

Predictors of Clinically Suspected Intra-articular Hip Symptoms and Prevalence of Hip Pathomorphologies Presenting to Sports Medicine and Hip Preservation Orthopaedic Surgeons

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Purpose: The first purpose of the study was to evaluate the prevalence of various radiographic parameters and pathomorphologies for patients presenting with the diagnosis of hip pain. The second purpose of this study was to identify those pathomorphologies and radiographic parameters that were predictive of clinically suspected intra-articular and hip joint-related symptoms. **Methods:** A total of 998 hips (499 patients, 228 males, 271 females, mean age 38 years) presented to 2 orthopaedic surgeons with the diagnosis of hip pain. Patients were retrospectively identified as intra-articular and hip joint-related symptoms or extra-articular and non-hip joint-related symptoms based on history, examination, injection response, and diagnosis listed on clinical notes. A detailed morphologic evaluation of anteroposterior and 45° modified Dunn lateral radiographs of both hips was performed for all patients. **Results:** The presence of at least 1 finding consistent with femoroacetabular impingement (FAI) was noted in 96.6% of patients (89.9% of hips) and was bilateral in 83%. The prevalence of dysplasia was 10.6% in patients (6.7% of hips) and was bilateral in 2.8%. Cam-type morphology was more common in males ($P < .001$). Profunda and protrusio were more common in females ($P < .001$). Acetabular retroversion was more common in males ($P = .02$). Fifty-seven percent of hips (564/998) were diagnosed clinically with intra-articular and hip joint related symptoms. Cam-type FAI, mixed-type FAI, increasing alpha angle, and increasing Tönnis grade were independent predictors of clinically suspected intra-articular and hip joint symptoms ($P < .001$), whereas isolated Pincer-type morphology was not. **Conclusions:** FAI is highly prevalent (96.6%) and frequently bilateral (83%) in patients presenting to an orthopaedic clinic with hip pain. Cam-type morphology and acetabular retroversion are more frequent in men, whereas profunda and protrusio are more frequent in women. Cam-type morphology, increasing alpha angle (larger cam morphology), and increasing Tönnis grade were highly predictive of clinically suspected intra-articular symptoms, whereas isolated pincer-type morphology was not. **Level of Evidence:** Level III, case-control study.

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Femoroacetabular impingement (FAI) is an increasingly recognized pathomorphology associated with hip pain and disability. The prevalence of FAI is reported to range between 1% and 95% and varies depending on the population studied.¹⁻¹⁴ Recent studies have shown that FAI morphology can develop in response to athletic activity during childhood,¹⁵ and is present in up to 95% of young athletic patients and 87% of patients presenting with hip pain.^{2,7,8,10-12} With the high prevalence of radiographic FAI in athletes regardless of symptoms and in patients presenting with hip pain, it becomes increasingly important to define those radiographic pathomorphologies and parameters that are predictive of hip joint and intra-articular-related symptoms. Having reliable radiographic predictors for the development of hip pain might allow us to ultimately modify training and institute prevention programs for our at-risk hip patients in the future.

The first purpose of the study was to evaluate the prevalence of various radiographic parameters and pathomorphologies for patients presenting with the diagnosis of hip pain. The second purpose of this study was to identify those pathomorphologies and radiographic parameters that were predictive of clinically suspected intra-articular and hip joint-related symptoms. The hypothesis were as follows: anatomic hip abnormalities are common in patients presenting to an orthopaedic clinic with hip pain; cam-type morphology will be more common in males; global overcoverage, coxa profunda, and pincer-type morphology will be more common in females; and larger cam deformities and increasing Tönnis grade for arthritis would be predictive of intra-articular hip-related pain.

Methods

From September 6, 2007, to December 2, 2009, all patients who presented to one of 2 orthopaedic surgeons (C.M.L., M.R.S.) with complaints of hip pain were included in the study group. No patients were excluded from the study regardless of hip anatomy (FAI and dysplasia), or degree of arthritis. Demographic data including age, gender, and side were documented for each patient. Clinically suspected intra-articular and hip joint pain was also determined for each hip through retrospective chart review and documentation of a final diagnosis by one of the 2 senior authors who are both sports medicine fellowship-trained orthopaedic surgeons with extensive experience in hip preservation (C.M.L., M.R.S.). The diagnosis of intra-articular and hip joint-related pain was defined based on the following: history of groin or deep lateral hip pain; pain with passive hip range of motion; a positive anterior impingement test, FADIR test (flexion adduction internal rotation), scour test, or flexion abduction test

that re-created the patient's anterior or deep lateral hip presenting symptoms; and temporary relief with an intra-articular anesthetic injection followed by physical examination or provocative testing. Intra-articular injections were routinely used and evaluated by both senior surgeons (C.M.L., M.R.S.). Relief was simply recorded as either complete relief or definitely better (positive for intra-articular symptoms) versus minimal to no relief of pain (not consistent with intra-articular symptoms) for several hours after the injection. Injection response was recorded for the first several hours after prior corticosteroid injections and/or magnetic resonance imaging arthrograms that included an anesthetic. If the patient could not recall, did not have a prior injection, or history and examination were inconclusive, a fluoroscopic or ultrasound-guided injection was then performed followed by an attempt to re-create the patient's presenting symptom. Relief or lack thereof was then recorded as previously described. Ultimately, the above criteria and the note with the surgeon's diagnosis and impression were used to define predominantly hip joint or intra-articular pain versus predominantly primarily extra-articular hip, pelvis, or greater trochanteric pain syndrome or low back pain. The patients who did not meet the previously defined intra-articular and hip joint pain criteria were defined as extra-articular and non-hip joint-related pain. Examples of extra-articular and non-hip joint-related pain would include referred pain from spinal pathology, trochanteric pain syndrome with or without abductor pathology, sacroiliac dysfunction, athletic pubalgia or core muscle injury, myotendinous hip and pelvic pain, and various nerve entrapment disorders all of which presented without the typical pain with hip range of motion or impingement testing. These other diagnosis were simply identified as extra-articular and non-hip joint-related hip pain for study purposes and were not further evaluated individually.

All patients had an anteroposterior radiograph of both hips and lateral hip radiographs (45° modified Dunn view). All plain radiographs were evaluated and radiographic parameters recorded by one of 2 sports medicine fellowship-trained orthopaedic surgeons (D.A.B., Z.D.F.) with training in hip preservation. The orthopaedic surgeons were blinded to the patient history, examination, and final diagnosis (intra- vs extra-articular hip pain) during radiographic analysis. Radiographs were evaluated with respect to appropriate alignment, defined as a well-centered anteroposterior radiograph with symmetric obturator foraminae, the coccyx centered over the symphysis, and 0 to 2 cm between these 2 structures.^{16,17} Proper alignment was taken into account when defining the pathomorphologies. Radiographic parameters that were assessed included the lateral center-edge angle, Tönnis angle or acetabular inclination, alpha angle on both

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