ORIGINAL ARTICLE

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Magnetic resonance arthrographic demonstration of extension of labral defects in paraglenoid labral cysts

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SUMMARY

OBJECTIVE: This study aimed to investigate the extension of labral tears associated with paraglenoid labral cysts by magnetic resonance arthrography.

METHODS: The magnetic resonance and magnetic resonance arthrography images of patients with paraglenoid labral cysts who presented to our clinic between 2016 and 2018 were examined. In patients with paraglenoid labral cysts, the location of the cysts, the relation between the cyst and the labrum, the location and extent of glenoid labrum damage, and whether there was contrast medium passage into the cysts were investigated. The accuracy of magnetic resonance arthrographic information was evaluated in patients undergoing arthroscopy.

RESULTS: In this prospective study, a paraglenoid labral cyst was detected in 20 patients. In 16 patients, there was a defect in the labrum adjacent to the cyst. Seven of these cysts were adjacent to the posterior superior labrum. In 13 patients, there were contrast solution leak into the cyst. For the remaining seven patients, no contrast-medium passage was observed in the cyst. Three patients had sublabral recess anomalies. Two patients had rotator cuff muscle denervation atrophy accompanying the cysts. The cysts of these patients were larger compared to those of the other patients.

CONCLUSION: Paraglenoid labral cysts are frequently associated with the rupture of the adjacent labrum. In these patients, symptoms are generally accompanied by secondary labral pathologies. Magnetic resonance arthrography can be successfully used not only to demonstrate the association of the cyst with the joint capsule and labrum, but also to reliably demonstrate the presence and extension of labral defects.

KEYWORDS: Shoulder joint. Magnetic resonance imaging. Glenoid cavity.

INTRODUCTION

Paralabral cysts are pericapsular loculated fluid collections associated with labral tears. While cysts near the anterior labrum are often related to anterior instability, those near the posterior labrum are associated with posterior instability and those near the superior labrum are associated with SLAP lesions. Paralabral cysts can have a mass effect and cause nerve compression in the shoulder. These cysts appear as lesions with fluid intensities on magnetic resonance (MR) imaging[1]. In a study performed by Tung et al., only 2.3% of 2,000 shoulder MR images taken for shoulder pain revealed paralabral cysts[2].

Large paralabral cysts may compress the suprascapular or axillary nerve, causing shoulder weakness and denervation of the external rotator muscles[1,3-5]. MR arthrography (MRA) plays an important role in detecting superior labrum from anterior to posterior tears (SLAP lesions), impingement syndromes, and instability accompanying paraglenoid labral cysts[2,4,6,7].

If there are no symptoms in patients with paralabral cysts, clinicians usually monitor these patients by performing rest and movement exercises without surgery. However, symptomatic patients with paralabral cysts often have accompanying labral tears, and these tears often require surgical intervention[8]. In this study, we aimed to evaluate the incidence and extent of accompanying labral tears in paraglenoid labral cysts by MRA. These tears may be overlooked on conventional MR imaging when not carefully examined. Our secondary aim was to increase the success of the operation by providing surgeons with more concrete data for this patient group.

METHODS

Between 2016 and 2018, 350 patients with shoulder pain and limitations of movement presented to the Department of Orthopedics and Traumatology of the Atatürk University Medicine Faculty, and they underwent MR and MRA.

MRA and conventional MR examinations were performed using a 3-T MR scanner (MAGNETOM Skyra, Siemens Healthcare). A 16-channel coil was used in all MR procedures.

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For routine MR imaging, the following sequences were used: T2-weighted imaging in the axial plane (repetition time/time to echo [TR/TE]=3,800/72 ms), proton density imaging in the oblique coronal plane (TR/TE=4,000/24 ms), and T1-weighted imaging in the axial and oblique sagittal planes (TR/TE=650/15 ms). The field of view (FOV) was selected as 18 cm, matrix as 256×256, sectional thickness as 4 mm, and sectional range as 0.1 mm. MRA images were obtained in the axial, oblique sagittal, and oblique coronal planes using 16-channel shoulder coils. For the MRA examinations, T1-weighted spin echo (fat-suppressed) imaging was performed in the transverse, oblique coronal, and oblique sagittal planes (TR/TE=650/15, section thickness=3 mm, spacing=0.3 mm, FOV=16 cm, and matrix=256×250).

The images were retrospectively reviewed by two musculoskeletal radiologists with 12 and 2.5 years of experience, respectively. The localization of the cysts adjacent to the labrum, T1- and T2-weighted image characteristics, the dimensions, and signal characteristics of the adjacent labrum were evaluated on MR scans. In MRA, it was determined whether there was a rupture of the labrum adjacent to the cysts localized by MR imaging. In cases of a rupture, it was determined whether the rupture continued along the labrum and if there was leakage of contrast material into the cyst. The MRA images were also evaluated for labral variations. All findings were clarified based on the consensus of the two radiologists. All arthroscopies were performed by a single orthopedist with 7 years of experience in shoulder joint arthroscopy. In arthroscopic cases, the orthopedist removed the cyst and repaired the adjacent joint capsule and labrum. In Figure 1, the labrum is presented as a clock dial, showing the points where the tears in the labrum begin and end and the locations of the cysts.

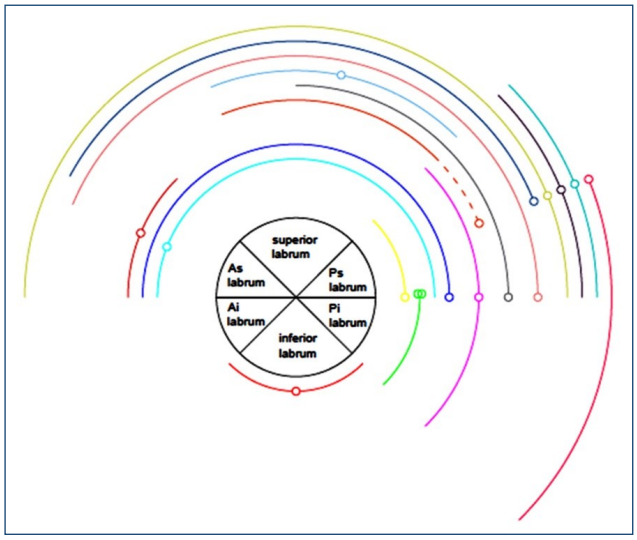

Figure 1. Schematic representation of the tears in the labrum. As: anterior-superior; Ai: anterior-inferior; Ps: posterior-superior; Pi: posterior-inferior.

RESULTS

Of the 350 patients who underwent MRA, 20 (5.7%) were included in the study. Of them, 16 (80%) patients were male and 4 (20%) were female. The right shoulder was examined in 10 cases, and the left shoulder was examined in 10 cases. The age range of the patients was 21–70 years, and the mean age was 37.4±10.4 years. Only one patient had two cysts on one shoulder, whereas the remaining cases had one. On MR imaging, the smallest size of the cysts was determined as 5×5×5 mm and the largest as 50×16×36 mm.

A total of 21 paraglenoid labral cysts were diagnosed in the 20 patients included in the study. Notably, 7 (33%) of the cysts were adjacent to the posterior superior labrum, 6 (28%) were adjacent to the posterior labrum, 3 (14%) were adjacent to the anterior superior labrum, 2 (9%) were adjacent to the posterior inferior labrum, 2 (9%) were adjacent to the superior labrum, and 1 (4%) was adjacent to the inferior labrum. The localization of the paraglenoid cysts and the extent of the accompanying labral tears are summarized in Figure 1. On MR imaging, 18 (90%) of the 20 patients had pathological signal enhancement in the labrum adjacent to the cyst and a suspected labral rupture (Figure 2). The MRA revealed the rupture of the labrum in 16 (80%) of these patients (Figure 3) and the sublabral recess or cleft anomaly adjacent to the labrum in 2 (10%) patients. There were no accompanying labral pathologies or sublabral variations on MRA in two (5%) patients without a pathological labral signal on MR imaging. Eight (40%) patients had no additional pathology associated with

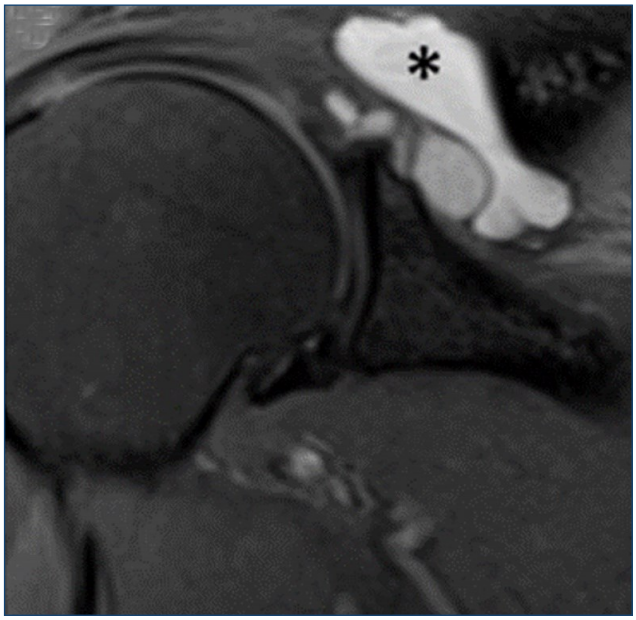

Figure 2. Oblique coronal fat-saturated PD magnetic resonance image showing a cyst (star) with high signal intensity near the posterior superior labrum.

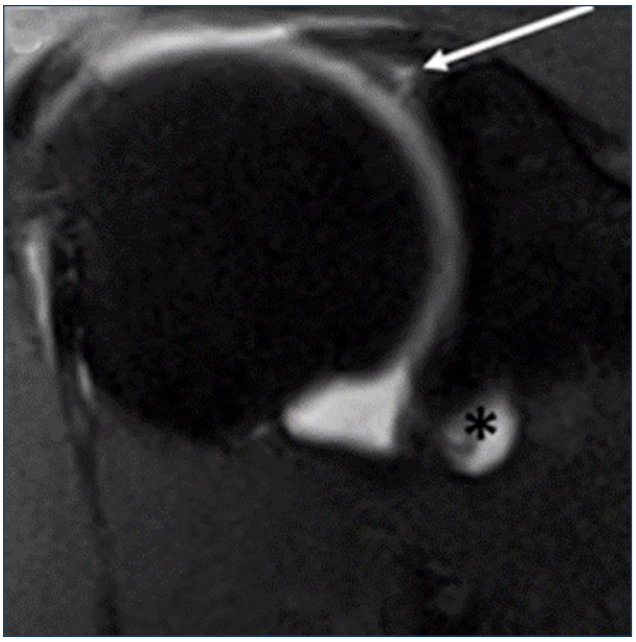

Figure 3. In the same patients mentioned in Figure 2, oblique coronal fat-saturated T1-weighted magnetic resonance arthrography image showing extravasation into a superior labral anterior posterior lesion and paralabral cyst (star).

the paralabral cyst or labrum pathology. Hill-Sachs deformities were observed in four patients. One case presented with a reverse Hill-Sachs deformity and biceps tendon dislocation. In addition, adhesive capsulitis, synovial osteochondromatosis, and supraspinatus and infraspinatus muscle atrophy were observed in one patient each. Finally, a cartilage defect in the humeral head was present in one patient, and supraspinatus tendinitis was observed in another patient.

The passage of contrast material was observed in 14 (66%) cysts in MRA. In the remaining 7 (33%) cysts, no contrast material passage was observed. As late images were not obtained, the filling rates of the cysts with contrast medium could not be demonstrated. The cyst lumen was not completely filled with contrast media in any of the patients. The atrophy of the infraspinatus muscle was observed in one patient, and the atrophy of both the supraspinatus and infraspinatus muscles was observed in another case secondary to cyst pressure. Arthroscopic surgery was performed in three patients, for whom the MRA findings were arthroscopically confirmed. The pathologies of the labrum were repaired arthroscopically. The cysts were removed.

DISCUSSION

Conventional MR imaging sequences are widely used in musculoskeletal pathologies because of their high soft tissue resolution. However, conventional MR imaging may fail to evaluate the hyaline cartilage, capsule, fibrocartilage structures such as the labrum, and undersurface of the tendons. These limitations have resulted in the development of new imaging modalities, such as MRA and computed tomography arthrography (CTA). The accurate detection of labral tears in the shoulder is important for the treatment of patients. However, common labral and sublabral anatomical variations in the shoulder joint may also be inadvertently diagnosed with labral tears, resulting in unnecessary surgical procedures. MRA and CTA allow for the accurate identification of labral and perilabral variations and facilitate the diagnosis of labral tears[10].

There are several studies in the literature evaluating the efficacy of conventional MR imaging, MRA, and CTA in the identification of labral lesions. Chandnani et al. compared these three imaging methods in the detection of labral tears in 30 cases by correlating them with the surgical results. In that study, the sensitivity and specificity in detecting labral ruptures were found to be 93 and 46%, respectively, for conventional MR imaging, 73 and 52%, respectively, for CTA, and 96 and 96%, respectively, for MRA. The authors concluded that MRA was the best imaging modality in the detection of labral pathologies[11]. In another study, Palmer and Caslowitz found that MRA had 91% sensitivity and 93% specificity in the identification of labral lesions in patients with anterior instability and concluded that MRA could be used with high accuracy in the diagnosis of these lesions[12].

Paraglenoid labral cysts are easily seen on T2- or PD-weighted fluid-sensitive MR sequences, and if MRA is performed alone, these cysts may be overlooked. Therefore, we applied conventional MR imaging sequences before MRA to each patient we included in the study.

In this study, 16 of the 20 patients had labral tears adjacent to the cyst. In a study of 46 patients by Tung et al., the researchers found ruptures on the conventional MR images of 27 patients[2]. Our labral tear detection rate was higher because we performed MRA in all patients. Not only labral tears but also other factors play a role in the mechanism of cyst formation. In the current study, we did not see labral tears in four patients, probably due to the spontaneous healing of pre-existing labral tears[1]. In some studies, labral diseases have been implicated in the mechanism of cyst formation. A good example is the presence of meniscal cysts in osteoarthritis and calcium pyrophosphate storage disorders in the knee[13]. As earlier, other examples include spontaneous primary ganglion cysts in the joint capsule, bursa, or tendon sheath without labral tears[14,15].

In MRA, intracystic contrast agent extravasation is a direct evidence of the relationship between the cysts and the joint space. In our series, we did not detect contrast agent penetration into

the cyst on the MRA images of 7 of the 20 patients, but there was no contrast material passage in the remaining 13 patients. Tung et al. performed MRA in only 5 of the 46 patients with paraglabral cysts. The authors showed contrast agent extravasation into the cyst in one patient[2]. In another study, Malghem et al. retrospectively screened 20 patients with knee-related cysts. The direct radiogram images were obtained in early and late series, and CTA was performed. The radiographs took 20 min after arthrography showed cyst opacification in only 2 patients, while in late series, cyst opacification was seen in 10 patients. As a result, the authors concluded that the late images taken an hour after arthrography better showed the relationship between the cyst and the joint[16]. In our patients, we performed imaging within half an hour and did not wait for late series. It is possible that the rate of contrast agent extravasation would have been higher in later image series. However, in delayed series, synovial absorption and dilution of intraarticular contrast media would have potentially caused difficulties in interpretation.

In the present study, we found infraspinatus atrophy in one patient and the atrophy of both infraspinatus and supraspinatus muscles in another patient. In both of these patients, the cysts were located in the adjacent posterior labrum. The dimensions of the cysts were measured as 50×39×32 mm and 50×36×16 mm, respectively, and were the largest cysts in the series. These cysts extended to the spinoglenoid notch. In the study performed by Tung et al., the mean diameter of the cysts associated with muscle denervation was measured as 3.1 cm, and the cysts were smaller in patients without muscle denervation[2]. The findings in our study are in agreement with these data. In the present study, 7 of the 21 cysts were localized to the posterior superior labrum, and the majority of the cysts were found in this area. Tirman et al. reported that the majority of the cysts were located adjacent to the posterior superior labrum[1], which is consistent with the findings obtained from our series. These results are probably due to the posterior superior capsule being located above the posterior band of inferior glenohumeral ligament, which is weaker than the thick anterior capsule.

There are several limitations to this study. The first concerns the relatively small number of patients, which did not allow for statistical analysis. Second, we were not able to make a surgical correlation in all of our cases. In only three cases, we confirmed our arthrographic findings with the gold standard method (arthroscopy). As there was no surgical correlation, we could not compare the diagnostic efficacy of conventional MR imaging and MRA. Finally, we cannot assess the true frequency of intracystic contrast material extravasation in late series.

In conclusion, the diagnosis of paralabral cysts can be made easily by conventional MR imaging. However, conventional MR sequences may be inadequate in the diagnosis of the accompanying labral tears and in the determination of the actual size of these tears. MRA can be successfully used to diagnose labral tears accompanying paraglenoid labral cysts and to determine the actual size of the tears before surgery. The results of this study suggest that MRA provides more data for the surgeon in the surgical planning of symptomatic paraglabral cysts located in the shoulder joint and may increase the rate of operative success.

ETHICAL APPROVAL

No animal was used in this study. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The study protocol was approved by the Institutional Review Board for Human Subjects Research and Ethics Committee of Ataturk University Medical Faculty (2016).

AUTHORS' CONTRIBUTIONS

HO: Conceptualization, Data curation, Formal Analysis, Investigation, Writing – original draft. **SK:** Conceptualization, Data curation, Formal Analysis, Writing – review & editing. **AKOK:** Conceptualization, Data curation, Formal Analysis, Writing – review & editing. **AKOR:** Conceptualization, Data curation, Formal Analysis, Writing – review & editing. **AKI:** Conceptualization, Data curation, Formal Analysis, Writing – review & editing. **MK:** Conceptualization, Data curation, Formal Analysis, Writing – review & editing.

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