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Original article

Arthroscopic classification of posterior labrum glenoid insertion

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ABSTRACT

Purpose: We performed a prospective arthroscopic study to explore the variability of the posterior labrum glenoid insertion. We aimed to classify the insertions and to explore whether these insertions can be identified by pre-operative arthro-CT scan.
Patients and methods: From January to December 2011, 86 patients were prospectively included in the current study. During arthroscopy, anterior labrum was evaluated and posterior labrum was assessed in 3 different locations: superior, medial, and inferior. For each segment, the labrum was considered normally inserted (directly to the glenoid cartilage), medialized (inserted at the posterior part of the glenoid bone, without direct contact with the cartilage), torn (macroscopic degenerative changes, tears, fragments) or absent (agenesis). Imaging was analyzed segment by segment by an experienced osteoarticular radiologist, using the same classification.
Results: Four types of posterior labrum insertions were identified. Type 1, 60% of the cases, corresponded to a posterior labrum totally inserted in the glenoid, with direct contact with the cartilage. Type 2, 20% of the cases, represented medialized insertion of the superior segment. Type 3, 15% of the cases, represented an associated medialization of the superior and medial segment of the posterior labrum. Type 4 is a medialized insertion of the all-posterior labrum. Fifty-six shoulders were used for arthro-CT and arthroscopy correlation: for the superior segment ($n = 22/56$), the sensitivity of arthro-CT to identify an abnormal insertion when the labrum is medialized was 68.18%, specificity 70.59%, positive predictive value (PPV) 60%, and negative predictive value (NPV) 77.42%. For the medial segment ($n = 16/56$), the sensitivity of arthro-CT to identify an abnormal insertion when the labrum is medialized was 81.25%, specificity 57.50%, PPV 43.33% and NPV 88.46%. For the inferior segment ($n = 5/56$), the sensitivity was 100%, specificity 47.60%, PPV 15.63% and NPV 100%.
Conclusion: The current study points out the high variability of shoulder posterior labrum glenoid insertion, and thus the risk of misdiagnosis with posterior labral tears, especially in posterior instability and also the risk of considering as labral lesions some non-pathological aspects.
Level of evidence: Level III. Anatomic prospective study.

1. Introduction

Radiologic and surgical anatomy of the anterior and superior labrum of the shoulder is well documented because of the frequent involvement of these structures in shoulder disorders. Anterior labral lesions are well defined because of their close relationship with anterior shoulder instability, and superior labral lesions are increasingly being defined because of the growing interest in management of superior labral anterior-posterior (SLAP) lesions [1–3].

However, the exact relation between the posterior labrum and posterior instability is still unclear and probably more complex. Lesions of the anterior labrum clearly represent anterior instability, and many authors consider the same association of the posterior labrum and posterior instability [2]. Many authors argue that continuity between the cartilage and the labrum is necessary to maintain a stable shoulder [4,5]. However, native insertion of the posterior labrum seems to be less regular than that of the anterior labrum.

We performed a prospective arthroscopic study to describe native insertion of the posterior labrum of the shoulder in patients without any history of posterior or multidirectional instability. We aimed to identify the frequency of variations in fixation, describe them, and point out the risk of misdiagnosis with posterior labral tears in posterior instability or in postero-superior impingement. We aimed to classify the insertions and to explore whether these insertions can be identified by pre-operative arthro-CT.

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Our hypothesis was that the insertion of this posterior labrum is highly variable, independently of any clinical data, and that is not possible to clearly identify this specific fixation on pre-operative CT scan.

2. Patients and methods

We enrolled 86 patients (46 men; mean age 55 years [range: 17–75 years]) in this 6-month prospective study. Inclusion criteria were patients undergoing arthroscopy, who had no history or clinical sign of posterior or multidirectional instability and no shoulder osteoarthritis seen on plain radiography, with imaging performed in our department. In total, 36 patients underwent arthroscopy for cuff repair, 27 for anterior shoulder instability, 5 for AC resection, and 22 for decompression and/or biceps tenotomy, some of them have several disorders. A total of 29 patients underwent MRI, 47 arthro-CT (9 of them had both exams), and 2 arthro-MRI.

During arthroscopy, the posterior labrum was assessed in 3 locations: superior, medial and inferior. For each segment, the labrum was considered normally inserted (directly to the glenoid cartilage), medialized (inserted at the posterior part of the glenoid bone, without direct contact with the cartilage), torn (macroscopic degenerative changes, tears, fragments) or absent (agenesis). The medialized aspect was defined by an absence of continuity with the glenoid rim. Imaging was analyzed segment by segment by an experienced osteoarticular radiologist. The aspect should be considered normal (directly inserted to the cartilage) or abnormal (other cases). The anterior labrum was assessed as a gold standard for radiography interpretation, and data were compared to the literature.

3. Statistical analysis

Descriptive data (correlation between arthroscopic observation) and clinical data (age, gender, shoulder disorders) were analyzed by Chi-square test and logistic regression by use of R v2.15. Data on imaging and arthroscopy were analyzed in terms of sensitivity, specificity, and positive and negative predictive value (PPV and NPV).

4. Results

No statistically significant difference was found in between the two populations.

4.1. Arthroscopic descriptive study (n = 86)

4.1.1. Anterior labrum

During arthroscopy, 26 patients showed anterior Bankart lesions, 1 patient anterior glenoid rim fracture, 54 patients a healthy anterior labrum, 3 patients degenerative changes of the anterior labrum, and 1 patient a bone block behind the glenoid. One SLAP lesion was extended to the anterior inferior labrum.

Anterior labral lesions were associated with patient age (odds ratio [OR] = 0.93), for a decreased risk of having a labral tear with every increase in year ($P = 0.00253$). Anterior labral lesions were associated with the initial diagnosis of anterior shoulder instability (OR = 3.18).

4.1.2. Posterior labrum

In 39 cases, the superior segment was directly attached to the cartilage; in 34, it was medialized, without direct contact with the cartilage; in 11, it was affected by degenerative changes (tears, erosions); and in 2, it was absent.

In 62 cases, the medial segment was directly attached to the cartilage; in 18 cases, it was medialized, without direct contact with the cartilage; in 5 cases, it was affected by degenerative changes (tears, erosions); and in 1 case, it was absent.

In 72 cases, the inferior segment was directly attached to the cartilage; in 5, it was medialized, without direct contact with the cartilage; and in 9, it was affected by degenerative changes (tears, erosions).

The particular anatomy of each segment did not differ by age, sex, or initial diagnosis, and the presence of a SLAP lesion was not associated with the posterior segment aspect.

A medialized medial posterior segment was associated with a medialized superior segment (OR = 8.02; $P = 0.004$), and a medialized inferior segment was associated but not significantly with a medialized medial segment (OR = 2; $P = 032$).

Medialization or tear of the inferior segment was not associated with tear of the anterior labrum.

4.2. Classification of posterior labrum insertions

To describe a classification of healthy non-traumatized posterior labrum, we removed cases of torn labrum and agenesis from the data used for the classification.

We found 4 types of posterior labrum insertions. Type 1, 60% of the cases, corresponded to a posterior labrum totally inserted in the glenoid, with direct contact with the cartilage, totally flush. Type 2, 20% of the cases, represented medialized insertion of the superior segment. Type 3, 15% of the cases, represented an associated medialization of the superior and medial segment of the posterior labrum. Type 4 is a medialized insertion of the all-posterior labrum (Fig. 1).

4.3. Correlation of arthroscopy and imaging (n = 56)

Most imaging exploring instability involves use of intra-articular contrast injection [5]. Because most of the disorders of the posterior labrum are summarized as posterior instability, we focused on imaging with injection as being highly clinically relevant. Thus, we investigated data for patients who underwent arthro-CT in our institution and retained data for only those who were part of our classification, excluding patients without a labrum or with a torn labrum. We aimed to determine whether imaging could identify differences between fixed and medialized posterior labrum by comparing data from arthroscopy with data reported by the radiologist.

For the superior segment ($n = 22/56$), the sensitivity of arthro-CT to identify an abnormal insertion when the labrum is medialized was 68.18%, specificity 70.59%, PPV 60%, and NPV 77.42%. For the medial segment ($n = 16/56$), the sensitivity of arthro-CT to identify an abnormal insertion when the labrum is medialized was 81.25%, specificity 57.50%, PPV 43.33% and NPV 88.46%. For the inferior segment ($n = 5/56$), the sensitivity was 100%, specificity 47.60%, PPV 15.63% and NPV 100%.

To compare our results to the those in the literature, we assessed the efficiency of arthro-CT in diagnosis of the anterior labrum insertion, with an anterior Bankart lesion used as a gold standard. For anterior labrum insertion ($n = 17/56$), the sensitivity of arthro-CT to identify an abnormal insertion with a Bankart lesion was 88.24%, specificity 53.85%, PPV 45.45% and NPV 91.3%.

5. Discussion

In the current study, we assessed the native insertion of the posterior labrum to provide knowledge of the normal anatomy and for identifying disorders. With the growing focus on SLAP lesions, differentiating normal insertions, variations of normal

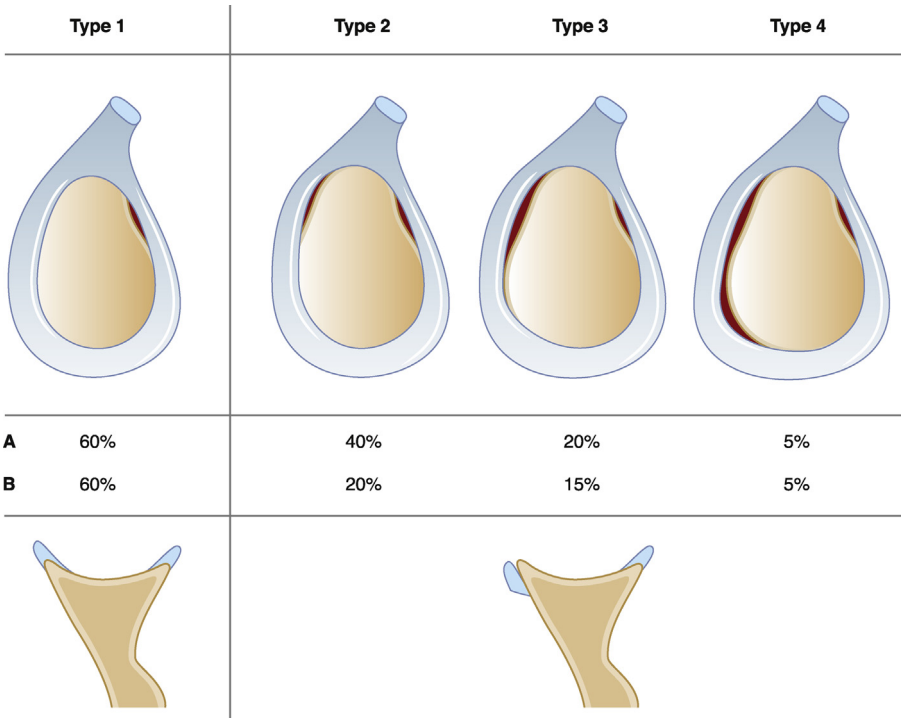

Fig. 1. Arthroscopic classification of posterior labrum insertion. Type 1: the most frequent, corresponding to the direct insertion of the posterior labrum in the cartilage surface, without a gap. It represents 60% of shoulders. Type 2: no direct contact between cartilage surface and the superior segment of the posterior labrum, with a medialized aspect of the segment. This aspect is frequent (40%) and isolated in 20% of cases. It can be associated with medialization of the medial fragment in 15% of cases corresponding to type 3. Type 4: (5%) medialization of all labrum. A: percentage of medialized aspect of the posterior labrum, by segment. B: percentage of each type of insertion. Bottom: the two modalities of fixation of the posterior labrum: left, in continuity with articular surface; right, medialized aspect, with a gap between the labrum and the cartilage.

insertions, and pathological conditions is important to not overestimate disorders [2,3,6–8]. The incidence of posterior Bankart lesion was found strongly overestimated or misdiagnosed during arthroscopy [4,9,10], which could be related to the various insertions we described.

We found only 60% of posterior labrums fixed to the glenoid, contrary to what is reported in literature (i.e., directly fixed to the glenoid cartilage) [11–14]. Anatomic descriptions of posterior labrum insertion routinely describe a labrum in continuity with the cartilage, and Waldt et al. [8] reported that absence of perfect continuity between the cartilage and the labrum is an important source of shoulder instability.

Our population aged from 17 to 75 years old. This should be considered as a flaw of our study but, for the native insertion

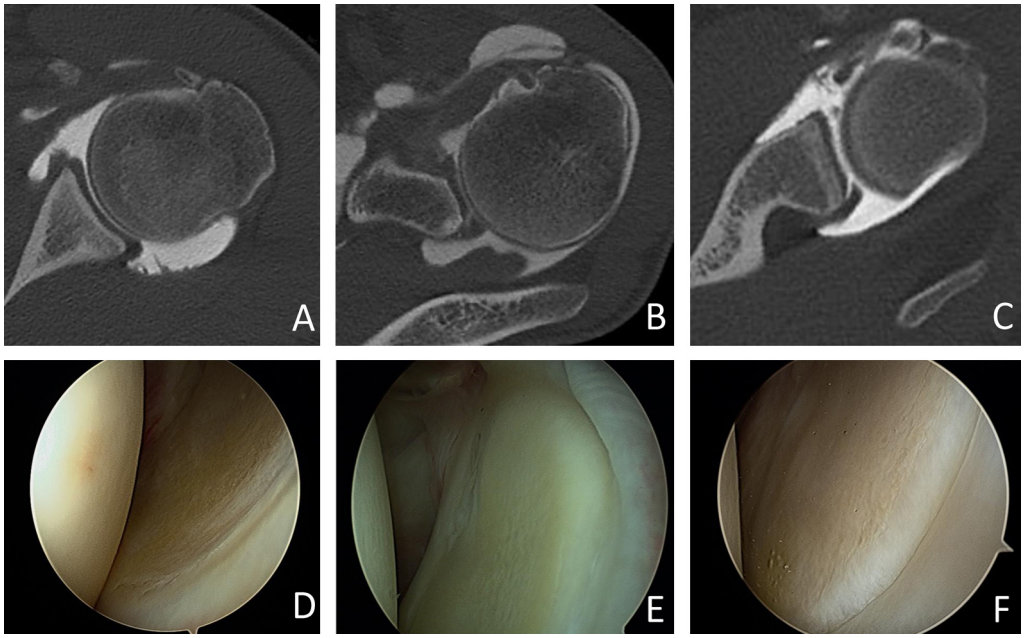

Fig. 2. Arthro-CT of a directly inserted posterior labrum (A), a medialized posterior superior labrum (B) (not considered a pathologic aspect of a posterior Bankart lesion) and a medialized posterior medial labrum (C). Arthroscopic aspect of a directly inserted inferior segment of the posterior labrum (D), a posterior labrum with medialized superior and medial segment (E) (type 3) and a directly inserted medial segment (F).

classification, every torn labrum was excluded, no OA or multidirectional instability was involved, and exploration of the posterior labrum can be useful also in elderly patients. Furthermore, the posterior labrum should be naturally medialized, without contact to the cartilage, and is not associated with age, sex, pathological condition or SLAP disorders. This incidence of the medialization is higher in the superior part of the labrum.

Isolated lesions or medialization of the inferior posterior labrum is frequent in posterior instability [10] but not elsewhere in the posterior labrum. These data suggest that the posterior labrum insertion is highly variable, and apart from the clinical history, a medialized labrum cannot be considered a pathological disorder (Fig. 2).

To date, imaging seems to be of little interest for helping clinicians in decision making when focusing only on the posterior labral aspect. We lack reports of imaging of the healthy posterior labrum [1,13–17], and most studies describe pathological conditions using MRI or arthro-MRI, rarely with arthroscopic comparison. In the literature, the sensitivity and specificity of arthro-CT in identifying anterior labral disorders is 89 and 96%, respectively [5,14,18]. We found similar values for the anterior labrum insertion, which confirms the accuracy of radiological diagnosis for the anterior labrum, and thus, we can consider that the values are comparable for the posterior labrum.

Noël et al. [19] reported that lesions of disinsertion labral tears are rarely isolated (only in 5% of cases) and in posterior instability are usually associated with other bony or cuff disorders. Thus, without other lesions, one cannot speak of pathological conditions when identifying medialization of the labrum. Kim et al. [10] described a typical lesion of posterior instability associating inferior tear of the posterior labrum with osteochondral modifications – the Kim's lesion – frequently found in posterior shoulder instability. Saupe et al. [20], with traumatic posterior shoulder disorders, identified only 58% lesions of the posterior labrum. Gobezie et al. [2], in a retrospective study involving 100 arthroscopic stabilizations of posterior shoulder instability, reported 13% healthy posterior labrum on arthro-MRI, 29% displaced labrum, and 58% medialized or absent labrum. Interestingly, during arthroscopy, the authors reported 43% healthy labrum, 27% partially torn labrum, and 30% totally detached labrum. These data agree with our findings, with the difficulties of the association of the medialized aspect on imaging (arthro-CT or arthro-MRI) and operative findings. The authors also confirmed the complex relation between the normal posterior labrum, whatever the position (medialized or not), and the notion of posterior shoulder instability.

Limitations should be due to the small number of patients involved in the current study, the high variety of the age of patients, and the difficulty to clearly identify multidirectional instability for patient affected of anterior shoulder instability.

6. Conclusions

Even if the variability of posterior labrum is known, its incidence is unknown. The current study explores its frequency and demonstrate that this variability is not correlated to any clinical factor. Imaging of posterior labrum attachment, using arthro-CT scan, is recommended in Europe and provides information with a low sensibility and specificity. Better understanding and exploring the normal function and aspect of this labrum is important to better manage posterior labrum disorders and thus posterior shoulder instability.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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