Bone Scintigraphy in Acetabular Labral Tears

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Background: Acetabular labral tears are an increasingly recognized cause of hip pain in young adults with hip dysplasia and older patients with degenerative disease of the hips.

Methods: The authors analyzed retrospectively bone scintigraphy in 27 patients with acetabular labral tears diagnosed by MRI/arthroscopy. Analysis was also made of scintigraphy in 30 patients without labral tears being investigated for other causes of hip pain for comparison.

Results: Patients with labral tears had hyperemia of the superior or superomedial aspect of the acetabulum and increased delayed uptake in either a focal superior pattern or in an "eyebrow" pattern of a superomedial tear. This pattern was not seen in any other sources of hip pathology.

Conclusion: Uptake in the superior or superomedial aspect of the acetabular rim is characteristic of a labral tear. Absence of this pattern carries a high negative predictive value for the diagnosis.

Key Words: hip, acetabular labral tear, scintigraphy, arthrography, arthroscopy

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Acetabular labral lesions are a cause of significant hip pain in young adults[1,2] and older patients with degenerative joint disease.[3] There is, however, no specific historical event that leads to suspicion of the diagnosis other than antecedent trauma such as dislocation of the hip.[1] Clinical suspicion of the diagnosis may be heightened in the setting of hip dysplasia. There is little in the scintigraphic literature that deals with the issue other than a small number of case reports.[4,5]

Although MRI has been used increasingly as the first-line cross-sectional imaging test, its use for assessment of the acetabular labrum without arthrography has shown poor sensitivity (30%) and accuracy (36%).[6] MR arthrography is required for a definitive imaging diagnosis, leading to an incremental sensitivity of 90% and accuracy of 91%.[6] Arthroscopy also has a high rate of diagnosis and the potential to allow surgical intervention at the same time.[7] It is, however, invasive and more technically demanding in the hip than at other sites.[8] We present the results of bone scintigraphy in a series of patients with acetabular labral tears that allows a simple screening test before either MR arthrography or arthroscopy

METHODS

Patients

All patients with a diagnosis of acetabular labral tears were extracted from an extensive database of patients who had undergone hip arthroscopy and or MRI for hip pain (group 1). All patients had also undergone 3-phase bone scintigraphy of the hips. Thirty consecutive patients with hip pain resulting from causes other than acetabular labral tears on the basis of arthroscopy/MRI were also extracted for comparison of the scintigraphic patterns of uptake (group 2). Group 1 patients (n = 27) were comprised of 2 demographic populations, one with an average age of 28 years (n = 17; range, 22–41 years) and one with an average age of 69 years (n = 10; range, 58–79 years). Patients in group 2 had an average age of 52 years (n = 30; range, 24–78 years).

Technique

MRI

Patients were scanned in 3 different 1.5-T machines with acquisition of T1- and T2-weighted and fat-suppressed multiplanar images with dedicated hip coils. A proportion of patients was scanned after either intravenous or intraarticular injection of 10 to 15 mL dilute gadopentetate dimeglumine (Magnevist, Berlex, Wayne, NJ).

Arthroscopy

Arthroscopic studies were obtained under general anesthesia as described elsewhere,[8] with the leg in distraction.

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Scintigraphy

Three-phase studies were obtained after the intravenous injection of Tc-99m MDP in doses ranging from 750 to 1000 MBq. Delayed images were obtained with a high-resolution parallel-hole collimator fitted to a single or double-headed gamma camera (General Electric MPR or Millennium, Milwaukee, WI). Planar images of the pelvis were obtained for 7 to 10 minutes in the anterior and posterior projection, and the index hip was imaged with magnification (1.33–2.0) in the same projections. Images were reported from hard-copy film by an experienced nuclear medicine physician.

RESULTS

Group 1

Of the 27 patients with a scintigraphic diagnosis of acetabular labral tears, 2 patients had osteochondral lesions of the acetabulum, leading to false-positive reports. Both cases were in younger patients with steep acetabular angles (center edge angle $< 20°$). Both showed focally increased uptake in the superomedial aspect of the acetabulum. The diagnosis of labral tears was obtained in 15 patients by arthroscopy/MRI and in 10 by MRI (arthrography in 7) alone. No attempt was made to assess sensitivity/specificity of scintigraphy because the patient group was selected to evaluate the predictive power of the test. Most cases of labral tears showed detachment of the labrum from the underlying subchondral bone (Fig. 1) and/or disintegration, which was most commonly seen in degenerative disease (Figs. 2 and 3).

All cases correctly diagnosed as labral tears had hyperemia in the blood pool phase and increased uptake in the superior aspect of the acetabulum. This could be focal or extended in an "eyebrow pattern" from the superior to medial edge of the acetabulum (Fig. 4). Two patients with acetabular dysplasia had osteochondral fractures of the femoral head in addition to labral tears (Fig. 4A).

Group 2

None of these patients had evidence of labral pathology on either arthroscopy or MRI. Diagnoses varied from stress fractures (n = 12) to bursitis (n = 8), tendinitis (n = 4), arthropathy/synovitis (n = 3), synovial chondromatosis (n = 1), and no identifiable cause (n = 2). None of these patients showed the same scintigraphic pattern of focal uptake in the superior acetabulum or the "eyebrow" extension of uptake. Several patients with fractures or arthropathy/synovitis showed diffuse increase in uptake throughout the hip but did not demonstrate the focal pattern of uptake.

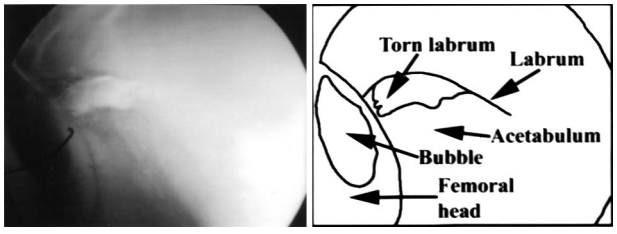

FIGURE 1. Arthroscopy of labral tear. The arthroscopic photograph shows fraying of the torn edge of the labrum. The orientation of the photograph and key structures are indicated by the line drawing.

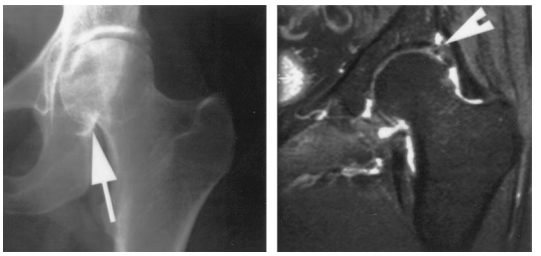

FIGURE 2. Degenerative labral tear. The plain film shows acetabular sclerosis, joint space narrowing, and formation of an osteophyte at the inferior edge of the femoral head (arrow). The fat-suppressed MR image shows joint effusion and disintegration of the acetabular labrum with separation of the labrum from the acetabular rim (arrowhead).

DISCUSSION

The acetabular labrum is a rim of fibrocartilaginous tissue attached firmly to the rim of the acetabulum. It is a

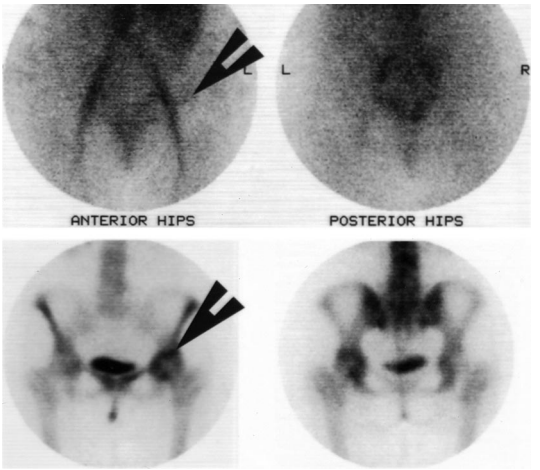

FIGURE 3. Bone scintigraphy of the patient in Figure 2. Blood pool images show hyperemia in the region of the superior acetabulum (arrowhead) and along the synovial reflections of the right hip. The delayed images show increased superomedial uptake in the "eyebrow" pattern (arrowhead) corresponding to the torn labrum. There is also more diffuse uptake in the hip and along the synovial reflections consistent with synovitis and background changes of degenerative disease. Note the focal uptake in the inferior aspect of the right femoral head corresponding to the osteophyte evident in the plain film.

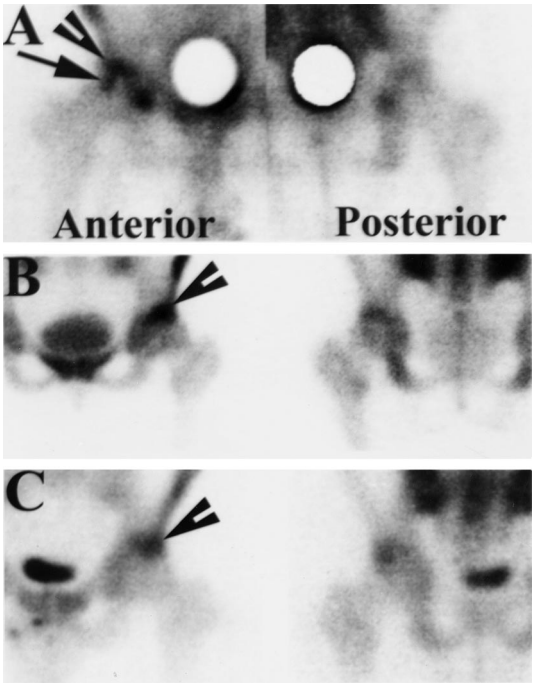

FIGURE 4. Examples of labral tears. (A) "Eyebrow" pattern of uptake corresponding to an anterosuperior labral tear (arrowhead). There is also a femoral head osteochondral fracture (arrow) in association with the steep acetabular angle of hip dysplasia. (B) "Eyebrow" pattern of uptake of an anterosuperior labral tear. (C) Focal uptake in a tear of the superior labrum.

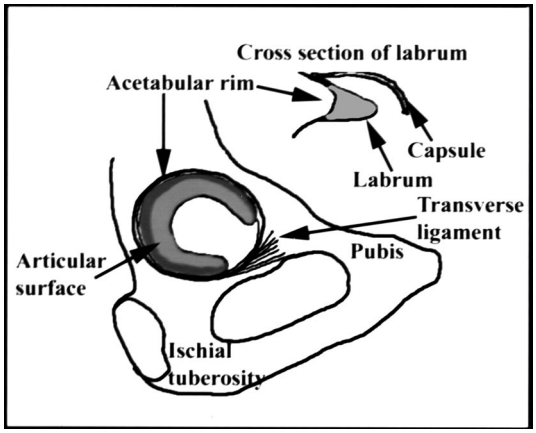

FIGURE 5. Anatomy of the acetabulum with the femoral head removed. Note the close association of the acetabular labrum with the articular cartilage of the hip. The cross-section through the acetabular rim demonstrates the triangular shape of the labrum and its association with the joint capsule.

continuous structure that deepens the cavity of the acetabulum and bridges the acetabular notch as the transverse ligament. The labrum is triangular in cross-section, with the base applied to the acetabular rim and the apex being the free margin (Fig. 5). The articular cartilage of the acetabulum extends to the edge of the labrum but not beneath it, unlike the glenohumeral joint.[9] The joint capsule attaches to its external edge, creating a potential recess between the capsule and labrum. There are a number of variants in the anatomy of the labrum, including complete absence or attenuation of the labrum.[10]

The major form of pathology affecting the acetabular labrum is acute trauma resulting from dislocation or subluxation, which is more common in dysplastic hips and chronic degeneration.[11] Patients with dysplastic hips who experience acute, traumatic dislocation/subluxation may also sustain osteochondral injuries of the femoral head (Fig. 4A) and acetabulum,[12] as did several patients in group 1. There are no large studies that examine the prevalence of labral tears as a cause of hip pain, because increasing clinical awareness of the pathologic entity is a recent phenomenon triggered by increasing use of MRI arthrography and hip arthroscopy.

MRI is being used as a first-line method of cross-sectional imaging in the assessment of hip pain in numerous settings. However, conventional MRI is both insensitive and inaccurate in the diagnosis of acetabular labral tears.[6] One of the reasons postulated is the presence of a redundant joint capsule that abuts the labrum and reduces its discernibility in the absence of joint fluid.[6] With increased fluid from an effusion or with instillation of intraarticular contrast material, there is greater distension of the capsule and increased contrast resolution of the labrum. Furthermore, MRI studies in asymptomatic volunteers have shown some high signal intensity at the base of the labrum in more than 50% of cases.[13] Explanations have ranged from early degenerative change[9] to normal variation at the articular cartilage–labral junction[10] to the presence of a fluid-containing sulcus between the labrum and capsule, as in the shoulder.[10] These vagaries have led to the use of MRI arthrography to establish the diagnosis of labral tears with higher sensitivity and specificity.[6,9,14]

Little scintigraphic literature has been generated on the subject of acetabular labral tears,[4,5] again because of a lack of clinical awareness, until recently. Two patterns of uptake were found in group 1 patients, being of focal uptake in the superior aspect of the labrum and extending in an "eyebrow" pattern from the superior to the anteromedial aspect of the acetabular rim. The pattern of uptake would correspond to the common sites of labral tears being superior and the "eyebrow" corresponding to the anteromedial aspect of the labrum. This was distinct from the diffuse changes seen in arthropathy/synovitis. The sites of labral pathology correspond to the maximal sites of stress in the acetabulum resulting from the force vector from the femoral head maximally loading the acetabulum superiorly and anteromedially.

All cases of symptomatic labral tears were associated with the focal pattern of uptake and none of the other causes of hip pain manifested this pattern. The appearance confers a high and reliable negative predictive value of scintigraphy for clinically important labral tears. It can serve as a good screening test before MRI arthrography or arthroscopy.

CONCLUSION

We present a retrospective series of patients with acetabular labral tears that demonstrates a specific scintigraphic pattern of uptake in the superior and anteromedial rim of the acetabulum. A bone scan that does not have this pattern of uptake carries a high negative predictive value for the absence of clinically significant labral pathology. The positive predictive value of the scintigraphic study is being evaluated prospectively.

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