Is external rotation the correct immobilisation for acute shoulder dislocation? An MRI study

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Summary
Introduction: Anterior dislocation of the shoulder is frequent, with high rates of recurrence. Immobilization in external rotation (ER) seems to improve results, although few studies have actually demonstrated this. The present MRI study examined the impact of ER on labral and capsular ligamentous complex lesions after primary dislocation.

Material: A prospective study was started up on January 1st, 2007. Inclusion criteria were: acute initial anteromedial dislocation of the shoulder, without past history of shoulder trauma. There were 23 such patients, with a mean age of 37 years.

Methods: Early MRI scan used the following protocol: one acquisition in internal rotation followed by one in ER. Study criteria were: hemarthrosis, ER amplitude, rotator cuff status, bone lesion, and labral lesion stage (Habermeyer’s classification) and displacement (Itoi criteria).

Results: There were 12 right and 11 left shoulders. Mean time to MRI was 3.7 days. There were three rotator cuff tears, no glenal lesions, and 14 humeral notches. Hemarthrosis was almost systematically present, with its distribution modified by ER in 75% of cases; three patients showed no posterior hemarthrosis, in whatever rotation. Mean ER was 37°. On Habermeyer’s classification, there were 12 stage-1 lesions, and 10 stage-2; one patient had no labral lesion. All separated labra were reduced in ER, five (21%) totally. In six cases, labral displacement changed according to rotation. All anterior joint effusion was reduced in ER, in three cases totally.

Discussion: According to Itoi among others, immobilization in ER is the way to reduce recurrence of anterior dislocation. The present study confirmed that labral reduction was systematic with ER, but it was by no means always complete. ER seemed more effective in reducing the separation. Results further confirmed that ER reduced anterior capsule volume, a recurrence factor.
Conclusion: ER reduced hemarthrosis, anterior capsule detachment and labral lesions, and never the contrary. The interest of immobilization in ER to prevent shoulder instability needs confirming by long-term clinical studies; we are therefore extending the present MRI study by a clinical study of ER immobilization in all patients showing significant labral lesion reduction.

Level of evidence: Level IV. Retrospective therapeutic study.

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Introduction

Anteromedial shoulder dislocation is a frequent pathology, without treatment consensus. Recurrence rates are high, and various authors have therefore recommended changes to management, including immobilization in external rotation (ER). Few studies, however, have as yet actually demonstrated this to be effective. We used MRI to study lesions during the early course of primary anterior shoulder dislocation, to determine the effect of ER on the labral and capsuloligamentary lesions encountered in such trauma.

Material and methods

A prospective study was run in the Traumatology Department of the Dupuytren Teaching Hospital in Limoges (France). Analysis was descriptive. Inclusion began on January 1st, 2007, in co-ordination with the Emergency and Radiology Departments. Between January 1st and June 30th, 2007, 23 patients admitted in Emergency met the following inclusion criteria: male or female, aged not more than 40 years, presenting with primary anteromedial shoulder dislocation of whatever mechanism. Any previous history of trauma in the affected shoulder was an exclusion criterion.

The study protocol comprised two series of MRI acquisitions as early as possible after reduction of the dislocation, one in internal rotation (IR) and one in ER. Acquisitions were performed by two senior radiologists, using the same protocol, on 1.5 Tesla ACHIEVA and INTERA MRI scanners. The IR series comprised T1-weighted axial and oblique coronal images and Rho Spir axial, oblique coronal and oblique sagittal images, the arm lying on the scanner table with the hand on the patient’s abdomen. After the IR series, the patient remained supine and the arm was placed in the greatest degree of external rotation the patient and the machine’s configuration would allow, for the ER acquisitions (Rho Spir axial and oblique coronal). Images were then interpreted in consultation with the radiologists, analyzing the criteria detailed below. (1) Scapulohumeral hemarthrosis in IR and ER was defined as the area (mm²) behind the anterior capsule and forward of the glenoid cavity and humeral head in the inferior third of the cavity, as described by Itoi. (2) Humeral ER was measured starting from a zero-position with the elbow of the affected limb against the body (1st acquisition series), and humeral head rotation was measured on the MRI console during external rotation of the limb (2nd acquisition series), using as landmarks the centerpoints of the humeral head and of the occipital groove. (3) Status of the rotator cuff, glenoid, humeral head (notch and fracture), and labrum. Labral lesions were classified as per Habermeyer et al. [1] into four stages (Figs. 1–3) and labral displacement was assessed on the criteria defined by Itoi et al. [2] (Fig. 4): displacement, defined as the distance (mm) between the extremity of the labrum and the edge of the glenoid cavity, and separation, defined as the distance (mm) between the inner edge of the labrum and the anterior part...
of the glenoid neck. Displacement was measured in IR then in ER, so as to assess the impact of ER on labral reduction, and was counted as positive for medial displacement of the labrum forward of the scapula and as negative for lateral displacement towards the humeral head. All measurements were made on the MRI console by the same operator.

**Results**

Twenty three patients agreed to participate in the study; 20 male, three female; mean age 32 years (range, 17–40 yrs). There were 12 cases of right involvement, 11 of left. Reduction was systematically performed by external maneuver, and under general anesthesia in 10 cases. The mean interval between trauma and reduction was 6 hours, and that between reduction and MRI 3.75 days (range, 1–10 days). Three patients had rotator cuff tears, one supraspinous, one of the deep subscapular face, and one associated supraspinous and subscapular. A Malgaigne posterior humeral notch was found in 14 cases: five slight (chondral), eight moderate (<5 mm deep), one severe (10 mm deep). Twenty patients had bone contusion of a mean 22% of humeral head area (range, 10–50%).

There were eight glenoid lesions. Hemarthrosis was systematic except in one patient (96%), who also showed no humeral head contusion, but a labral fissure without displacement. Of the other 22 cases, four showed no change in anterior or posterior hemarthrosis volume with the changer from IR to ER; one showed no posterior hemarthrosis in whichever rotation. In the other 17, anterior hemarthrosis decreased in ER (Fig. 5), with a mean area of 310 mm$^2$ in IR versus 218 mm$^2$ in ER. Mean ER was 37$^\circ$ (range, 12–60$^\circ$).

On Habermeyer’s classification [1] (Fig. 4), there were 12 stage-1 lesions and 10 stage-2; one patient had no labral lesion. Six patients (5 stage-1, 1 stage-2) showed no labral separation or displacement. All separated labra were reduced in ER, five totally (Fig. 6). Mean separation was 2.8 mm in IR versus 1.3 mm in ER. In six cases, labral displacement varied with rotation, from a mean 3.2 mm in IR to a mean 1.8 mm in ER.

**Figure 4** Classification of labrum lesions according to Habermeyer [3].

**Figure 5** Capsular coaptation with the arm in external rotation.
Discussion

Although there is no real consensus, immobilization is classically imposed in IR adduction [3–6], for a period ranging from three to six weeks according to age [3–6,2]). Recurrence rates are high, reaching 70.5% at two years and 18.7% between two and five years, according to Rowe [6].

The pressure induced by hemarthrosis is one factor maintaining anterior capsule detachment following dislocation (Itoi et al. [2]), whence the idea of lowering pressure by arthroscopic lavage [2,7,8], as hemarthrosis is reabsorbed only after three to seven weeks, according to Wintzell et al. [7]. In parallel, Miller et al. [9], Hatrick et al. and Itoi et al. [2,10] recommended external rotation for labral reduction: the force of the contact of the labrum with the glenoid cavity is greater with the arm placed in ER, reaching a maximum at 45°.

Itoi et al. performed an MRI study [2] of 19 shoulders, including six primary dislocations, to demonstrate the interest for labral reduction of placing the soft parts under tension by external rotation: a mean 52° ER provided labral reduction in all cases (although only 1 seems to have been complete), and a decrease in anterior capsule detachment from a mean 161 mm² in IR to a mean 54.7 mm² in ER.

In the present study, mean ER was 37°, limited partly by pain but mainly by the configuration of the MRI tunnel. Reduction of labral separation was systematic with ER, as (although less than) in Itoi et al.’s study [2]. Reduction, however, did not completely abolish separation and displacement except in five cases (21%), compared to 16.7% for Itoi et al. [2]. Distinguishing separation and displacement in Itoi et al.’s and in the present study, ER would seem to be more effective on separation. Itoi et al. [2], however, obtained better reduction of displacement than we did, with higher initial values. The present study also found that anterior hemarthrosis decreased in 18 patients (75%), while remaining stable under whichever rotation in the other four (17%). Capsule detachment was completely reduced in three patients (12.5%), which Itoi et al. [2] never found. From their MRI study [2], Itoi et al. concluded that ER immobilization provided benefit. A comparative clinical study of 40 patients (20 immobilized in IR, 20 in ER, for 3 weeks) with a mean 15.5 months’ FU reported 27% recurrence in the IR group, versus 0% for ER (Itoi et al. [11]); for patients under 30 years of age, the figures were respectively 45% vs. 0%. These findings confirmed those of the MRI study [2].

Itoi then continued the clinical study, from 2000 to 2004, with 198 primary dislocations randomized for three weeks’ immobilization in either IR or 10° ER, with a mean 25.6 months’ FU [12]. ER immobilization was reported to reduce the relative risk of recurrence of dislocation by 38.2%. Itoi stressed the importance of rapid treatment and immobilization as of day 1, to minimize risk of recurrence. He also studied the effect of type of immobilization per age group: early ER immobilization following primary dislocation seemed to be especially beneficial in patients under the age of 30. Finally, he aired the issues of treatment compliance and duration and the requisite degree of external rotation.

The present study confirmed the interest of ER for decreasing anterior capsule detachment and labral reduction; although the latter was complete in only 18.75% of cases, it was never worsened by ER. There remain, however, the issues of toleration and duration of immobilization and the requisite degree of external rotation.

Conclusion

External rotation seems to have a positive effect on decreasing anterior hemarthrosis and reducing anterior capsule detachment and labral lesions. The latter are reduced both sagitally and coronally. In no cases did ER aggravate lesions pre-existing under IR. Long-term clinical studies may confirm the interest of such immobilization for preventing
shoulder instability, despite patient discomfort. To this end, we shall extend the present MRI study with a clinical study, with ER immobilization for all patients showing significant labral lesion reduction.

Conflict of interest

The authors have not communicated any conflict of interest.

References


