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Original Research Article

Abnormal ossified structures around the hip joint and its clinical implications

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ABSTRACT

Background: The hip joint is the body's second largest weight-bearing joint forms a connection from the lower limb to the pelvic girdle. It is formed by an articulation between the pelvic acetabulum and the head of the femur. Ankylosis or fusion of the joint, ossification of the adjacent ligaments and calcific tendinitis of adjacent muscles can decrease the mobility of the joint. The study was undertaken to evaluate the incidence of abnormal ossified structures around the hip joint.
Methods: This study was carried out on 228 dry human hip bones (right- 114 and left-114) and 228 dry human femur bones (right- 114 and left-114) irrespective of age and sex at Varun Arjun medical college-Banthra, UP, KMCT Medical College, Manassery-Calicut and Melaka Manipal Medical College-Manipal. All the hip and femur bones were macroscopically inspected for the abnormal ossified structures around the pelvic acetabulum and upper end of the femur. Photographs of the abnormal ossified structures were taken for proper documentation.
Results: Very rare and unusual unilateral ossified and complete fused left hip joint was noted (0.43%). Unilateral ossified acetabular labrum with ossified transverse acetabular ligament was noted in seven right hip bones (3.07%). Unusual ossified fibrous capsule on the posterior aspect of neck of femur was noted in 4 left sided femur bones (1.75%). Unusual unilateral ossified deposits near the greater trochanter and intertrochanteric line of femur was noted in nine left sided femur bones (3.94%).
Conclusions: Anatomical knowledge of ankylosis of hip joint, ossification of the ligaments and muscles tendons around the hip joint as found in the present study made this study unique such abnormal ossifications may be helpful for clinicians, radiologists and surgeons for differential diagnosis and can be implicated in the development of innovative treatments of hip joint and hip pains.

Keywords: Ankylosis, Ossification, Trendelenberg's sign, Trochanteric pain syndrome

INTRODUCTION

The hip joint is the body's second largest weight-bearing joint forms a connection from the lower limb to the pelvic girdle. It is formed by an articulation between the pelvic acetabulum and the head of the femur. The femur is the longest and heaviest bone in the human body. It consists of a proximal end, a shaft, and a distal end. The proximal end of the femur consists of a head, a neck, greater and lesser trochanters.

Muscles and ligaments around the hip joint play an essential role in the stability of the joint damage to any single component can negatively affect range of motion and ability to bear weight on the joint. The acetabular labrum is a C-shaped fibro cartilaginous structure attaches to the acetabular margin. The acetabular labrum deepens the acetabulum and increase contact between the pelvis and the femoral head. The articular capsule is strong and dense it attaches proximally to the margin of the acetabulum and transverse acetabular ligament and distally it surrounds the neck of femur and is attached, in front, to the intertrochanteric line; above, to the base of the neck; behind, to the neck, about 1cm. medial and parallel with the intertrochanteric crest; below, to the lower part of the neck, close to the lesser trochanter.

Patients with traumatic brain or spinal cord injuries, other severe neurologic disorders or severe burns or in rare genetic disorders such as fibrodysplasia ossificans progressiva may leads to formation of abnormal formation of bone within extra skeletal soft tissues, most commonly around the hips. Such abnormal ossified structure around the hip joint may leads to pain, impingement, and decreased range of motion and also leads to the compression of the neurovascular structures around the joint. Accordingly, in the present study we aimed to evaluate the incidence of abnormal ossified structures around the hip joint.

METHODS

This study was carried out on 228 dry human hip bones (right- 114 and left-114) and 228 dry human femur bones (right- 114 and left-114) irrespective of age and sex at Varun Arjun medical college-Banthra, UP, Melaka Manipal Medical College-Manipal University, KMCT Medical College, Manassery-Calicut. All the human hip and femur bones were macroscopically inspected for the abnormal ossified structures around the pelvic acetabulum and upper end of the femur. Photographs of the abnormal calcified structures were taken for proper documentation.

RESULTS

Out of 228 dry human hip bones (right- 114 and left-114) and 228 dry human femur bones (right- 114 and left-114) following types of abnormal ossified structures were noted around the pelvic acetabulum and upper end of the femur-

- Very rare and unusual unilateral ossified and complete fused left hip joint was noted (0.43%) Figure 1a and Figure 1b,
- Unusual Unilateral ossified acetabular labrum with ossified transverse acetabular ligament was noted in seven right hip bones (3.07%) Figure 2a and Figure 2b,
- Unusual ossified fibrous capsule on posterior aspect of neck of femur was noted in 4 left sided femur bones (1.75%) Figure 3,
- Unusual unilateral ossified deposits near the greater trochanter and intertrochanteric line of femur was noted in nine left sided femur bones (3.94%) Figure 4.

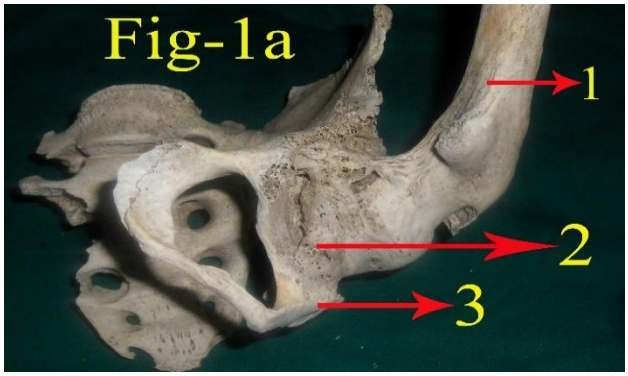

Figure-1a: showing ossified and completely fused left hip joint (ankylosis). 1-left sided femur; 2-total ankylosis of the hip joint; 3-lef sided hip bone.

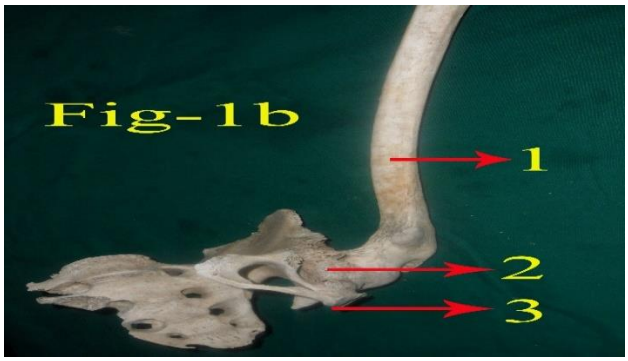

Figure-1b: Showing Total ankylosis of the hip joint. 1-Left sided femur in a reverse position (femur upper end facing downwards and lower end facing upwards); 2-Total ankylosis of the hip joint; 3-Left sided hip bone.

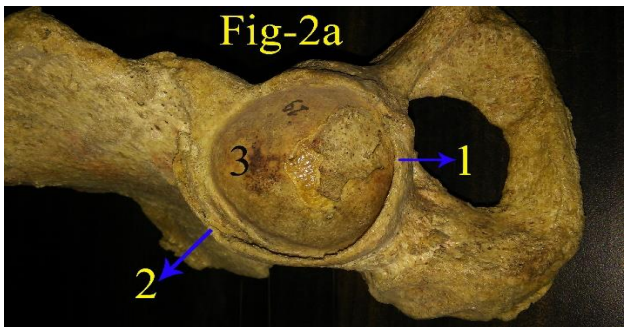

Figure 2a: Right hip bone showing ossified transverse acetabular ligament and ossified acetabular labrum. 1-Ossified transverse acetabular ligament; 2- Ossified acetabular labrum; 3-Acetabulm.

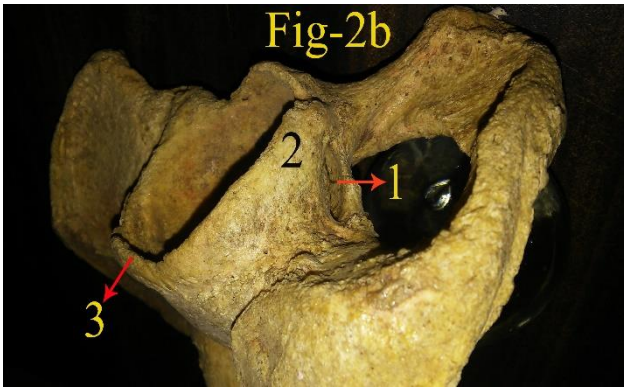

Figure 2b: Right hip bone showing ossified transverse acetabular ligament, ossified acetabular labrum and acetabular foramen. 1- acetabular foramen; 2- ossified transverse acetabular ligament; 3- ossified acetabular labrum.

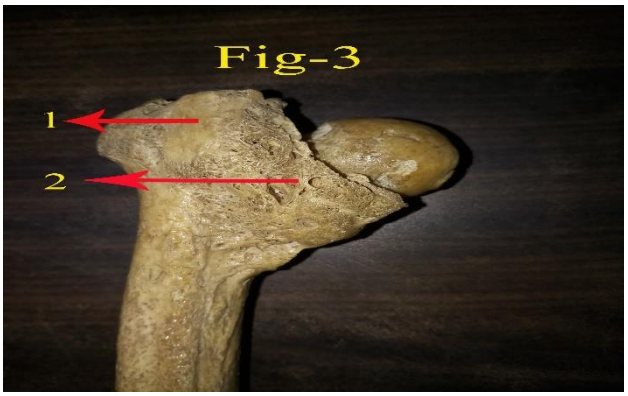

Figure 3: Posterior view of left sided femur showing ossified fibrous capsule of hip joint. 1-greater trochanter; 2-fibrous capsule of hip joint.

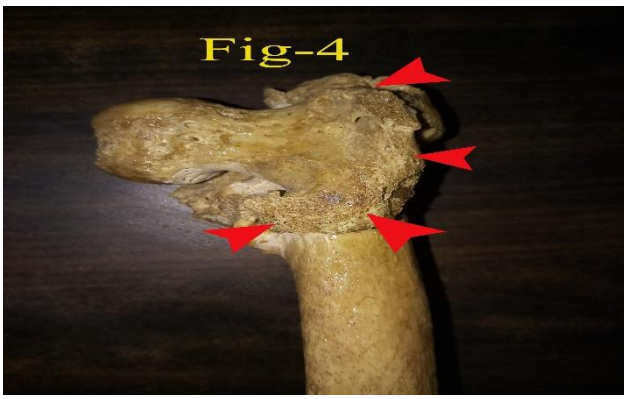

Figure 4: Anterior view of left sided femur showing ossified deposits. Arrows showings ossified deposits near the intertrochanteric line, greater and lesser trochanter of left sided femur.

DISCUSSION

Hip ankylosis is a rare entity; ankylosis is characterized by stiffness of a joint due to abnormal adhesion and rigidity of the bones of the joint, which may be the result of directly by injury or disease. Ankylosis of the hip is very difficult to treat surgically and should only be attempted by an experienced surgeon together with comprehensive pre-operative planning.[1] Abnormal formation of mature lamellar bone within extra skeletal soft tissues is called as Heterotopic ossification, pathological mechanism responsible for this has not been established. Based on the anteroposterior radiographs Brooker classified four grades of heterotopic ossification. Grade 1 represents small islands of bone within the soft tissues, grade 2 represents bone islands between the pelvis and femur with >1cm between the bone surfaces, grade 3 represents bone islands that reduce the space between the pelvis and femur to <1cm and grade 4 represents complete ankylosis of the hip.[2] Ankylosis of hip joint in patients has been presented by many authors but in our study we noted a very rare and unusual unilateral grade 4 type of ankylosis of hip joint in dry human bones.[3-8] In this unusual ankylosis the head of femur was completely ossified and fused with the hip bone with a reverse position (femur upper end facing downwards and lower end facing upwards) such ankylosis of hip joint has not been cited in the recent medical literature. Hence, knowledge of such abnormalities should be kept in mind for orthopaedic surgeons and radiologists when planning the different surgical approaches.

The acetabular labrum is a band of fibro cartilage that lines the acetabular margin and increase contact between the pelvis and the femoral head and increases stability of the joint, any anatomical or pathological modifications of the labrum may disturb the normal hip joint biomechanics. The two ends of the acetabular notch give attachment to the transverse acetabular ligament. The transverse acetabular ligament contributes to the stability of the joint by preventing inferior displacement of head of femur. Ossification or calcification of ligaments or cartilages is a well-known phenomenon in various pathological conditions which limits the movement of joints and also leads to the compression of the neurovascular structures and can cause serious implications in any surgical intervention in the region, and may lead to false neurological differential diagnosis.[9-11] Acetabular labrum ossification is not common, and I have been able to find only a few reports on, Ninomiya et al and Corten et al described ossification of the labrum originates at the subperiosteal region of the outer acetabular rim as a consequence of pre-existing femoroacetabular impingement.[12,13] Other authors have concluded that these lesions should be grouped together with acetabular osteophytes and may represent an early stage of acetabular osteophyte pathogenesis.[14,15] Rim fracture as a result of rim loading has also been implicated as a source of such ossification.[16]

The ossification of transverse acetabular ligament is a very rare interesting anatomical variation which converts the acetabular notch into a foramen also leads to the

compression of the acetabular branches of obturator and medial circumflex femoral vessels and subsequently results in ischemia of the area supplied by it.[17] A. Perumal et al reported 4.3% of complete ossification of transverse acetabular ligament the left sided hip bones.[18] Where as in our study unusual unilateral complete ossified acetabular labrum with complete ossified transverse acetabular ligament was noted in seven right hip bones (3.07%). As per our knowledge such unusual combination of ossification of acetabular labrum and transverse acetabular ligament has not been cited in the recent medical literature.

The greater trochanter is a bony prominence on the anterolateral surface of the proximal shaft of the femur, distal to the femoral neck. It serves as the insertion site for the gluteus medius and gluteus minimus. The gluteus minimus, the smallest of the three gluteal muscles, it is attached by a tendon to the anterior surface of greeter trochanter of femur. The gluteus minimus and medius abduct and medially rotate the hip joint; acting from below both muscles prevent the unsupported side of the pelvis from sagging downward during locomotion. Thereby they maintain horizontal level of pelvis while walking or running by alternate lifting of feet from the ground. Injuries and bursitis of tendon gluteus minimus muscle may leads to greater trochanteric pain syndrome. Calcific tendinitis has been reported at numerous anatomic locations, by far most commonly around the shoulder but involvement of the gluteus minimus tendon is uncommon. Jones and England reported calcification around the hip joint, but gluteus medius calcification was identified in only one case.[19] Hayes et al reported five cases of calcific tendinitis with radiographic evidence of cortical bone erosion.[20] Wepfer et al reported three cases of gluteus maximus tendinitis, apparently none of which showed bone destruction.[21] Goldenberg and Leventhal reported calcified deposits near the greater trochanter (5 to 4%).[22] Where as in our study we noted ossified deposits (3.94%) near the anterior surface of greater trochanter, along the length of intertrochanteric line and near the anterior surface of lesser trochanter of femur.

Such abnormal ossified deposits noted in our study may be due to injuries and bursitis of tendons of gluteus minimus and psoas major muscles, such calcified and ossified masses may lead to greater trochanteric pain syndrome or psoas syndrome. Calcification of tendon of gluteus minimus muscle may leads to weakness of the muscle and results in the Trendelenberg's sign. Abnormal ossified deposits near greater, lesser trochanter may also decrease range of motion and loss of strength in the hip joint. Capsular ligament of hip joint is strong and dense distally it surrounds the neck of femur and is attached, in front, to the intertrochanteric line; above, to the base of the neck; behind, to the posterior surface of neck, about 1cm. medial and parallel with the intertrochanteric crest; below, to the lower part of the neck, close to the lesser trochanter. The capsule is much thicker at the upper and anterior part of the joint, behind and below it is thin and loose. Ossification of ligaments is a well-known phenomenon in various pathological conditions but involvement of the capsular ligament of hip joint is very rare and uncommon.

In our study we presented an unusual thick ossified fibrous capsule extending from intertrochanteric crest, greater and lesser trochanter towards the head of femur where it covered posterior surface of neck of femur. Unusual capsular ligament ossification noted in this study made this study unique, such pathology may contribute to increase the prevalence of hip pain, development of osteoarthritis, decreases the range of motion and loss of strength in the hip joint. Much work remains to be done to more accurately define the varying causes of such capsular ligament ossification that may be important in determining optimal treatment and forecasting outcomes.

CONCLUSION

Anatomical knowledge of ankylosis of hip joint, abnormal ossification of the ligaments and muscles tendons around the hip joint as found in the present study made this study unique such abnormal ossifications may be helpful for clinicians, radiologists and surgeons for differential diagnosis and can be implicated in the development of innovative treatments of hip joint and hip pains.

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