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Research Paper Review

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Examination of Acetabular Labral Tear: A Continued Diagnostic Challenge

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ABSTRACT

Acetabular labrum tears (ALT) are present in 22-55% of individuals with hip or groin pain. Tears can occur as a result of trauma or degeneration and are markedly associated with femoral acetabular morphological variations. An ALT can lead to biomechanical deficiencies and a loss of stability to the coxafemoral joint due to the labrum serving as a stabilising structure of this joint. The diagnosis of ALT is complex and multidimensional. Although tremendous improvements in diagnostic utility for ALT have occurred in the past 25 years, there are few patient history, clinical examination and special test findings that are unique to the condition. Imaging methods such as MRI, CT and ultrasonography have demonstrated reasonable accuracy, but not at a level that allows use as a stand-alone measure. Outcomes measures that focus on functional limitation or that are used to measure recovery should envelop the complexities of the condition and be captured using both self-report and physical performance measures. Only when patient history, objective testing, clinical examination special testing and imaging are combined can a clinician fully elucidate the multidimensional diagnosis of ALT

ANALYSIS

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Background Information
The hip complex creates a very challenging clinical diagnostic situation, since pain in the hip region is often difficult to localize to a specific pathological structure (this can be said for many structures and regions in the body!). The acetabular labrum is one possible hip structure that can be injured. In fact, it is estimated that between 22-55% of individuals with groin or hip pain actually have an acetabular labral tear (ALT). Currently, patient history, clinical examination findings, MRI, MR arthrography (MRA), CT arthrography, and diagnostic anaesthetic intra-articular

injection are proposed as helpful methods for diagnosing painful conditions resulting from intrinsic hip pathology. Even with all these tools, the diagnosis of intra-articular hip conditions remains difficult. Further, most manual medicine providers have limited access to these types of diagnostics, so we must rely on our clinical history and examination skills to arrive at a diagnosis. With this in mind, the purpose of this paper was to examine the current evidence and provide a systematic approach based on the evidence for the examination of patients with suspected ALT.

Summary

Anatomy, Biomechanics, Epidemiology & Mechanism of Injury

The acetabular labrum is a fibrocartilaginous structure that lines and supports the hip joint. Blood supply to the labrum enters through the hip capsule, and supplies the outer 1/3 of the structure. Free nerve endings are most densely located in the superior and anterior portions of the labrum. Since this is the area with the highest concentration of nerves, this area in particular is a suspected pain-generating structure.

The labrum itself increases the hip's articular surface area by 22%, and is believed to create a seal in the hip joint. It is believed to be stressed by compressive loads and extremes of hip motion (1-3). It is thus theorized that damage to the labrum may compromise its ability to enhance joint stability and load distribution.

Acetabular labral tears (ALTs) are very common, as prior research has shown 96% of cadaver hips to have this injury, with 74% of the tears located in the anterio-superior quadrant of the labrum (9). However, many times, this injury is asymptomatic. Conditions such as femoral acetabular impingement (FAI), labral disruption, chondral lesions or combinations therein are inter-related and are part of a continuum of degenerative joint disease in the hip.

Five Categories of ALTs

1. *Traumatic*: those with an identifiable mechanism of injury/history, with potential acetabular trauma.
2. *Congenital*: in the presence of acetabular dysplasia.
3. *Degenerative*: radiographic evidence of degenerative changes.
4. *Capsular laxity*: global laxity (as in systemic connective tissue disorders) or focal rotational laxity, which is known to happen with sports such as golf, hockey and baseball.
5. *Idiopathic*: those related with femoral acetabular impingement and other bony abnormalities.

Imaging & Clinical Evaluation

Subjective History (Signs and Symptoms)

- Anterior groin pain that worsens with prolonged standing, sitting or walking.
- A history of groin pain has a sensitivity ranging between 96-100%.
- Pain from ALT can refer to the buttocks and anterior thigh.
- Symptoms such as clicking, giving way and hip pain are commonly associated with cartilage defects and underlying ALT, and have a reported sensitivity of 100%, and specificity of 85%.

Outcome Measures

- No conclusive evidence supports a single patient-reported questionnaire evaluating patients undergoing hip arthroscopy.
- The Hip-Outcome Score has the highest positive rating for internal consistency, construct validity, agreement responsiveness and interpretability, according to a recent systematic review (4).
- Recently, the 33-item tool named the International Hip Outcome Tool (iHOT-33), was suggested as the primary outcome measure for ALT patients due to its development following rigorous methodology and large sample sizes. This questionnaire uses visual analogue scale response format and is completed by the patient through a computer. A shorter version has also been developed, with very similar characteristics to the original, losing very little information. The short version has been suggested for use for an initial assessment and post-

operative follow-up in clinical practice (5).

- The Copenhagen Hip and Groin Outcome Score has been suggested for the assessment of symptoms, activity limitations, participation restriction and quality of life in those with long term injuries, in individuals who are young-to-middle age and active.

Diagnostic Imaging

- Imaging should be used to confirm clinical findings, and should not be used in the absence of appropriate signs and symptoms.
- Magnetic resonance imaging (MRI) is more sensitive in detecting avascular necrosis, non-displaced fracture (i.e. stress fractures) and osseous lesions.

Radiographs:

- Imaging of a painful hip should begin with plain films, and should include a minimum of weight bearing AP projection of the pelvis and the lateral projection of the symptomatic hip. Frog leg lateral, Dunn lateral and modified Dunn lateral projections are also useful.
- Films should be assessed for abnormal morphology of the acetabulum and femoral head, most frequently to determine whether or not the patient has an anatomical predisposition to FAI (see below) or acetabular dysplasia. Alternatively, the radiographs can reveal advanced osteoarthritis, femoral head avascular necrosis, fracture and other osseous lesions.
- Briefly, FAI is regarded to cause painful symptoms due to the abnormal morphology of the hip, either on the side of the femur (cam morphology: where there is a asphericity of the femoral head-neck junction, which more common in young males) or acetabulum (pincer morphology: where there is abnormal coverage of the proximal femur by the acetabulum, which is more common in older females), or both. The most common pathomorphology is a mix or combination of both the cam and pincer types. These pathomorphologies create a scenario where the femur and acetabulum abnormally contact or abut one another during normal or extreme ranges of motion.
- It is not unusual to see small round or ovoid lucency, or cluster of lucencies, with thin sclerotic margins, typical of focal fibroblastic changes. These changes are also called synovial herniation pits, or Pitt's pit. These are thought to be due to a focal intrusion of synovial fluid or intraosseous ganglia created during repeated episodes of abnormal contact between the acetabulum and the femur, and are more commonly seen with pincer type deformities.
- Advanced cartilage loss of the hip predicts an unfavorable outcome of FAI surgery, and necessitates a total-hip arthroplasty in many cases. Subchondral cysts in the acetabulum or the femoral head generally means that there is overlying high grade chondral loss and is important to note when reading plain films. Additionally, it is important to note if the joint space width is 2mm or less, as this is an indication of advanced chondral loss, and is greatly associated with the eventual need for total-hip arthroplasty.

MRI:

- This modality provides a high level of soft tissue contrast, giving practitioners a great visualization of the acetabular labrum. They are most commonly performed with intra-articular contrast material (MRA).
- ALTs are diagnosed when a signal is present at the base of the labrum, or within the labrum itself, if there is a displaced flap of the labral tissue, or if there is an irregular contour of morphology of the labrum itself.
- Pathognomonic of a labral tear is a paralabral cyst, characterized by a small collection of fluid communicating with the labrum or with the cartilage-labral junction.

Multidetector CT:

- Needs to be performed with intra-articular contrast to outline the articular surfaces and labrum, as it has a much lower soft tissue contrast resolution than MR, but at the same time has much higher spatial resolution.
- This is usually performed in individuals with catastrophic injuries and in those implanted with metallic-based devices, such as pacemakers.

- While scarcely used, this modality is great at detecting ALTs. Studies evaluating cartilage loss show that it is as good, if not better, than MRA.

Patient Observation

- As these conditions are common in those with ALT, individuals suffering from coxofemoral synovitis or inflammation may present with their hip in a flexed, slightly abducted and externally rotated position, as this position slacks the hip joint capsule. These patients also will likely avoid hip extension during gait, as this position places the anterior capsule at its greatest tension while placing the greatest joint force on the anterior labrum during gait.
- Combined motions of hip flexion and adduction can cause the greatest amount of strain on the overall labrum.
- Patients with synovitis may find sitting in low chairs, stepping up with the involved leg or squatting very painful.
- Decreased gluteal muscle performance may be found in those with ALT, which makes powerful movements such as standing out of a chair or sprinting very difficult (please see one of Dr. Stuart McGill's latest studies reviewed here on RRS explaining why this phenomenon occurs – see Related Reviews below).

Patient Screening

- Pain in the hip can be referred from a number of anatomical areas, such as the lumbar spine, pelvic girdle, abdominal viscera and peripheral nervous system.
- Lumbar radiculopathy, particularly in lumbar nerve roots 1 and 2 can create pain in the posterior hip, iliac crest and anterior thigh/groin.
- Ask the patient if there is a history of cancer, such as prostate or breast cancer, as these are associated with metastasis to the lumbar spine or hip joint.
- Pain which coincides with menstruation could be due to symptomatic ovarian cysts and/or endometriosis. On the other hand, pain that radiates to the testicles in men can indicate urogenital pathology.
- Ask about a history of surgery on the hip, abdomen or pelvis, insidious onset of pain, pain that is unchanged by position of movement, symptoms related to menses, acute hip pain occurring with fever, malaise, night sweats or weight loss. Also, ask about intravenous drug use, compromised immune system, corticosteroid exposure or alcohol abuse, as these are predisposing factors for AVN.
- Rule out fracture or stress fracture using the patellar-pubic percussion test, which has demonstrated 95% sensitivity and 86% specificity.

Ruling Out Lumbar Spine & Pelvic Pathology

- *Radiculopathy/discogenic-related pathology*: SLR, Slump test, peripheralization with flexion, centralization with extension.
- *SIJ and pelvic girdle dysfunction*: normally a battery of tests will be utilized for this region – examples include the Thigh Thrust, Thomas, FABER, Dorsal ligament palpation, etc.

Motion Tests

- Reduced hip ranges of motion in flexion, internal rotation and/or adduction are commonly seen.
- In younger athletes who are suspected to have slipped capital femoral epiphysis, the clinician must observe for Drehmann's sign: obligatory hip external rotation and abduction with hip flexion.
- Assessment of hip joint mobility is also suggested. Hip anteroposterior glide and lateral glide are of primary importance.
- Functional limitations can be correlated with hip joint range limitations. For instance, hip flexion ROM deficit has been shown to explain up to 95% of the variability in the results of star excursion balance testing (6).

Muscle Performance Testing

- Manual muscle testing (MMT) and performance testing is important in the clinician's assessment. Of particular importance are the gluteus medius, minimus and maximus (hip extension and abduction) and psoas (hip flexion), as muscular deficits and the subsequent increase in anterior hip joint forces resulting from dysfunction of these muscles could lead to ALTs.
- Patients with gluteus medius weakness may demonstrate a positive Trendelenberg's gait pattern, which may lead to increased compressive forces in the involved hip as a result of the increased length of the muscle's lever arm.

Special Tests & Orthopedic Testing:

- The majority of these tests attempt to replicate the primary mechanism of ALT (flexion and twisting).
- *Thomas test* has the strongest diagnostic accuracy, as it replicates the position of greatest force on the hip joint capsule (extension), as well as the position where the majority of ALT are located (anteriorly). While this test is traditionally used to find iliopsoas muscle tightness, here the clinician is aiming to reproduce the patient's painful click or groin pain, which are indicative of intra-articular pathology (i.e. loose bodies, or degenerative/arthritic changes of the hip, or ALTs).
- *Flexion-Adduction-Internal Rotation (FADDIR) test*: this test replicates the motion most likely to create mechanical abutment of the femoral head against the acetabulum. A negative result on this test provides greater value than a positive result, as it demonstrates greater sensitivity than specificity.
- Other tests, such as the *scour test, internal rotation with over pressure, resisted SLR, internal rotation-flexion-axial load compression test and the posteriorinferior labral test* have all been described elsewhere (7,8). These all demonstrate greater sensitivity than specificity. However, none of them demonstrate likelihood ratios high enough to alter post-test probability of ALT more than a small degree.

Palpation

- It is important to palpate the lumbar spine, pelvis and hip structures whilst examining a patient. While it is typical for an ALT patient to suffer from pain referral to the groin, buttock or lateral trochanter, generally these areas are non-tender to palpation unless there is extra-articular involvement.
- It is also important to palpate the psoas major, as it is a potential major contributor to ALT pathology.

Physical Performance Measures (PPM)

- Most PPMs investigated to date have quite a few limitations and have poor criterion validity as compared to more widely used means of testing (i.e. self-report measures and special tests).
- While they have been proven to be highly reliable when used for patients with knee or ankle pathologies, the validity of their use in the hip is still questioned.
- If a clinician notes major dysfunction on PPMs such as squatting, star-excursion balance test, single leg squat etc., the tests previously described should be employed to investigate further.

In conclusion, diagnosing acetabular labral tears is incredibly difficult, and requires a dedicated examination of patient history, pertinent objective findings and adequate clinical tests, along with conformational imaging. Unfortunately, no single detail in the patient history or clinical examination is a sufficient stand-alone to diagnose ALT. Clinicians should also be aware of the fact that there is a large correlational relationship between ALT and FAI, and both must be considered should one be present.

Study Methods

The article did not detail any methods the authors used to collect data or search for articles. While this is a review, no meta-analysis or other statistical analysis was performed.

Study Strengths / Weaknesses

Strengths

- This article is a detailed and well-referenced depiction of how to diagnose this complex condition.
- In spite of the many tests and different testing procedures, the authors conclude, rather accurately so, that there is no one test, imaging modality or historical detail that can lead a clinician to the diagnosis of ALT.

Weaknesses

- No statistical analysis was performed.
- No article inclusion or exclusion criteria were detailed.

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