Radiographic Evidence of Cam Type Femoroacetabular Impingement in Young Patients with End Stage Hip Osteoarthritis

Introduction

Femoroacetabular impingement (FAI) may contribute to the development of early onset hip osteoarthritis (OA). Cam-type FAI lesions (or pistol grip deformity) are caused by a lateral increase in the radius of the anterosuperior proximal femur. This contour deformity reduces the femoral head-neck offset resulting in decreased joint clearance and early pathological contact with the acetabular rim. With repetitive and forceful hip flexion and internal rotation, the aspherical femoral head in cam-type FAI initiates premature avulsion and delamination of the anterosuperior acetabular cartilage. A validated radiological measurement used to quantify the asphericity of the femoral head-neck junction in cam-type FAI is the alpha angle. Although the alpha angle was originally described for anterior-posterior (AP) views of the proximal femur, the alpha angle measured from cross-table or frog-leg lateral radiographs has been shown to have a higher sensitivity in diagnosing cam-type lesions. Previous clinical studies on cam-type FAI have demonstrated that higher alpha angles are correlated with more pronounced cartilage damage, greater incidences of labral trauma and impeded range of motion. Our study aims to determine if patients with early onset hip OA have a higher incidence of radiographic cam-type FAI as compared to older patients also with end-stage hip OA.

Methods

We retrospectively reviewed anteroposterior (AP) pelvis and lateral hip radiographs of 285 patients who presented to our institution for hip arthroplasty and 107 hip fracture fixation between January 1, 2006 and December 31, 2008. Patients with inflammatory arthritis, avascular necrosis of the femoral head, hip dysplasia, Legg-Calvé-Perthes disease, previous surgery and post-traumatic hip OA were excluded from study. Patients with insufficient AP or lateral radiographs were also excluded from study. Additionally, AP and lateral radiographs from 101 hip fracture patients were used as to generate control values to allow for comparison. Three cohorts were compared: 1) patients with end stage hip OA < 55 years old (N=76); 2) patients with end stage hip OA ≥ 55 years old (N=84); 3) hip fracture patients ≥ 65 years old without radiographic evidence of hip arthritis were used as controls (N=101). Alpha angles were measured on the AP pelvis and lateral radiographs by three coauthors using ImageJ 1.43 software (National Institutes of Health, USA). For patients with end stage hip OA, AP alpha angles were measured on both the hip with OA and the contralateral hip by three coauthors blinded to the diagnosis using ImageJ 1.43 software (National Institutes of Health, USA). Lateral alpha angles were measured only on the hip with OA. For hip fracture patients, AP alpha angles were measured on the non-fractured hip and lateral alpha angles were measured on the fractured hip. A one-way ANOVA with post hoc Tukey’s HSD test was used to compare the AP and lateral alpha angles for the three cohorts.

Results

The intraclass correlation coefficient (ICC) for the three coauthors measuring AP and lateral alpha angles was 0.85 and 0.86 respectively, indicating excellent inter-rater agreement. The younger hip arthroplasty patients (<55 years old; mean 45.4±7.4 yrs) with end stage hip OA were found to have the largest AP alpha angles (82.7±11.6 degrees) out of the three cohorts (Figure 1). These alpha angles were significantly larger (p<0.01) than alpha angles measured for older hip arthroplasty patients (≥55 years old; mean 68.4±8.5) with end stage hip OA (71.7±17.8 degrees) and hip fracture patients (mean age 81.8±8.5) without hip OA (52.7±10.9 degrees). Similarly, alpha angles measured from pre-operative lateral radiographs were significantly higher (p<0.01) in young arthroplasty patients (63.9±18.5 degrees) as compared to both older hip arthroplasty patients (55.5±19.0 degrees) as well as the hip fracture patient group (without evidence of hip OA) (44.4±11.4 degrees). Comparing AP alpha angles of the contralateral hips, the mean AP alpha angle for patients <55 years old with hip OA (70.8±13.2 degrees) was significantly larger (p=0.04) than patients >55 years old with hip OA (64.5±16.2 degrees) which in turn was significantly larger (p<0.01) than the unaffected side of hip fracture patients (52.7±10.9 degrees).

Discussion

Patients < 55 years old with hip OA had the largest mean AP and lateral alpha angles, significantly larger than patients ≥ 55 years old with hip OA and hip fracture patients without hip OA. These results suggest that younger patients with hip OA may have more pronounced cam-type impingement than their older counterparts and therefore function to expedite the progressive arthritic changes required to produce end-stage hip disease. With significantly elevated alpha angles measured from contralateral hips, younger (<55 years old) arthroplasty patients also possess a higher risk of developing cartilage damage and the early onset of OA on their currently unaffected side. Our study demonstrates that young patients with end stage hip OA commonly display radiographic evidence of cam-type FAI.

Significance

Establishing an effective approach to assessing which patients are susceptible to the early development of hip OA will prove to be an invaluable clinical tool. With the early recognition of cam-type lesions, surgical intervention has already been shown to protect the hip joint from progressing to advanced stages of degenerative disease.

References