Comparison of the results of ultrasonographic evaluation and arthroscopy in patients scheduled for surgery of the supraspinatus tendon rupture

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Aims and objectives

Shoulder ultrasonography (US) is a cost-effective and non-invasive method for the evaluation of the rotator cuff pathology. In previous studies carried out by orthopedic surgeons and radiologists, remarkable results in the detection of full-thickness rotator cuff ruptures have been achieved. Due to difficulties in the detection of rotator cuff tears with US, a variety of secondary symptoms have been described. (Humeral degeneration and joint space effusion)

The purpose of this study is to determine the diagnostic performance and the rate of accuracy of ultrasonography in the diagnosis of rotator cuff tears and secondary findings, compared to arthroscopic surgery.
Methods and materials

A total of 50 patients scheduled for an arthroscopy of the shoulder due to a supraspinatus (SS) tendon rupture were included in this study. All patients were admitted with persistent pain or limitation of motion in the shoulder, not responding to rehabilitation.

The study was designed as a prospective controlled study. All patients were informed with 2008 Helsinki Declaration. The gender, age, and the side of the arthroscopy were recorded. Patients with complaints in both shoulders were excluded. The patients who were scheduled for arthroscopy of the shoulder were referred to our clinic one week before the procedure, for an US of the shoulder.

The US examination was performed by two radiologist whom were blind to patients and had enough experience about shoulder examination with a GE Logiq S6 (GE Health Care, Milwaukee, Wisc.) 7-12 MHz high-frequency linear transducer. In addition, a wide field of view (FOV) was used in the examination. The US examination was performed by two radiologist whom were blind to patients and had enough experience about shoulder examination. Sonographic findings classified as; supraspinatus pathologies (tendinosis, partial tears and full-thickness tears), humeral degeneration, acromioclavicular joint degeneration. Tendinosis seen as partially increase in thickness of supraspinatus tendon and focal -generally nodular- hypoechoic area in this thick segment. Partial-thickness tears manifest as focal, well-defined hypoechoic or anechoic defects in the tendon but involve only the bursal or articular surface. Full-thickness tears extend from the bursal surface to the articular surface. Full-thickness rotator cuff tears usually appear as hypoechoic or anechoic defects in which fluid has replaced the area of the torn tendon. Humeral degeneration is imaged as irregularity in the humeral head, absences of regular hyperechoic cartilage line and in cases of chronic supraspinatus tear, crash hypoechoic areas consistent with fracture. Acromioclavicular joint degeneration seen as irregularity and expansion of the level of acromioclavicular joint. The patient was examined in the sitting position on a stool. The evaluating physician examined the symptomatic shoulder sitting on a higher stool. The findings of the SS tendon were classified as full-thickness tears of the SS tendon, partial tears of the SS tendon, tendinosis, and cases with no pathology. In addition, the findings of the humeral degeneration and the AC joint degeneration were recorded.

Following those procedures, the patients underwent shoulder arthroscopy with a diagnosis of a rotator cuff tear by the surgeon who had ten years experience in shoulder arthroscopy. The images obtained during arthroscopy and the arthroscopic findings were recorded and the recorded data were analyzed in detail. The obtained data were compared with that of the arthroscopic ultrasound images.
Results

The average age of the women included in the study was 51 and that of the men was 53. Of all the included patients, 74% were female and 36% male. There was involvement of the right side in 70%, and the left side in 30% of the patients. There were no significant differences in age and gender distribution of the patients with respect to the operated side. The US examination of 50 patients who underwent arthroscopic surgery revealed no tendon pathology in 4 patients (8%), tendinosis of the SS tendon in 6 patients (12%), partial tears in 22 patients (44%), full-thickness tears in 18 patients (36%), bursal effusion in 25 patients (50%), humeral degeneration in 27 (54%) patients, and AC joint degeneration in 37 (74%) patients. In the arthroscopic evaluation of the SS tendon, 4 patients (8%) had no tendon pathology. In 7 patients (14%) tendinosis of the SS tendon, in 22 patients (44%) partial tears, and in 17 patients (34%) full-thickness tears were detected. AC degeneration was found in 37 patients (74%) and humeral degeneration was found in 27 (54%) patients, respectively. There was a significant correlation between the ultrasonography findings and the arthroscopic findings in the examination of the SS tendon (p<0.05). Results are summarized in Table 1. Table 1. With reference to the arthroscopic data, the sensitivity of the ultrasonographic evaluation for the diagnosis of AC joint degeneration was 95%, with a specificity of 85%. There was a significant correlation between the ultrasonography findings and the arthroscopic findings in the detection of the AC joint degeneration (p<0.05). The results are summarized in Table 2. Table 2. There was a significant correlation between the ultrasonography findings and the arthroscopic findings in the detection of the humeral degeneration (p<0.05). With reference to the arthroscopic data, the sensitivity of the ultrasonographic evaluation for the diagnosis of humeral degeneration was 93%, with a specificity of 91%. The results are summarized in Table 3.
### Table 1: Arthroscopic evaluation, SS tendon findings

<table>
<thead>
<tr>
<th>U.S. examination, SS tendon findings</th>
<th>None</th>
<th>Partial tear</th>
<th>Tendinositis</th>
<th>Full-thickness tear</th>
<th>Total</th>
<th>Chi square</th>
<th>SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>N 3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>81.399</td>
<td>9</td>
<td>0.0*</td>
</tr>
<tr>
<td>Partial tear</td>
<td>N 1</td>
<td>18</td>
<td>1</td>
<td>2</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tendinositis</td>
<td>N 0</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-thickness tear</td>
<td>N 0</td>
<td>2</td>
<td>1</td>
<td>15</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>N 4</td>
<td>22</td>
<td>7</td>
<td>17</td>
<td>50</td>
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</tr>
</tbody>
</table>

*a. In 12 cells (75.0%), a frequency less than 5 was expected. The smallest expected frequency was 0.32.*

### Fig. 1

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### Table 2: Arthroscopic evaluation, AC joint degeneration

<table>
<thead>
<tr>
<th>U.S. examination, AC joint degeneration</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>U.S. examination, AC joint yes</td>
<td>N</td>
<td>35</td>
<td>2</td>
</tr>
<tr>
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<td>N</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>N</td>
<td>37</td>
<td>13</td>
</tr>
</tbody>
</table>

Fisher's Exact Test p-value: 0.000*

### Fig. 2

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<table>
<thead>
<tr>
<th>U.S. Examination, Humeral Degeneration</th>
<th>Arthroscopic Evaluation, Humeral Degeneration</th>
<th>Fisher's Exact Test p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

*Fig. 3*

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*Fig. 4*

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Fig. 5

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Conclusion

This study compared the US findings of 50 patients with a diagnosis of SS tendon rupture with that of the shoulder arthroscopy. The aim was to determine the reliability and the place of the shoulder ultrasonography in the algorithm of the shoulder pathologies.

In 18 patients with a diagnosis of full-thickness tear in the ultrasonographic evaluation, the arthroscopic surgery revealed a full-thickness tear in 15 patients (84%). With reference to the arthroscopic data, the sensitivity of the ultrasonographic evaluation for the diagnosis of full-thickness tendon tears was 91%, with a specificity of 88%. This study's findings are in concordance with the literature. The reasons for the high rate of diagnosis of the full-thickness tears in US examination are the objective ultrasonographic findings and pronounced clinical symptoms, which may provide clues for the radiologist.

In this study, in 22 patients with a diagnosis of partial-thickness tear in the ultrasonographic evaluation, the arthroscopic surgery revealed a partial-thickness tear in 18 patients (82%). (US sensitivity 86%, specificity 82%). This study's results are in concordance with the literature. However, the varying sensitivity and specificity rates for the diagnosis of the partial-thickness tears in US examination can be explained by the size of the tear, the necessity to evaluate the partial tear separately on the articular and the bursal surface, and the technical specifications of the US device.

With reference to the arthroscopic data, the high rates of detection of full-thickness and partial-thickness tears, the high sensitivity and specificity rates in detecting the pathologies of the SS tendon, the secondary pathologies (AC joint degeneration and humeral head degeneration) indicate that the US examination is an important diagnostic method.

The high sensitivity and specificity rates in detecting the pathologies of the SS tendon indicate that the US examination is an efficient and reliable method, which should be preferred to the other more expensive and more invasive methods. With high-definition devices and experienced radiologists, diagnosis can be made in many cases.
References


