loose attachment of superior labrum to the glenoid and many variations in the insertion of the long head of the biceps tendon (2). Some studies described 'meniscoid labrum', which has larger labral dimension and covers the articular surface of the glenoid excessively, and it is thought to be a normal anatomical variant that does not require to be repaired (3).

In 1990, Snyder et al. introduced the term of SLAP (Superior Labrum Anterior to Posterior) for lesions that occurs at the superior glenoid labrum (4) with separation of the labrum from the glenoid extending from anterior to posterior aspect to include the insertion site of the long head of the biceps.

There have been several studies about the relationship between anatomical variations of the superior labrum and SLAP (5,6,7) but no studies about the relationship between the variable labral dimension and SLAP.

The purpose of this study is to measure the labral dimension quantitatively on MR arthrography and to evaluate its relationship with SLAP.

MATERIALS AND METHODS

Patients

Among 959 patients who underwent direct MR arthrography in Seoul National University Bundang Hospital due to shoulder pain or instability from May 2003 to December 2007, 296 patients (300 shoulders) were included who got arthroscopic shoulder surgery after MR arthrography. The time delay between MR arthrography and arthroscopy was less than 3 months. 17 shoulders were excluded due to poor MR image quality, leaving 279 patients (283 shoulders) for evaluation. The resulting group consisted of 119 men and 164 women, mean age of 58 years (range: 19~84). Arthroscopy was performed by an experienced orthopedic shoulder surgeon. Presence of SLAP was verified by reviewing operation records of all patients.

MR imaging

Magnetic resonance imaging was performed on 1.5 T MR system (Intera, Philips Medical Systems, Netherlands) with dedicated shoulder coil. All patients had MR arthrographic examination after injecting 10~15ml of Gadolinium/normal saline mixture (1:200,20ml) into glenohumeral joint space by fluoroscopic guidance via anterior approach.

Three-dimensional fast spin echo (FSE) images were obtained in axial, oblique coronal and sagittal planes. Coronal oblique sequences were obtained perpendicular to the glenohumeral joint. Axial, oblique coronal and sagittal T1-

weighted fat suppressed images on 1.5T (repetition time (TR) = 450~600ms, echo time (TE) = 10~20ms, echo train length (ETL) = 4, flip angle = 90’ and number of signal averages (NSA) = 3). Oblique coronal T1-weighted images (repetition time (TR) = 500~600ms, echo time (TE) = 90ms, echo train length (ETL) = 3, flip angle = 90’, number of signal averages (NSA) = 3), coronal and sagittal T2-weighted images (repetition time (TR) = 2900~3500ms, echo time (TE) = 90ms, echo train length (ETL) = 17, flip angle = 90’ and number of signal averages (NSA) = 3) were acquired. 16 slices was obtained resulting in a slice thickness of 3mm. The field of view was 140mm x140mm, imaging matrix was 256 x 256.

Image analysis

Image evaluation was performed by one experienced musculoskeletal radiologist (reader 1) and one third-year resident (reader 2) without any information of the arthroscopic records. Measuring the dimension of the labrum was performed on oblique coronal T1-weighted images at the level where long head of biceps looks smallest and labrum largest. The level was decided by consensus of the two readers. At each level, transverse and longitudinal dimensions were obtained by measuring the base and height of inverted triangular-shaped labrum (Fig. 1). Measurement was performed after consensus training session between the two readers for about 20 cases. Reader 2 reviewed the images twice with one month interval (session 1 and session 2) for the evaluation of intra-observer variability.

Statistical analysis

For the association between the presence of SLAP lesion and labral dimension, unpaired t-test was performed. The p-values less than 0.05 were considered to have statistical significance. Inter- and intra-observer variability was evaluated between 2 readers and between sessions 1 and 2 of reader 2, respectively, using intra-class coefficients. Statistical analysis was done with commercially available software (MedCalc, Mariakerke, Belgium).

RESULTS

Among the 283 shoulders, 122 (43.1%) patients (men: n=66, women: n=56) were diagnosed to have SLAP in the arthroscopic shoulder operation. The mean base/height of superior labrum in SLAP and non-SLAP patients measured on T1-weighted MR images were 8.8mm (SD = 1.7) / 5.2mm (SD = 1.1) and 8.5mm (SD = 1.7) / 4.9mm (SD = 0.9) for radiologist 1, 8.2mm (SD = 1.6) / 4.9mm (SD = 1.1) and 8.1mm (SD = 1.5) / 4.5mm (SD = 0.8) for session 1 of radiologist 2, 8.0mm (SD = 1.5) / 4.8mm (SD = 1.2) and 7.6mm (SD = 1.3) / 4.3mm (SD = 0.8) for session 2 of radiologist 2. The height in SLAP vs. non-SLAP patients showed a significant difference in both radiologist 1 (p=0.02) and radiologist 2 (p=0.00) (Table 1).

Intra-class correlation coefficient (ICC) was calculated to evaluate inter- and intra-observer variability of superior labral dimension measured on MRI. ICC was 0.76 between radiologist 1 and radiologist 2 on session 1, 0.68 between radiologist 1 and radiologist 2 on session 2 and 0.86 between sessions 1 and 2 of radiologist 2.

Table

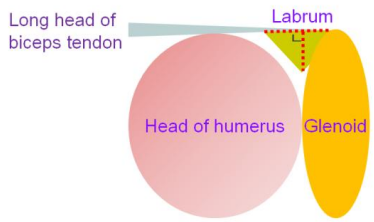
Table 1. Superior labral dimensions measured on MRI in SLAP vs. non-SLAP patients.

	Reader 1 base(mm)(SD)	Reader 1 height	Reader 2 – session 1 base	Reader 2 – session 1 height	Reader 2 – session 2 base	Reader 2 – session 2 height
SLAP (n = 122, 43%)	8.8 (1.7)	5.2 (1.1)	8.2 (1.6)	4.9 (1.02)	8.0 (1.5)	4.8 (1.2)
Non-SLAP (n = 161, 57%)	8.5 (0.7)	4.9 (0.9)	8.1 (1.5)	4.5 (0.8)	7.6 (1.3)	4.3 (0.8)
p-value	0.175	0.019	0.648	0.000	0.047	0.000

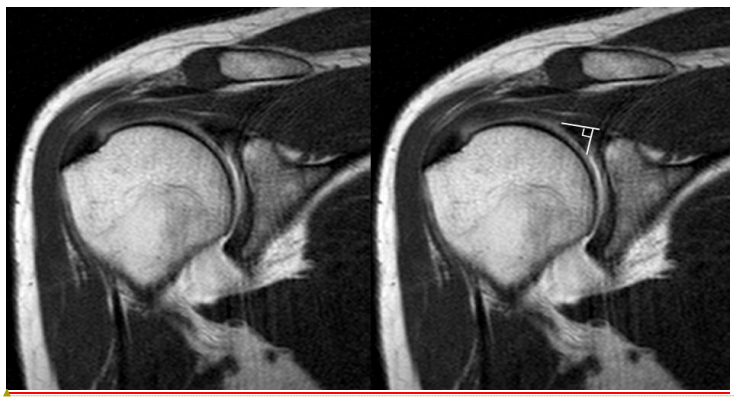
FIGURES

Figure 1. Measurement of superior labral dimension. (a) Superior labral dimension was measured on the plane where long head of biceps looks smallest and labrum largest. Transverse and longitudinal dimensions were obtained by measuring base and height of inverted triangular shaped labrum. (b) On T1-weighted oblique coronal MRI, the base and height of the superior labrum were measured.

(a)



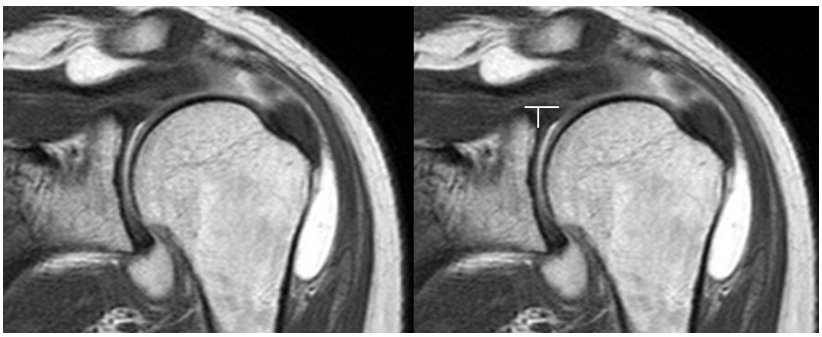
(b)



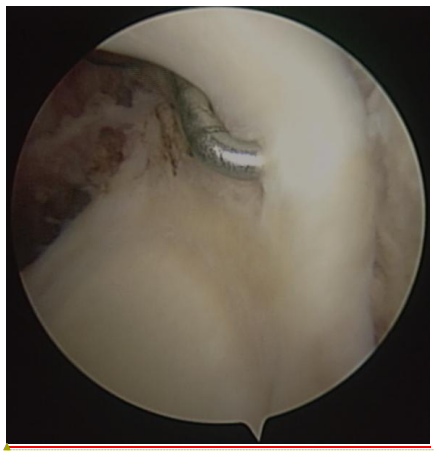
서식 있음: 글꼴: (영어) Times New Roman, (한글) 굴림, 11 pt, 글꼴 색: 텍스트 1

Figure 2. 65-year- old female with rotator cuff tear. (a) Triangular shaped superior labrum attached to glenoid rim is seen on oblique coronal T1-weighted MR image. The height of the labrum is measured to be 6.4mm. (b) There was no SLAP on arthroscopy.

(a)



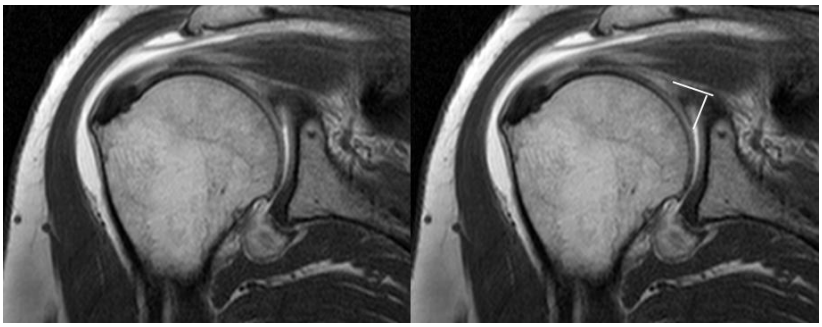
(b)



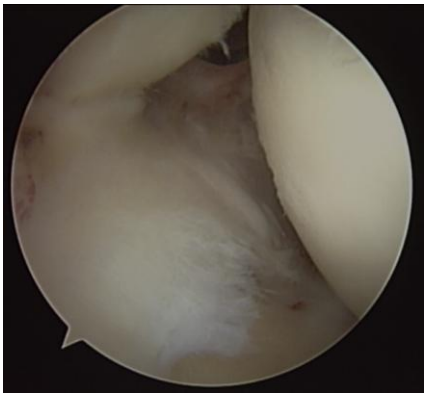
서식 있음: 글꼴: Times New Roman, 11 pt

Figure 3. 55-year- old female with rotator cuff tear and SLAP. (a) The height of labrum is measured to be 10.3mm on oblique coronal T1-weighted MR image. It is considered to be larger than usual. (b) On arthroscopy, SLAP was detected. The superior labrum was covering upper one quarter of the glenoid.

(a)



(b)



DISCUSSION

The superior glenoid labrum has been extensively described to have highly variable morphology in many previous studies (8,9,10). The spectrum of normal variation of the superior labrum varies from firm attachment to complete absence of the superior labrum including conditions, such as sublabral recess, sublabral foramen or Buford complex (7,11,12). Meniscoid labrum is one of normal variations of the glenoid superior labrum which has larger labral dimension. There have been few studies that described meniscoid labrum in the literature. Davison et al. categorized the types of labrum that exist on the superior glenoid. They identified a bumper type of labrum in 18% of shoulders, meniscal labrum in 38%, and a triangular labrum in 44% in a total of 191 consecutive patients who were prospectively evaluated arthroscopically (13). As such, although meniscoid labrum has been described in the previous literature, there has been no suggested quantitative diagnostic criterion of the meniscoid labrum.

There have been only few studies that focused on measuring labral dimension in the literature. Zanetti et al. evaluated MR arthrographic variability of the arthroscopically normal glenoid labrum both qualitatively and quantitatively (14). In the study, there was no significant relationship between quantitative dimensions and arthroscopically normal or abnormal status of the labrum.

There have been several studies about the relationship between SLAP lesions and anatomical variations of the anterosuperior labrum. Kanatli et al.

suggested that anatomic variants of the anterosuperior labrum such as sublabral foramen or Buford complex are associated with the development of SLAP lesions (5).

We noticed that sometimes superior labrum is seen to be larger than usual on MRI. We wanted to evaluate the possible association between the larger superior labrum and SLAP lesions, hypothesizing that if the superior labrum covered a larger area of the glenoid (larger 'height'), it could be a predisposing or associated factor of SLAP lesions.

In this study, the mean measurement of heights in both radiologists showed statistically significant difference between SLAP and non-SLAP patients, which may suggest the possibility of larger superior labral dimension being one of the predisposing conditions of SLAP lesion. On the other hand, there is a possibility that degenerative state of superior labrum with SLAP may have caused it to appear larger.

This study has some limitations. First, there are some cases which showed vague boundary between labrum and long head of biceps tendon, which suggests that measured dimension may possibly represent part of the biceps-labral complex rather than pure labrum in some cases. Second, superior glenoid labrum is a small structure that is usually measured to be about 5mm on MRI. Possibility of measurement error cannot be excluded, although intra-class coefficient was acceptable.

In conclusion, in SLAP patients, the height of the superior glenoid labrum on oblique coronal image of MR arthrography was significantly larger than that of

non-SLAP patients. This may suggest that a larger height of superior glenoid labrum may be associated with SLAP.

REFERENCES

1. Bencardino JT, Beltran J, Rosenberg ZS, et al. Superior Labrum Anterior-Posterior Lesions: Diagnosis with MR Arthrography of the Shoulder. Radiology. 2000;214(1):267-71.

2. Vangsness C, Jorgenson SS, Watson T, Johnson DL. The origin of the long head of the biceps from the scapula and glenoid labrum. An anatomical study of 100 shoulders. Journal of Bone & Joint Surgery, British Volume. 1994;76(6):951-4.

3. Lee S-B, Harryman II DT. Superior detachment of a glenoid labrum variant resembling an incomplete discoid meniscus in a wheelchair ambulator. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 1997;13(4):511-4.

4. Snyder SJ, Karzel RP, Pizzo WD, Ferkel RD, Friedman MJ. SLAP lesions of the shoulder. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 1990;6(4):274-9.

5. Kanatli U, Ozturk BY, Bolukbasi S. Anatomical variations of the anterosuperior labrum: prevalence and association with type II superior labrum anterior-posterior (SLAP) lesions. Journal of shoulder and elbow surgery. 2010;19(8):1199-203.

6. Kreitner K-F, Botchen K, Rude J, Bittinger F, Krummenauer F, Thelen M. Superior labrum and labral-bicipital complex: MR imaging with pathologic-anatomic and histologic correlation. AJR American journal of roentgenology. 1998;170(3):599-605.

7. De Maeseneer M, Van Roy F, Lenchik L, et al. CT and MR Arthrography of the Normal and Pathologic Anterosuperior Labrum and Labral-Bicipital Complex. Radiographics. 2000;20(suppl 1):S67-S81.

8. Cooper DE, Arnoczky S, O'brien S, Warren R, DiCarlo E, Allen A. Anatomy, histology, and vascularity of the glenoid labrum. An anatomical study. The Journal of bone and joint surgery American volume. 1992;74(1):46-52.

9.Ilahi OA, Labbe MR, Cosculluela P. Variants of the anterosuperior glenoid labrum and associated pathology. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2002;18(8):882-6.

10. Ide J, Maeda S, Takagi K. Normal variations of the glenohumeral ligament complex: an anatomic study for arthroscopic Bankart repair. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2004;20(2):164-8.

11. Waldt S, Metz S, Burkart A, et al. Variants of the superior labrum and labro-bicipital complex: a comparative study of shoulder specimens using MR arthrography, multi-slice CT arthrography and anatomical dissection. European radiology. 2006;16(2):451-8.

12. Smith DK, Chopp TM, Aufdemorte TB, Witkowski EG, Jones RC. Sublabral recess of the superior glenoid labrum: study of cadavers with conventional nonenhanced MR imaging, MR arthrography, anatomic dissection, and limited histologic examination. Radiology. 1996;201(1):251-6.

13. Davidson PA. Mobile Superior Glenoid Labrum: A Normal Variant or Pathologic Condition? American Journal of Sports Medicine. 2004;32(4):962-6.

14. Zanetti M, Carstensen T, Weishaupt D, Jost B, Hodler J. MR arthrographic variability of the arthroscopically normal glenoid labrum: qualitative and quantitative assessment. European radiology. 2001;11(4):559-66.

초 록 (국문)

목적

직접 자기 공명 견관절 조영술에서 측정한 상부 관절순의 크기와 상부 관절순 전후방 파열과의 관계를 평가하고자 함.

대상 및 방법

만성적인 견관절 통증 또는 불안정성으로 직접 자기 공명 견관절 조영술을 시행하고 견관절 관절경 수술을 받은 296명의 환자 (300개의 견관절) 이 연구 대상이 되었다. 모든 환자에서 관절경 수술 기록이 검토되었으며 자기 공명 영상이 두명의 영상의학과 의사에 의해 분석되었다. 상부 관절순은 T1 강조 관상면 영상에서 상완 이두근 장두가 사라지고 상부 관절순이 가장 커보이는 단면에서 측정되었다. 역삼각형 모양의 상부 관절순에 대하여 밑변과 높이가 측정되었고 관절경 수술 상에서 상부 관절순 전후방 파열을 가진 군과 그렇지 않은 군 사이에 통계적으로 유의한 차이가 있는지 비교하였다.

결과

17명의 환자는 낮은 영상의 질 때문에 연구에서 제외되었고 총 279명의 환자 (283개의 견관절) 중 122명 (43.1%) 의 환자에서 상부 관절순 전후방 파열이 있었고 161 명 (56.9%) 의 환자에서는 없었다.

T1 강조 관상면 영상에서 측정된 상부 관절순의 밑변/높이 의 평균값은 상부 관절순 전후방 파열을 가진 군과 안 가진 군에서 측정자 1의 경우 8.8mm / 5.2 mm, 8.5mm / 4.9mm 였고 측정자 2의 경우 8.2mm / 4.9mm, 8.1mm / 4.5mm 그리고 8.0mm / 4.8mm, 7.6mm / 4.3mm 였다. 상부 관절순 전후방 파열 환자군에서 상부 관절순 높이의 평균이 그렇지 않은 군보다 통계적으로 유의하게 컸다.

결론

직접 자기 공명 견관절 조영술 T1 강조 관상면 영상에서 측정한 상부 관절순의 높이는 상부 관절순 전후방 파열 환자군에서 그렇지 않은 군에서 보다 통계적으로 유의하게 컸으며 이 사실은 상부 관절순이 관절와를 많이 덮는 경우에 상부 관절순 전후방 파열의 소인이 될 가능성을 제시한다.

주요어 : 관절순, 크기, 관절와 – 상완 관절, 상부 관절순 전후방 파열, 자기 공명 영상