MRI evaluation of the inferior glenohumeral ligament

Comparison with arthroscopic findings in 81 shoulders

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Arthroscopic Bankart repair, using staples, requires a thick and wide anterior band of the inferior glenohumeral ligament. We compared MRI and arthroscopic findings of the ligament in 81 shoulders with traumatic anterior glenohumeral instability. When fluid was present in the shoulder, sensitivity and specificity of the MRI evaluation for the presence of a thick and wide ligament were 82% and 100%, respectively. In shoulders without joint fluid, the condition of the ligament was evaluated according to the presence of a low- or moderate-signal triangle structure on the anterior margin of the glenoid cavity in the 3 MR images obtained from the inferior 2 cm of the glenoid. Sensitivity and specificity of the MRI evaluation in cases without fluid were 84% and 93%, respectively. The MR technique needs to be further improved to achieve better sensitivity for preoperative selection of shoulders suitable for Bankart repair with staples.

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The most important factor for recurrent traumatic shoulder dislocation is dysfunction of the inferior glenohumeral ligament-labrum complex (Turkel et al. 1981). The ligament acts as a primary static restraint and prevents anterior glenohumeral translation (Matsen et al. 1990). The anterior band of the inferior glenohumeral ligament (AIGHL) is a thickened anterior part of the ligament, and its fibers are attached to the glenoid via the inferior half of the anterior labrum (Turkel et al. 1981).

Recently, various arthroscopic reconstruction methods for anterior shoulder instability have been reported (Morgan 1991, Johnson 1993). We have employed one such technique: arthroscopic Bankart repair, using staples (Johnson 1993). However, this procedure requires the presence of an AIGHL with sufficient width and thickness. We compared MRI and arthroscopic findings in 81 shoulders, to see whether MRI could depict the condition of AIGHL.

Patients and methods

78 patients (81 shoulders, 67 men) with traumatic anterior glenohumeral instability were examined. Their mean age was 23 (15–72) years old. 12 shoulders were cases of first dislocation and the dislocation was confirmed by orthopedists. The patients were examined with MRI and then with arthroscopy to monitor the state of the AIGHL, and the findings on each examination were evaluated retrospectively in this study.

The arthroscopic examination was video-recorded, and evaluated (by MK) without knowledge of the MRI findings. The AIGHL was considered sufficient for Bankart repair (Figure 1) when the ligament was clearly observed and its upper proximal end was lo-

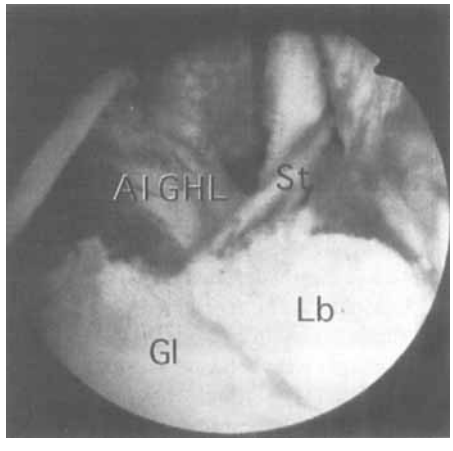


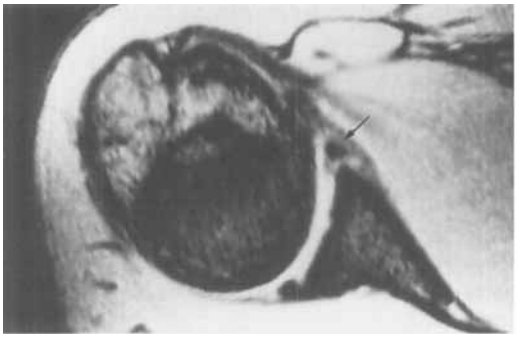
Figure 1. Sufficiently thick and wide anterior band of the inferior glenohumeral ligament (AIGHL) for arthroscopic Bankart repair, using staples. This case had lost the antero-inferior half of the labrum, but the entire AIGHL had sufficient width and thickness. For repair, the remaining labrum (Lb) was fixed with staples (St) to the anterior part of the glenoid (Gl).

Figure 2. MRI findings in patients who had fluid in the glenoid cavity.

Continuity of the anterior capsule where the AIGHL was present (white arrows).

Capsular continuity was lost.

Figure 3. MRI findings in patients without fluid in the glenoid cavity.



A moderate-signal triangle structure (arrow) is depicted, which indicates the presence of sufficient AIGHL for ABS.

There is no triangle structure.

cated in the area superior to the middle cavity or when a probe could easily raise it to the area above the middle cavity.

Immediately before MRI of 14 shoulders, 10 mL of physiological saline was injected into the joint via a posterior puncture, to evaluate the influence of fluid on the images. A written informed consent was obtained from each patient. For maximal distention of the joint capsule, 20 mL or more is required. However, in a preliminary study, most subjects complained of severe pain when we tried to inject more than 10 mL. In addition to these 14 shoulders, the presence of joint fluid was clearly depicted on MR images of another 15 shoulders. The remaining 52 shoulders had no joint fluid.

All MR images were obtained with a superconducting MR imager, SMT-100X (1.0 tesla, Shimadzu, Kyoto, Japan) and with a local surface coil. FOV was set at 20 cm and matrix was set at 256 × 256. T2*-weighted images with 5 mm axial sections (slice thickness) and 1 mm intersection gap (slice separation) were obtained, using the STAGE method (TR = 300 msec, TE = 17 msec, flip angle = 30 degrees) (Horii et al. 1997). The STAGE method is one of the spoiled gradient echo-sequence methods and is similar to the SPGR method (GE Medical Systems, Milwaukee, WI) and the FLASH method (Siemens Medical Systems, Iselin, NJ) (Elster 1993).

The MR images were evaluated (by MH and TK), without knowledge of the arthroscopic findings, for the presence of a satisfactory AIGHL. In the shoulders with fluid, 2 MR images obtained from the inferior 1.5 cm of the glenoid (slice thickness: 5 mm, slice separation: 1 mm) were examined. A thick, clear low-signal band, found between the anterior labrum and the head of the humerus, was interpreted as continuity of the anterior joint capsule (Figure 2). When this continuity was confirmed in both images, a satisfactory AIGHL was said to be present. In the shoulders without fluid, 3 MR images obtained from the inferior 2 cm of the glenoid (slice thickness: 5 mm, slice separation: 1 mm) were examined, and they were evaluated for the presence of a low- or moderate-signal triangle structure on the anterior margin of the glenoid cavity (Figure 3). If all 3 images showed this triangle structure, the AIGHL was classified as satisfactory.

Table 1. MRI and arthroscopic findings in 29 patients with intraarticular fluid

MRI finding Satisfactory AIGHL	Arthroscopic finding Present	Absent	Total no. of patients
Present	14	0	14
Absent	3	12	15
Total no. of patients	17	12	29

Table 2. MRI and arthroscopic findings in 52 patients without intraarticular fluid

MRI finding Satisfactory AIGHL	Arthroscopic finding Present	Absent	Total no. of patients
Present	21	2	23
Absent	4	25	29
Total no. of patients	25	27	52

In each group, sensitivity and specificity of the MRI diagnosis for the presence of a satisfactory AIGHL, as confirmed by arthroscopy, were calculated.

Results

Arthroscopy showed that a sufficiently thick and wide AIGHL—i.e., satisfactory for ABS—was present in 42 shoulders of 41 patients, mean age 21 (15–42) years, whereas it was absent in the remaining 39 shoulders of 37 patients, mean age 25 (15–72) years.

14 of the 29 shoulders with fluid were evaluated as having a satisfactory ligament on MRI and all had a satisfactory ligament arthroscopically. Among the remaining 15 shoulders without fluid, which were evaluated as having an unsatisfactory ligament on MRI, 3 cases had a satisfactory ligament arthroscopically (Table 1).

Among the 52 shoulders without fluid, 23 had a satisfactory ligament on MRI, and its presence was arthroscopically confirmed in 21 of the shoulders. MRI examination of the remaining 29 shoulders without fluid could not identify the ligament and, arthroscopically, the absence was confirmed in 25 cases, but 4 cases were found to have a satisfactory ligament (Table 2).

In the shoulders with fluid, sensitivity and specificity of MRI diagnosis for the presence of a satisfactory ligament were 82% and 100%. In the shoulders without fluid, these figures were 84% and 93%, respectively.

Discussion

Arthroscopic Bankart repair, using staples, reattaches an ablated labrum to the glenoid by intraarticularly placed staples. We consider that the main purpose of this repair is the functional reestablishment of the inferior glenohumeral ligament. We also regard the condition of the anterior band of the inferior glenohumeral ligament (AIGHL) as more important than the condition of the labrum; in patients who do not have a sufficiently wide and thick AIGHL, functional reconstruction would be quite difficult.

With conventional MRI, the joint capsule, including capsular ligaments such as AIGHL, is always depicted as a low intensity area. We previously confirmed that the STAGE method can depict muscular tissue as a medium intensity area and, when a low flip-angle is selected, this method can depict joint effusion and the physiological saline at a high intensity. Therefore, joint capsule itself can be depicted as a low intensity band, when fluid is present in the joint (Horii et al. 1997). Recently, the usefulness of MR arthrography, using Gd-DTPA solution for evaluation of the labral-ligamentous complex of the shoulder, has been reported (Palmer et al. 1994, Chandnani et al. 1995), but equivalent images can be obtained by using 10 mL physiological saline.

Many patients have joint effusion for several days after a dislocation. In such patients, MRI, using the same sequence as in this study can give images equivalent to those with MR arthrography (Horii et al. 1997).

If there is no fluid in the joint cavity, it is difficult to evaluate the AIGHL condition. In our study, we evaluated the presence or absence of a low- or moderate-signal triangle structure on MR images, as the indicator of satisfactory AIGHL. This triangle structure may represent the anterior labrum (Zlatkin et al. 1988, Neuman et al. 1991) and when this structure is not found on the images, trauma is usually severe and the AIGHL is also suspected of being damaged.

Still MRI cannot fully replace arthroscopy for evaluation of the AIGHL, but hopefully a more refined MRI-technique should be able to do so.

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