Editorial

Does hip morphology predispose to femoral head osteonecrosis?

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Femoral head osteonecrosis (ON) presents in about 10% of all total hip arthroplasty (THA) patients in united states (1). There have been a variety of traumatic and atraumatic factors identified as risk factors for ON, but the etiology and pathogenesis still remains unclear. Ollivier *et al.*'s work is trying to shed a light on the anatomical associations with idiopathic ON. In this study, hip morphology was compared (obtained by CT scan) between patients who had idiopathic femoral head ON and a matched control group of patients to determine whether any observed differences could have possible associations with the disease process. In this study, there was significant differences between the two groups and found ON group to be associated with a decreased femoral neck-shaft angle of <129°, greater femoral neck anteversion (femoral neck version of >17°), less acetabular coverage (lateral center-edge angle of <32°) and less acetabular version <19° (2).

Previously there were similar orthopedic conditions which were thought to be idiopathic in nature but then there have been literature based association with certain hip morphology or alignment. For example, before the association of femoroacetabular impingement and primary hip osteoarthritis (OA) has been discussed in research thoroughly. Before that, some OAs was thought to be idiopathic or metabolic in nature (3,4).

Ollivier *et al.*'s work is extremely important to help us identify patient at risk of developing ON without clear etiology. In this study, Ollivier *et al.* discussed two important theories: mechanical one where combination of a low femoral neck-shaft angle and less acetabular coverage would theoretically lead to more focused strain on femoral head subchondral bone. The second theory is vascular, in which there is dynamic loss of blood supply to femoral head when extraosseous branches of the medial femoral circumflex artery get pinched secondary to impingement. This happens during maximal external and internal rotation. Risk factors include retroversion of the acetabulum and increased anteversion of the femoral neck.

Although this study was well conducted, it has multiple limitations; which was mentioned in the manuscript. Most important factor, which could interfere in causality studies, is the limited number of subject used in this study. It might be a good idea to conduct prospective studies of ON in countries with high prevalence of ON in population (for example South Korea) (5). Another limitation is that it examine hip CT only, missing other osseous abnormalities, which might affect the control group (no ON or osseous abnormalities).

This study would have been of greater value if CT scan of the contralateral hip were also included and assessed for morphological variation. If both sides had similar anatomical changes, then the findings might have been less useful. However, if the specific described morphology were restricted to the diseased side, this study would have stronger evidence. Also, comparison of anatomical variation between idiopathic ON with etiology-based ON worth investigating (6).

Fraitzl *et al.*'s results have good support for Ollivier *et al.*'s hypothesis, they have shown that there is a significant association between idiopathic ON and higher alpha angle in patient with nontraumatic ON (The mean α-angle was 63° for anteroposterior and 68° for lateral radiographs *vs.* 47° (P<0.0001) and 48° (P<0.0001), respectively in control patients) (7). Compared to Ollivier *et al.*'s work where they

found that combination of 3 of these 4 hip anatomical variations in morphology (lower femoral neck-shaft angle, greater femoral neck anteversion, less acetabular coverage, and less acetabular version) was found in 73% of the idiopathic ON patients *vs.* 11% of the control cohort.

Since the diagnosis of idiopathic ON is a diagnosis of exclusion, further research should focus on what criteria or testes needed. Subtle asymptomatic coagulation abnormalities could be missed if not looked for specifically (8). Assessing these minor coagulopathies in ON cohorts using certain blood or genetic testing could reduce the diagnosis of idiopathic ON.

Another future study could also include MRI imaging of the contralateral hip, before or at the early stages of ON which give us a clue when do the morphological changes of hip happen; is these morphological changes lead to ON or is it a sequel of femoral head ON.

Ollivier *et al.*'s work was essential to start of research needed in this subject, as identifying possible risk factors will help us identify patients who may develop ON. This could lead to preventative measures for what we thought to be idiopathic ON.

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Footnote

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