Association between the Size of Humeral Head Cysts and the Extension of Rotator Cuff Tears

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Purpose: *To evaluate the association between the size of humeral head cysts and the number of rotator cuff tears.*
Methods: *A retrospective study of 115 patients who had a diagnosis of rotator cuff tear by magnetic resonance imaging (MRI) were reviewed and analyzed. The diameters of the cysts were measured using a calibrated digital caliper. Pearson's correlation test was used to identify the correlation between the number of rotator cuff tears and the diameter of cysts.*
Results: *A total of 115 shoulder MRIs from 115 patients were included in the present study. The average diameter of cysts was 6.7±2.9 mm. The average diameter of cysts for the group of one, two and three rotator cuff tendon tears was 6.2±3.0, 7.2±2.7, and 7.8±2.9 mm, respectively. There was no statistically significant difference of cyst diameters between the groups of rotator cuff tears. There was no statistically significant correlation between cyst diameters and the number of rotator cuff tears (r = 0.2, P = 0.1).*
Conclusion: *There was no correlation between the number of rotator cuff tears and cyst size. However, we observed a trend in which the cyst size was slightly larger when the number of tendon tears increase. This finding indicated that the diameter of subchondral bone cysts might be greater in patients with massive rotator cuff tears. Large humeral head cysts may cause unsecure fixation for suture anchor placement. The orthopaedic surgeon must be aware of and prepare for large subchondral bone cysts during the arthroscopic rotator cuff repair.*

Keywords: *Rotator cuff tear, humeral head cyst, diameter*

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Introduction

Rotator cuff disorder is a common cause of shoulder pain in the elderly population. The specific etiology of a rotator cuff tear has not been fully elucidated, but it has been considered to result from a combination of intrinsic and extrinsic factors. Intrinsic factors include degenerative change[(1)], hypovascularity[(2)], and microstructural collagen fiber abnormalities[(3)]. Recognized extrinsic factors include subacromial impingement[(4,5)], tensile overload[(6)], and repetitive use[(7)].

Magnetic resonance imaging (MRI) is a standard investigation to detect the rotator cuff tear and associated findings. Several literatures found strong associations between the rotator cuff tear and cysts in the humeral head by an MRI[(8-10)]. The size of cysts varies from 2 – 14 mm[(9,10)]. The etiology of the humeral head cyst is still largely unknown.

During arthroscopic rotator cuff repair, a large humeral head cyst can result in unsecure fixation for suture anchor placement[(11,12)]. Even though the size of the humeral head cyst has its clinical meaning during arthroscopic surgery, the factors which associate to the size of the cyst have never been studied before in the English literature database.

Upon our knowledge, there is no study regarding the association between the extension of rotator cuff tears and the size of humeral head cysts. We hypothesized that cyst size would be larger when the number of rotator cuff tendon tears is increased. The objective of this study was to evaluate the association between diameters of cysts and the number of full-thickness rotator cuff tendon

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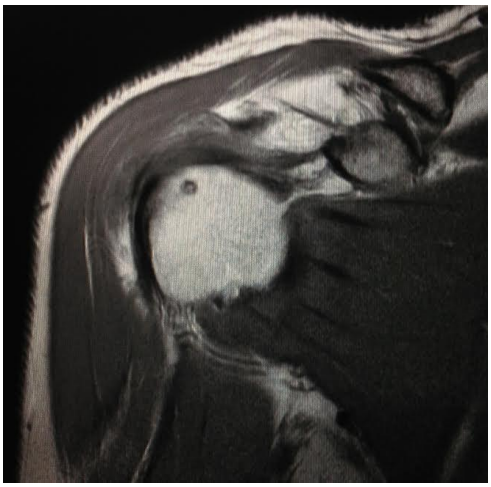
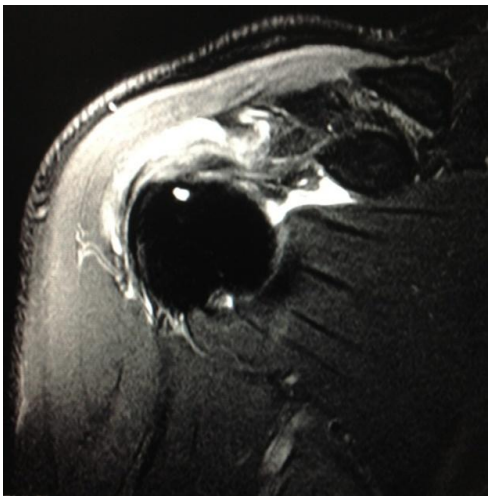
tears - supraspinatus, infraspinatus, and subscapularis tendons.

Patients and Methods

Data collected from 115 patients who had a diagnosis of rotator cuff tear by 3.0 Tesla MRI from September 2010 to February 2014 were retrospectively reviewed. The study was approved by the institutional review board at our hospital. MRI images were examined by two examiners.



(a)



(b)

Fig. 1 Coronal oblique views of MRI demonstrate a round-shape cyst (arrow) of the greater tuberosity with low signal intensity in proton density weighted image (a) and high signal intensity in fat suppressed T2 weighted image (b).

The diagnosis of a cystic lesion was made with visualization of the lesion on at least two pulse sequences and in two different imaging planes[13]. The cysts had sharp sclerotic margins, and they were in round or elliptical shape with low signal intensity on T1-weighted and proton density weighted images. On T2-weighted images, the cysts had either high signal intensity which indicated fluid, or mixed signal intensity[14] (Fig. 1). The diameters of cysts were measured by using a calibrated digital caliper. In elliptically–shaped cysts, the longest diameter was measured.

The location of cysts was separated into three areas; the lesser tuberosity, and anterior and posterior parts of the greater tuberosity. We divided the greater tuberosity into anterior and posterior parts with a line drawn parallel to the humeral shaft that starts from the 12 o'clock position on the greater tuberosity in sagittal oblique images. Axial images were used in determining the cysts at the insertion site of the subscapularis tendon on the lesser tuberosity. The location, number, and diameter of the cysts in the anterior/posterior greater tuberosity and lesser tuberosity were recorded for each shoulder.

The integrity of the supraspinatus, infraspinatus and subscapularis tendons were evaluated. Full-thickness tears were defined as having a fluid-filled gap through the entire thickness of the tendon on fat-suppressed, fast spin-echo (**FSE**) T2-weighted images. The rotator cuff tear data were collected only for full-thickness tear types. We did not include partial thickness tear and neither bursal-sided nor articular-sided tears into the study.

Patients with rheumatoid arthritis, glenohumeral osteoarthritis, previous shoulder surgery, and infection were excluded from the study.

Mean and standard deviation (SD) were used for describing continuous data. One-way analysis of variance (ANOVA) was used for comparisons of the means of cyst diameters between different numbers of rotator cuff tears. Pearson's correlation test was performed to identify the correlation between the numbers of rotator cuff tears and the diameters of cysts. P-value < 0.05 was considered statistically significant for differences and correlations. Data collection and calculations were performed using SPSS 17.0 for Windows (SPSS Inc, Chicago, IL, USA).

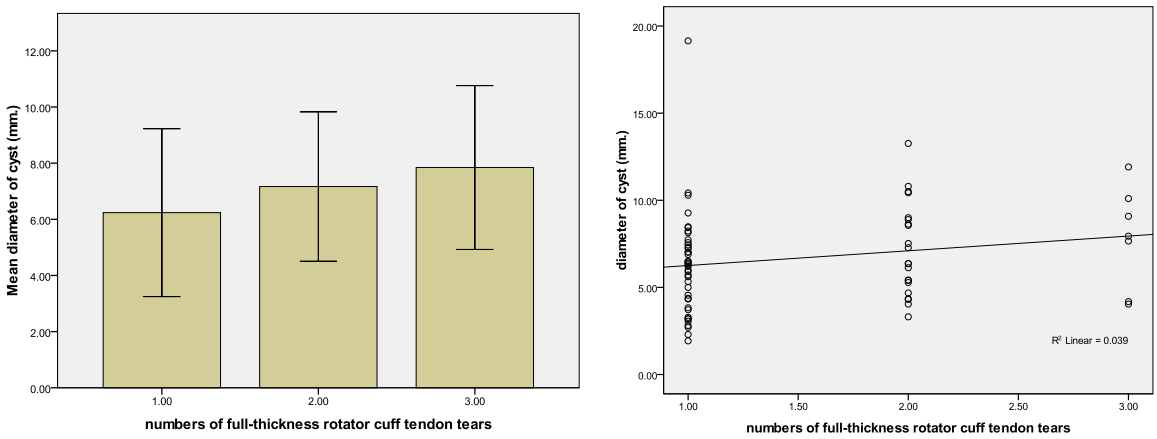
Results

A total of 115 shoulder MRIs from 115 patients were included in the study. There were 51 males and 64 females. The mean age of the patients was 67.8 (range 46-88 years of age). The median of the number of cysts was 1 (range 0-3) (Table 1). There were 69 patients (60%) having at least one cysts in the humeral head and 46 patients (40%) having no cyst (Table 2). The average diameter of cysts was 6.7±2.9 mm (range 1.9-19.1 mm).

The average diameter of cyst for the group of one, two and three rotator cuff tendon tears was

6.2±3.0, 7.2±2.7, and 7.8±2.9 mm, respectively (Fig. 2a). There was no statistically significant difference of cyst diameters between the groups of rotator cuff tears. No statistical significance for the correlation between cyst diameter and number of rotator cuff tears was observed (r = 0.2, P = 0.1) (Fig. 2b).

The number and mean diameter of cysts categorized by the location were shown in Table 3. There was no correlation between cyst diameter and number of rotator cuff tears in the lesser and anterior/posterior greater tuberosities (P = 0.8, 0.1, and 0.2).



(a) (b)

Fig. 2 (a) Comparison between different numbers of rotator cuff tears and cyst size. (b) There was no correlation between numbers of rotator cuff tears and cyst size (r = 0.2, P = 0.1).

Table 1 Demographic data and pathology characteristics of rotator cuff tear patients

	Total	Male	Female
No. of patients	115	51	64
Age (years ± SD)	67.8±9.4	67.6±9.4	67.7±9.5
Cyst size (mean ± SD)	6.7±2.9	7.1±2.5	6.3±3.2
Number of cysts (median)	1 (range 0-3)	1 (range 0-3)	1 (range 0-3)
Number of rotator cuff tears (median)	1 (range 1-3)	1 (range 1-3)	1 (range 1-3)

Table 2 Patients with different numbers of cysts and rotator cuff tears

	Number of Patients (%)
Number of Cysts	
0	46 (40 %)
1	35 (30 %)
2	26 (23 %)
3	8 (7 %)
Number of Rotator cuff tears	
1	69 (60 %)
2	31 (27 %)
3	15 (13 %)

Table 3 Number and mean diameter of cysts classified by the location

Location	Number of patients having cysts (%)	Diameter of cysts
LT	13 (11.3 %)	5.2 ± 1.6
Anterior GT	32 (27.8 %)	6.7 ± 2.6
Posterior GT	43 (37.4 %)	6.5 ± 3.2

LT lesser tuberosity, *GT* greater tuberosity

Discussion

Subchondral cysts can be found in many articular diseases[15]. Etiology of cyst formation is controversial. In osteoarthritis, theories of subchondral cyst formation are the bone contusion theory and the synovial fluid intrusion theory[16]. Because of the lacking of the epithelial lining, subchondral cysts are classified as pseudocysts[10].

The presence of cysts in the humeral head near the rotator cuff foot print is a supportive evidence of rotator cuff disorders[8,9,13,15]. Cyst formation may occur from the lacking of the rotator cuff tendon covering the humeral head. Subsequently, synovial fluid will intrude into subchondral bone and formation of the cyst occurs.

Jin et al. revealed one to three cystic lesions in the humeral head in 9 cadaveric shoulders and their mean diameter of cysts was 2.5 mm.[10] In comparison to our study, we also found one to three cystic lesions but our mean diameter was 6.7 mm. Wissman et al. studied the occurrence of cysts in the lesser tuberosity in forty–eight patients and observed one to three cysts in this area and the mean diameter was 3.0 mm (range, 2-8 mm)[9].

Our hypothesis is that an exposed area of the humeral head occurs after the rotator cuff tendon tears. This will cause the absence of tendon coverage over the greater or lesser tuberosities. Thus, the bare subchondral surface will impinge to the subacromial bursa or enthesophyte. Therefore, we hypothesize that the more area of subchondral bone exposed from a torn rotator cuff tendon, the larger the diameter of the cyst would be observed near the tendon footprint.

In this study, we found no correlation between the number of tendon tears and the diameter of cysts from Pearson's correlation test. However, we observed a trend in which the cyst size was slightly larger when the number of tendon tears increased (Fig. 2). This finding indicated that the diameter of subchondral bone cysts might be greater in patients with massive rotator cuff tears. Large humeral head cysts may cause unsecure fixation for suture anchor placement and failed rotator cuff repair. The surgeon must be aware of and prepare for large subchondral bone cysts during arthroscopic rotator cuff repair.

However, the current study has some limitations. First, the study was retrospective in design with a relatively small sample size due to a recent problem of being unable to access the MRI database of our hospital. Consequently, we were unable to demonstrate statistical significance of the relationship between the number of torn tendons and cyst size. Reduced data limited the statistical power of these results. Furthermore, there is no MRI of the control group that demonstrates the percentage of humeral head cyst in the intact rotator cuff patients. For future study, a prospective study should be conducted with a greater sample size to demonstrate the association between the number of rotator cuff tears and the diameter of cysts.

Conclusion

There was no correlation between the number of rotator cuff tears and cyst size. However, we observed a trend in which the cyst size was slightly larger when the number of tendon tears increased. This finding indicated that the diameter of subchondral bone cysts could be greater in patients with massive rotator cuff tears. Large humeral head cyst may result in the unsecure fixation for suture anchor placement. The orthopaedic surgeon must be aware of and prepare for large subchondral bone cysts during the arthroscopic rotator cuff repair.

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ความสัมพันธ์ระหว่างขนาดของซีสต์ในกระดูกต้นแขนกับจำนวนเส้นเอ็น rotator cuff ที่ฉีกขาด

ไตร พรหมแสง, พบ, สมศักดิ์ คุปต์นิรัติศัยกุล, พบ, กิตติพงษ์ คงรักเกียรติยศ, พบ, มนชยา ไพสินสมบูรณ์

วัตถุประสงค์: *เพื่อศึกษาความสัมพันธ์ระหว่างขนาดของซีสต์ในกระดูกต้นแขนกับจำนวนเส้นเอ็น rotator cuff ที่ฉีกขาด*
วิธีการศึกษา: *งานวิจัยชนิดเก็บข้อมูลย้อนหลัง โดยทำการศึกษาเอกซเรย์คลื่นแม่เหล็กไฟฟ้าของข้อไหล่ในผู้ป่วยที่มีเส้นเอ็นข้อไหล่ฉีกขาดจำนวน 115 ราย วัดขนาดของซีสต์โดยใช้เครื่องมือในคอมพิวเตอร์ แล้วทำการเปรียบเทียบจำนวนเส้นเอ็นข้อไหล่ที่ฉีกขาดกับขนาดของซีสต์ โดยใช้วิธีวิเคราะห์ทางสถิติ และศึกษาความสัมพันธ์โดยใช้ Pearson correlation test*
ผลการศึกษา: *ภาพถ่ายคลื่นแม่เหล็กไฟฟ้าของข้อไหล่ 115 ชุด จากผู้ป่วยทั้งหมด 115 ราย พบค่าเฉลี่ยของเส้นผ่านศูนย์กลางของซีสต์เท่ากับ 6.7±2.9 มิลลิเมตร โดยขนาดของซีสต์ในกลุ่มที่มีเส้นเอ็น rotator cuff ขาดจำนวน 1, 2 และ 3 เส้น เท่ากับ 6.2±3.0, 7.2±2.7 และ 7.8±2.9 ตามลำดับ การศึกษานี้ไม่พบนัยสำคัญทางสถิติของความสัมพันธ์ระหว่างจำนวนเส้นเอ็น rotator cuff ที่ฉีกขาดกับขนาดของซีสต์ในกระดูกต้นแขน (r = 0.2, P = 0.1)*
สรุป: *ไม่พบความสัมพันธ์ทางสถิติระหว่างขนาดของซีสต์ในกระดูกต้นแขนและจำนวนเส้นเอ็น rotator cuff ที่ฉีกขาด อย่างไรก็ตามพบว่าอาจมีแนวโน้มที่ซีสต์จะมีขนาดใหญ่ขึ้นเมื่อจำนวนเส้นเอ็นที่ขาดเพิ่มมากขึ้น*