

Current Concepts

Labral Lesions: An Elusive Source of Hip Pain Case Reports and Literature Review

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Summary: Three cases are presented highlighting varied aspects of labral lesions as a primary or contributing source of mechanical hip pain; including one chronic labral tear associated with old trauma, an acutely entrapped labrum, and a degenerative labral tear associated with osteoarthritis. The diagnosis of labral lesions may be elusive. Arthrography, double-contrast arthrography followed by computerized tomography, and magnetic resonance imaging all have been reported in the assessment of these lesions with variable success. Often, the clinical presentation, including history and physical examination, will yield useful information. A fluoroscopically guided intra-articular injection of the hip is a very useful diagnostic tool for differentiating an intra-articular source of hip symptoms, such as labral lesions, from an extra-articular source. Labral tearing can readily be assessed by arthroscopy and many can be successfully addressed by operative arthroscopy. However, there are many variations in the arthroscopic anatomy of the acetabular labrum.

Key Words: Acetabular labrum—Hip arthroscopy.

Tearing of the acetabular labrum was reported by Paterson from Scotland in 1957.¹ He described two cases of inadequate reduction following posterior dislocation of the hip where the labrum was found to be torn and displaced into the depths of the acetabulum, serving as a soft tissue block to a concentric reduction.

The first report in the United States was by Dameron in 1959.² He similarly described a bucket-handle tear of the labrum displaced into the acetabulum in association with a posterior dislocation and blocking the reduction.

However, it was Alphons Altenberg from Monroe, Louisiana who first described tearing of the acetabular labrum as a cause of hip pain not associated with major

trauma such as a dislocation.³ He reported two cases successfully treated by arthrotomy with resection of the torn portion of the acetabular labrum.

Between 1986 and 1990, there were three reports from Japan on rupture or tearing of the acetabular labrum.⁴⁻⁶ These each expanded on a common patient population. They all underwent diagnostic arthroscopy and were variably treated, either with protected weight bearing, or by arthrotomy with resection of the torn portion of the labrum.

In 1986, Dorrell and Catterall⁷ reported 11 cases of labral tearing associated with acetabular dysplasia. In 1990, Nishina et al.⁸ similarly reported an incidence of labral lesions associated with dysplasia and, in 1991, Klaue et al.⁹ also reported this finding, many associated with lesser degrees of dysplasia.

In 1995, Fitzgerald¹⁰ reported on his 20-year experience in the treatment of 64 patients with a diagnosis of torn acetabular labrum. Treatment varied including conservative treatment and surgical intervention by both arthrotomy and arthroscopy.

In the author's preliminary experience of 55 arthro-

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scopic procedures, 34 (62%) involved some type of labral pathology. The normal arthroscopic appearance of the labrum can be quite variable. The subgroup of labral tears still represents a very heterogeneous population with a variety of isolated tear patterns as well as occurrence in conjunction with other disorders and disease states. Herein, three cases examples are reported, highlighting different aspects of labral pathology followed by a discussion of the current knowledge of this entity.

CASE REPORTS

Case 1

A 35-year-old man presented with a 14-year history of intermittent pain, catching, and giving way of his right hip as the result of a motorcycle accident. His symptoms had progressed to the point where he had to give up his job as a construction worker because he never knew when his hip would give out, causing him to collapse.

Following one of these episodes, his symptoms would subside over several days and, between the episodes, he was essentially asymptomatic. On examination, flexion combined with rotational motion would elicit a painful pop within the hip joint.

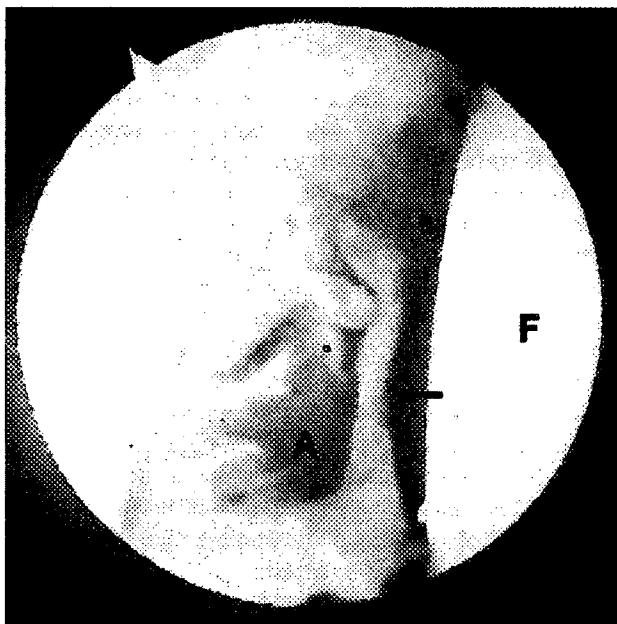


FIG 1. A 35-year-old man with 14-year history of intermittent pain, catching and giving way of the right hip. Arthroscopic view of the right hip from the anterolateral portal reveals a complex tear of the anterior labrum [Arrow] partially obscuring the view of the acetabulum [A]. The femoral head [F] is on the right.

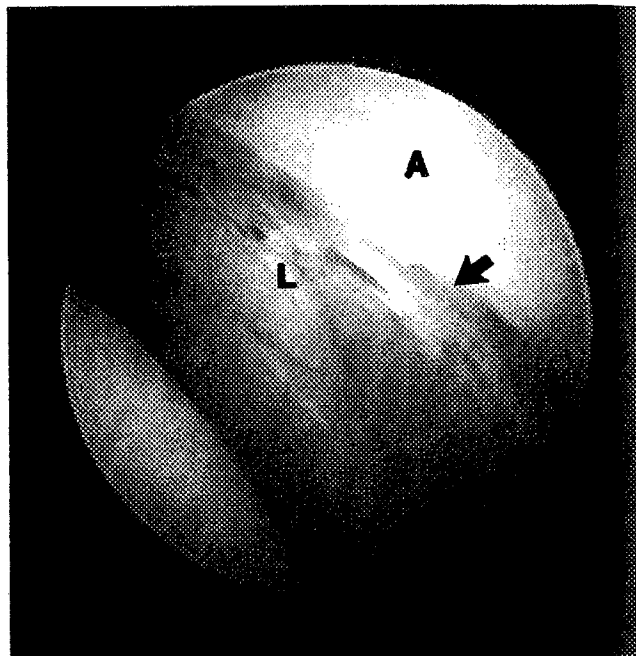


FIG 2. A 26-year-old man with 6-week history of painful clicking in the left hip following an extension injury. Arthroscopic view of the left hip from the anterior portal, viewing laterally. The labrum [L] is hemorrhagic and partially separated [Arrow] from its bony attachment to the lateral acetabulum [A].

Radiographs and a computed tomography (CT) scan were normal. At arthroscopy, extensive complex tearing of the anterior half of the labrum was identified, displaced into the weight-bearing portion of the joint (Fig 1). Following arthroscopic debridement, there was prompt resolution of symptoms, which has been maintained for the 3 years since.

Case 2

A 26-year-old man presented 6 weeks after a hyper-extension injury to his left hip when he came down extended and off balance on his left leg from getting a rebound playing basketball. Since the episode, he had been unable to bear weight without crutches and had developed a painful click in his hip. Previous radiographs and magnetic resonance imaging (MRI) were normal.

Physical examination revealed mechanical symptoms localized to the joint, characterized by anterior and lateral hip pain with extreme passive external rotation and a painful click with active rotational motion. Arthroscopy revealed the lateral labrum to be hypermobile with a hemorrhagic partial separation from its bony attachment to the acetabulum (Fig 2). The free margin would tend to sublux into the joint when the inflow was occluded,

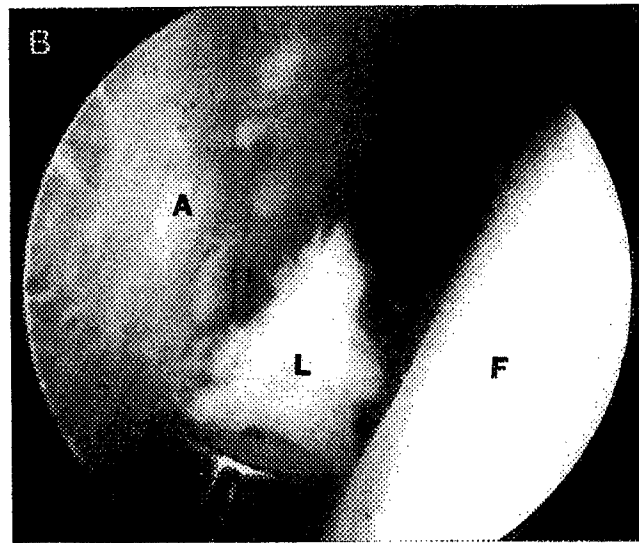


FIG 3. A 68-year-old man with recent onset of intractable right hip pain. (A) Anteroposterior (AP) radiograph is remarkable for moderate osteoarthritis. (B) Arthroscopic view of the right hip from the anterolateral portal. A large displaced fragment of labrum [L] posteriorly is being debrided. The femoral head [F] is on the right and the extent of underlying degenerative change is apparent in the acetabulum [A] on the left.

eliminating the distension effect. This was interpreted as reflecting an acute entrapment of the labrum, which was reduced by the combination of distraction and distension of the hip implemented during the course of arthroscopy. Postoperative resolution of symptoms was immediate and has persisted for $3\frac{1}{2}$ years.

Case 3

A 68-year-old man presented with a 5-month history of intractable mechanical right hip pain following a long car trip to Florida. He had previously had an extensive workup for his back because of long standing problems with degenerative disk disease.

Physical examination revealed modest limitation of motion in both hips, but associated mechanical pain through range of motion on the right. Radiographs revealed moderate evidence of osteoarthritis in both hips, only slightly more advanced on the right than the left (Fig 3A).

Because of the relatively recent onset of symptoms

and subsequent failure of response to conservative treatment including activity modification, anti-inflammatory medications and therapy, arthroscopy was offered as an option.

At arthroscopy, there was found a large displaced degenerative tear of the labrum posteriorly (Fig 3B) that was able to be debrided. Additionally, there was extensive articular surface damage reflecting the extent of degenerative disease.

Postoperatively, the patient still had some discomfort associated with his underlying osteoarthritis, but the intractable symptoms that had plagued him since the acute onset during his travels were resolved. However, 15 months later, his symptoms returned and he subsequently required a total hip arthroplasty.

DISCUSSION

Clinical Presentation

Clinical assessment of the patient with labral pathology will often show several characteristic features. In

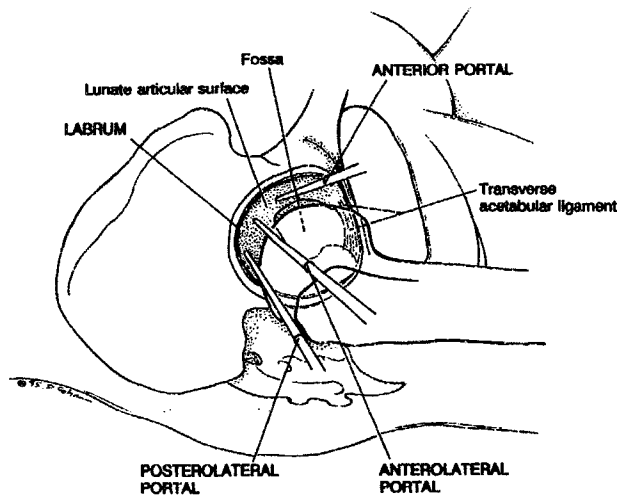


FIG 4. Illustration of a right hip showing the relationship of the labrum to the three standard portals used in hip arthroscopy.

the author's experience, the patient will usually recount an injury, whether severe or modest, such as twisting or falling. Symptoms may be pronounced from that point forward or initially seem inconsequential but then persist or worsen over time. When there is pre-existing degenerative disease, there will usually be an acute episode of symptom exacerbation while the radiographic picture appears fairly stable.

Symptoms and examination findings of mechanical catching and guarding of the hip are more indicative than just pain with activities or pain on provocative tests. Although a history of painful catching or clicking is often associated with labral damage, it is not always necessarily present; conversely, caution should be used to avoid overinterpreting painful clicking as necessarily an indication of labral damage.

Anatomy

The labrum is a fibrocartilaginous rim that encompasses the circumference of the acetabulum, effectively deepening the socket (Fig 4). The constrained ball and socket bony architecture of the hip renders the labrum less critical to stability than its counterpart, the labrum in the shoulder. It has not been studied as extensively as the glenoid labrum and, although functionally it may not be quite as complex, it undoubtedly is important to the health of the joint. It is also susceptible to acute tearing and degeneration.

Classic anatomic teaching describes the acetabular labrum as a homogenous structure throughout its circumference of the acetabulum. It terminates inferiorly at the anterior and posterior margins of the acetabular

fossa where it is contiguous with the transverse acetabular ligament. However, arthroscopic inspection has shown that there is considerable variation in the appearance of the labrum within different areas, and that there is considerable variation in the normal anatomy between different individuals. In addition to the cadaveric study by Dvorak et al.¹¹ of the arthroscopic anatomy, Keene and Villar¹² have done an admirable job of describing normal arthroscopic findings based on their clinical experience in several hundred cases.

Pathogenesis and Treatment

Altenberg³ was the first to recognize labral damage as a principal origin in the cause of disabling hip pain. An exploratory arthroscopy for this elusive diagnosis is a bold approach, but one that was well founded in Altenberg's cases, as evidenced in his description in the *Southern Medical Journal* and appears to have met with a successful result. Before Altenberg's report, labral tearing was principally identified when it served as a soft-tissue block to reduction in association with a posterior dislocation of the hip.^{1,2} It is suspected that there may be lesser degrees of labral damage associated with many hip dislocations. The forces necessary to dislocate the hip are usually associated with vehicular trauma or other high-energy impact and often accompany multiple injuries. Consequently, these are most commonly cared for in major trauma centers. In the busy follow-up clinics, symptoms associated with labral damage may go unrecognized when radiographs show a concentric reduction, CT does not show any evidence of retained intra-articular bony fragments, and there is no evidence of avascular necrosis of the femoral head.

Labral tearing has now been clearly associated with acetabular dysplasia. This was first reported by Dorrell and Catterall⁵ in 1986 in 10 adults and 1 teenager. Arthrography was reported to show the labral tearing in all cases, although in two cases, the tearing apparently was recognized only on retrospective review. In this series, Catterall also reported that cyst formation in the lateral roof of the acetabulum was present in all cases that demonstrated labral tearing. All patients ultimately underwent acetabular and/or proximal femoral osteotomy. Two patients initially underwent open excision of the torn labrum only, but ultimately required a proximal femoral osteotomy because of incomplete pain relief. All but one patient underwent concomitant excision of the torn labrum in conjunction with the osteotomy. Catterall felt that these labral tears were acquired and not congenital.

In 1990, Nishina et al⁸ reported on 64 adults who

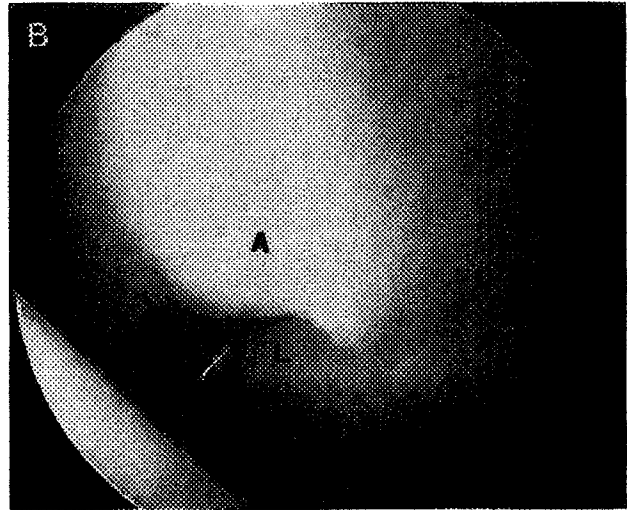
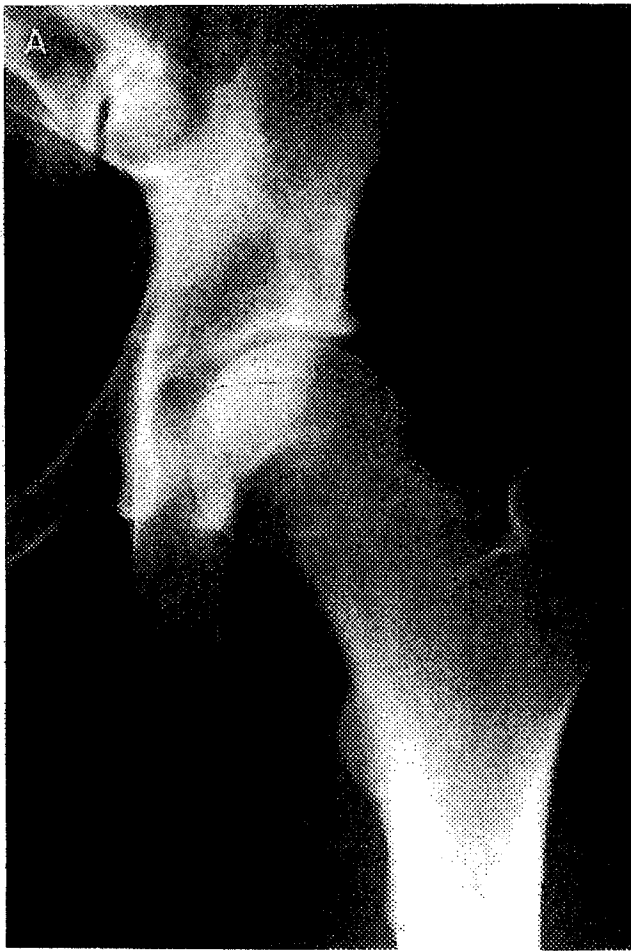


FIG 5. A 20-year-old male collegiate basketball player underwent arthroscopy for removal of an acute chondral fragment from the medial aspect of the femoral head. (A) AP radiograph shows no acute findings, but there is subtle evidence of underlying congenital changes, characterized by slight lateral uncovering of the femoral head. (B) Arthroscopic view from the anterior portal shows a partial detachment of the lateral labrum [L] from the bony acetabulum [A]. This is an incidental finding associated with his mild underlying dysplasia. This would be characterized as a detached labrum according to the work of Nishina et al.⁸

underwent Chiari pelvic osteotomy for secondary osteoarthritis associated with acetabular dysplasia. These patients also underwent arthrography to assess the labrum, which was categorized as normal (23), torn (21), or detached (20). The best results occurred in the group with an arthrographically normal labrum. Interestingly, results associated with a torn labrum were nearly as good, whereas the poorest result occurred in the group with an arthrographically detached labrum. The labral lesions themselves were not surgically addressed in conjunction with the osteotomy. It should also be noted that no correlation could be made between the operative inspection of the labrum and the interpretation of the arthrographic appearance because the Chiari osteotomy was an extracapsular procedure and the labrum was thus not visualized.

Klauc et al,⁹ in 1991, described the acetabular rim syndrome, which he felt to be a precursor of osteoarthritis associated with acetabular dysplasia. He re-

ported 29 cases consisting of acetabular dysplasia with an associated detachment of the labrum. He described two types of dysplasia, the more severe (type I) with an incongruent shallow acetabulum and a less severe (type II), in which the acetabulum was congruent, but coverage of the femoral head was deficient. For this acetabular rim syndrome, Klaue recommended a peri-acetabular osteotomy to reorientate the acetabulum and a concomitant arthrotomy to address the labral lesion. Presence of a labral tear in this group was established by the operative findings. Twelve patients underwent resection of the torn labrum, 12 underwent repair, and in 5 patients the tear was judged too small to need specific treatment. The poorest results occurred in the group that underwent repair of the labrum and two subsequently required revision to resect a reruptured labrum.

Similarly, although labral lesions are clearly associated with severe dysplasia, the author has felt that there

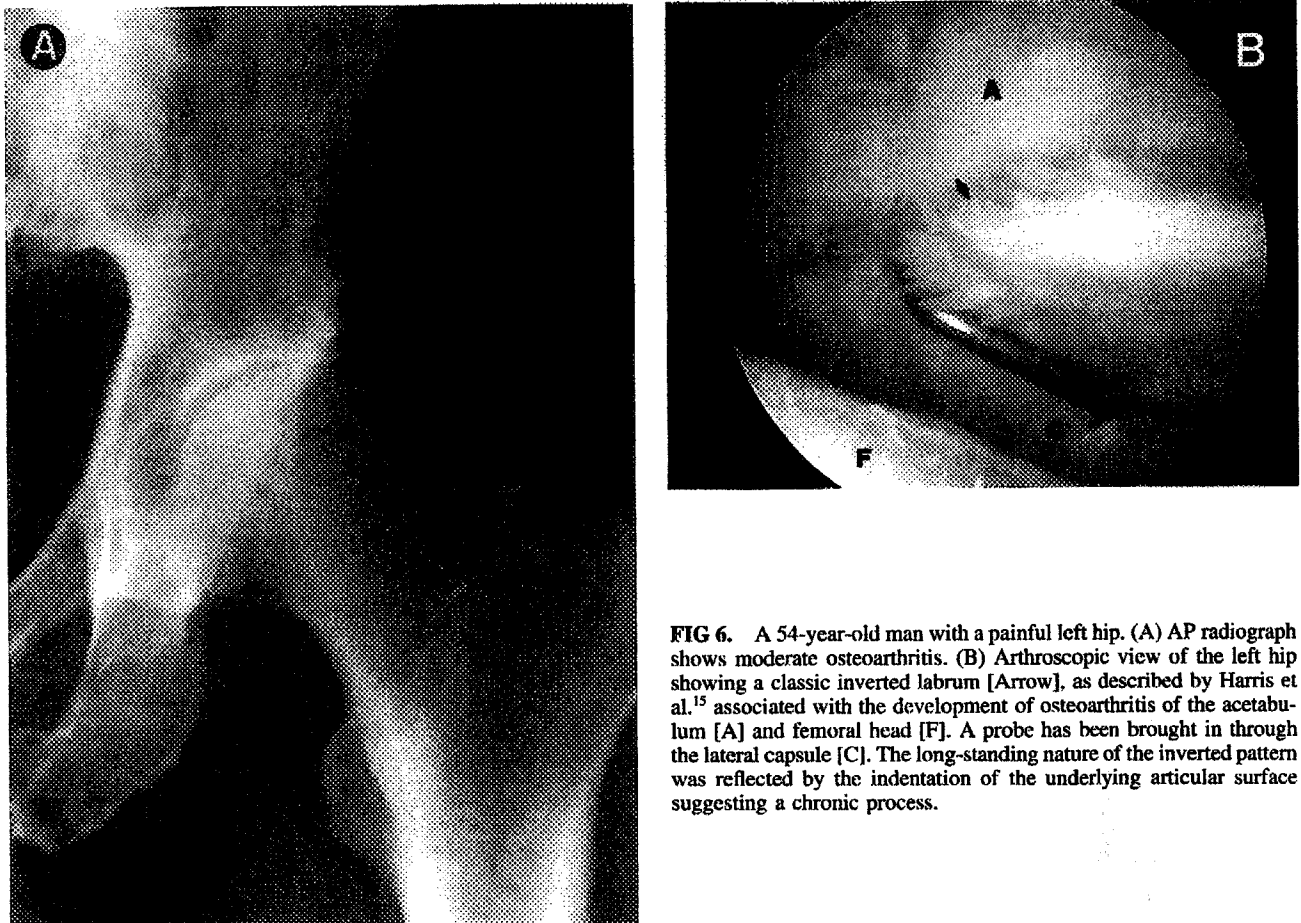


FIG 6. A 54-year-old man with a painful left hip. (A) AP radiograph shows moderate osteoarthritis. (B) Arthroscopic view of the left hip showing a classic inverted labrum [Arrow], as described by Harris et al.¹⁵ associated with the development of osteoarthritis of the acetabulum [A] and femoral head [F]. A probe has been brought in through the lateral capsule [C]. The long-standing nature of the inverted pattern was reflected by the indentation of the underlying articular surface suggesting a chronic process.

is a trend towards symptomatic labral pathology as well as incidental anomalous findings (Fig 5) being associated with subtle radiographic evidence of dysplasia such as slight lateral uncovering of the femoral head. In particular, partial separation of the labrum from the lateral aspect of the bony acetabulum has been found to often be a normal anomalous variation. Care should be taken not to diagnose this as a traumatic lesion, whether a "detachment" as described by Nishina et al.⁸ and Klaue et al.,⁹ or a "separation" as described by Fitzgerald.¹⁰

Inversion of the acetabular labrum has been well recognized in conjunction with congenital dislocation of the hip and also linked to congenital dysplasia.^{13,14} Harris et al.¹⁵ have also reported on the presence of an inverted acetabular labrum leading to the subsequent development of osteoarthritis in nondysplastic hips. Similarly, the author has documented arthroscopically the presence of a long-standing inverted acetabular labrum associated with osteoarthritic changes (Fig 6). In

addition to Harris' finding of osteoarthritis associated with an inverted labrum, Tanabe¹⁶ has studied the labrum by electron microscopy and it does undergo senile degeneration.

Several authors have commented on the role of arthroscopy in the assessment of labral lesions.^{17,18} However, it was the series of three articles from Japan that first specifically addressed the role of arthroscopy in the assessment of labral tearing.⁴⁻⁶ Arthrography was exceedingly poor in defining the labral tears. All were identified by diagnostic arthroscopy and most were posterior in location. Treatment included attempted conservative management with non-weight bearing and, in some cases, either concomitant or subsequent posterior arthrotomy to resect the torn portion.

Contrary to the Japanese experience, the author's observation has been that acute labral tears as a result of twisting injuries (12 cases) occurred principally at the anterolateral junction of the labrum. Posterior lesions occurred as a result of axial loading of the flexed

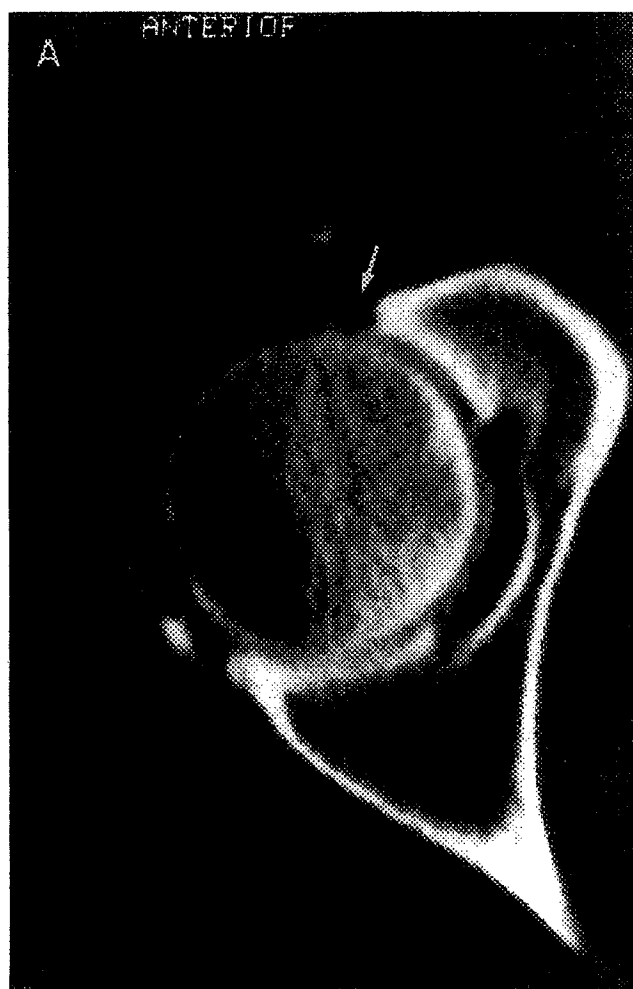


FIG 7. A 42-year-old man with chronic anterior right hip pain following a twisting injury. (A) Arthro-CT scan shows tearing of the anterior labrum, identified by the presence of contrast within the substance of the labrum [Arrow]. (B) Arthroscopic view of the right hip from the anterolateral portal showing a chronic tear [Arrow] of the anterior labrum.

hip such as with a dashboard injury (2 cases). These observations more closely parallel those of Fitzgerald in whose series 45 of 49 were located anteriorly.

Investigative Studies

Thus far, the author's experience with all imaging techniques used to discern labral lesions has been similar to the Japanese experience with arthrography. Arthrography, arthro-CT scan, and MRI are all often unpredictable in their ability to discern acute labral tears. Occasionally, they will clearly define a lesion (Figs 7 and 8), but frequently, they are plagued by false-negative results.

The seeming contradiction between the Japanese experience with arthrography and that of Catterall can be explained by several factors. Nishina's article is inconsequential in this discussion because his arthrographic findings were never correlated with the find-

ings at surgery. Although Catterall reported that all labral tears in his series were discerned by arthrography, 2 of the 11 were only discerned on retrospective review once the tear had been surgically described. Perhaps more importantly, arthrography with an AP "radiographic projection presents a two-dimensional picture best capable of seeing a labral tear only where the labrum is oriented in cross-section, specifically the lateral portion. Because labral anomalies associated with acetabular dysplasia and lateral uncovering of the femoral head would be expected to be most pronounced in the lateral portion of the labrum, this would explain why these lesions are so readily discernible on arthrography. This is in contrast to the Japanese experience where most of their tears were positioned in the posterior part of the acetabulum, or in the author's experience where many of these tears reside anterior or anterolateral and thus might not be as readily de-

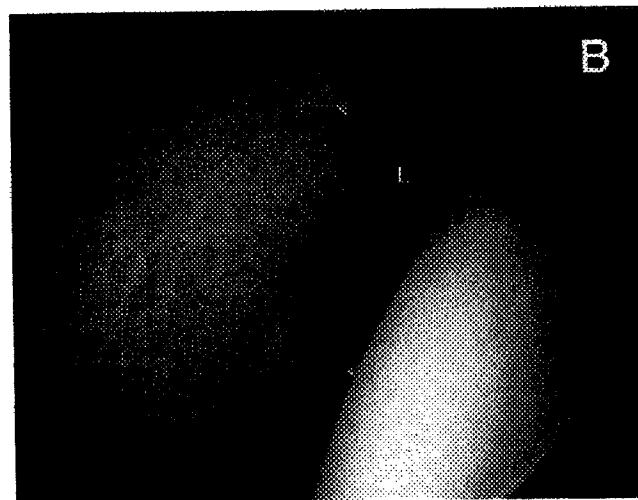


FIG 8. An 18-year-old man with recalcitrant right hip pain following a twisting injury playing basketball. (A) High-resolution MRI was obtained using a shoulder coil shows evidence of tearing in the labrum [Arrow]. (B) Arthroscopic view of the right hip from the posterolateral portal showing the area of traumatic detachment involving the anterior labrum [L]. The presence of granulation tissue [Arrow] highlights the attempted healing response.

ected by arthrography. Fitzgerald found arthrography to be quite reliable in diagnosing labral tears, even in the anterior location. However, 41 of the 49 tears consisted of a separation of the labrum from the articular surface of the acetabulum. It would be expected that arthrography discerning contrast in this cleft would be much more sensitive than defining a tear limited to the substance of the labrum. Again, caution should be used when distinguishing between traumatic separation and the normal anomaly that has been described here. This distinction is not always clear. One must keep in mind a clinical presentation and symptoms that are consistent with the lesion identified. Additionally, hemorrhage in association with acute injuries or granulation tissue reflecting an attempted healing response with chronic injuries may help distinguish a traumatic lesion from normal variations.

Although the gross anatomic appearance of the acetabular labrum has long been well described, the understanding of its arthroscopic and imaging appearance is

still in its infancy. Arthroscopically, surgeons are still learning to appreciate its normal appearance, normal variations, and pathological lesions. Secondly, this arthroscopic information will enhance the interpretive skills for various imaging studies. So, currently, we must learn how to manipulate the available technology to our advantage with combinations of contrast or enhancement, CT, and MRI.

The decision on which investigative study to obtain is individualized to each clinical situation as well as the resources available. Arthrography, despite its limitations, is still an appropriate consideration and is probably most dependent on the experience of the interpreter. Chevrot et al.¹⁹ apparently have been quite sensitive in the ability to discern labral fissures, although many of these were reported in conjunction with degenerative changes about the hip. It is probably less common that investigative studies are ordered when there is already radiographic evidence of degenerative disease. Usually, when searching for labral

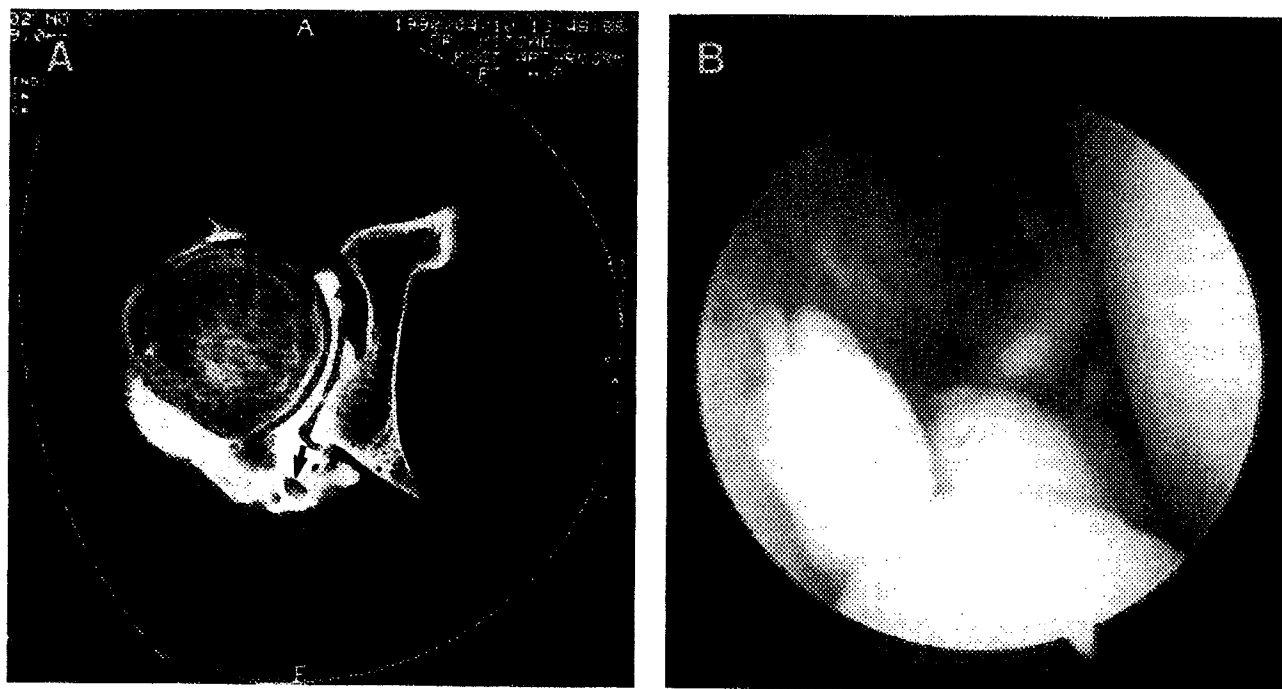


FIG 9. A 16-year-old boy with painful catching of the right hip 2 years after closed treatment of an acetabular fracture. (A) Double-contrast arthro-CT scan reveals multiple cartilaginous loose bodies, characterized by the filling defects seen posteriorly at the bottom of the picture (arrow). (B) Arthroscopic view of multiple loose bodies.

tears, it is in light of normal radiographic studies and the challenge is to determine that there really is some type of process occurring within the joint.

Arthrography or double-contrast arthrography followed by CT is certainly the study of choice for discerning radiolucent loose bodies and can be sensitive to labral tears (Figs 7 and 9). However, when ordering this study, one must be aware that it precludes an adequate plain arthrogram because the concentration of contrast must be much less to obtain a good CT study.

MRI may have the greatest impact on imaging techniques and interpretation (Fig 8). Current research suggests that gadolinium-enhanced MRI may provide appreciably better visualization of the labrum, but is as yet unreported. It is also important to equate the arthroscopic findings with the findings of the imaging studies to enhance the interpretative skills regarding these studies. Currently, MRI is often obtained in the course of the diagnostic workup of a patient with recent onset of symptoms suspected of being labral in origin. This study may not be so much to discern a labral tear, as to rule out the potential presence of stage I (preradiographic) avascular necrosis of the femoral head. Although a recognized incidence of labral lesions is being appreciated, the prevalence of avascular necro-

sis is probably still greater, and one must always be careful not to develop tunnel vision focusing on a single diagnosis.

Radionuclide bone scanning may occasionally have a role. Although it is useless in studying the labrum, it may help to rule out or discern other associated conditions including stress fracture, avascular necrosis, subchondral impaction injuries, or, occasionally, a degenerative or inflammatory process. Its application may overlap with uses of MRI. Although it is slightly more invasive and less specific, it is much less expensive.

Currently, the diagnosis of symptomatic labral lesions in the presence of normal radiographic findings is principally a diagnosis of exclusion. When considering the role of arthroscopy, the principal goal is to assure, as completely as possible, the intra-articular (or intracapsular) origin of the symptoms, which often is a labral tear or some other lesion such as a chondral fragment that may potentially be amenable to arthroscopic intervention. In the author's experience, the most conclusive way to discern an intra-articular origin is a fluoroscopically guided intra-articular injection of anesthetic characterized by temporary alleviation of symptoms. Fitzgerald has also commented on the effectiveness of this useful provocative test. Again, how-

ever, the investigator is forced to choose which aspect of a study is most important. For this type of injection, only a couple of milliliters of contrast is used to assure an intracapsular position reserving adequate volume for installation of 8 to 10 mL of bupivacaine. Allowing for adequate anesthetic, this solution is often too dilute for reliable arthrography or arthro-CT. For older patients with evidence of degenerative disease, concomitant instillation of a solution of corticosteroid may potentially serve as a therapeutic maneuver to provide relief from the degenerative symptoms.

Arthroscopy

Finally, with regard to surgical intervention, arthroscopy has been found to be effective in both the assessment and instrumentation of labral pathology. Contrary to Fitzgerald's impression, the author has found that the entirety of the acetabular labrum can be effectively visualized and torn portions debrided with proper portal placement. As noted by Fitzgerald, arthrotomy for labral debridement is a formidable procedure and requires dislocation of the hip. In 45 patients treated with this open technique, 15 required a second surgical procedure directly related to the arthrotomy. One patient also required a second arthrotomy for recurrent tearing and there was one case of thromboembolic disease with pulmonary embolus.

CONCLUSIONS

Labral lesions represent an increasingly recognized cause of disabling mechanical hip pain. These lesions have been associated with major trauma such as dislocation of the hip and also with acetabular dysplasia. It is now recognized that symptomatic labral tearing can occur with lesser degrees of twisting injuries and degenerative tearing may be present even in light of a normal radiographic picture.

The diagnosis is often elusive, but can frequently be discerned by a thorough clinical evaluation including history and physical examination and appropriately directed investigative studies. Often, it is a diagnosis of exclusion to rule out other extra-articular sources, such as referred symptoms, various snapping hip syndromes, stress fracture and avascular necrosis.

Arthroscopy has a recognized role in the assessment and treatment of labral lesions. One must proceed cautiously as we continue to learn to interpret the arthroscopic appearance of the anatomy. However, in selected cases, arthroscopic debridement of labral tears

can result in significant improvement on intermediate follow-up. The long-term consequences are as yet unknown. Labral lesions can also occur in conjunction with, or subsequently lead to, degenerative disease.¹⁵ Labral debridement in the face of degenerative changes may still result in moderate improvement, but the prognosis is usually more dependent on the extent of underlying arthritis. Whether or not arthroscopic management of labral lesions will allay the subsequent development of degenerative disease is unknown. Also, according to Catterall's work, isolated excision of a torn labrum by open techniques in the face of significant dysplasia is ineffective.

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