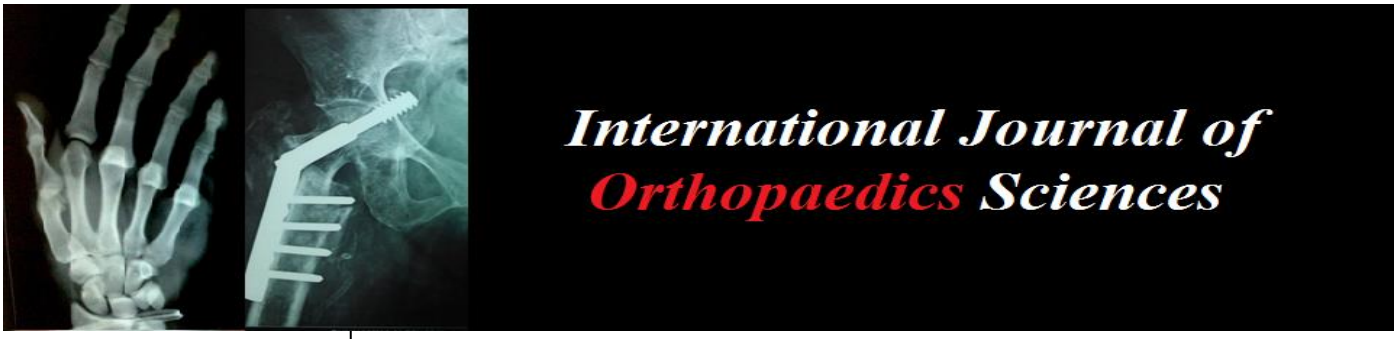

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Morphometric study of acetabulum in adult dry human pelvic bone

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Abstract
Background: The knowledge of normal anatomical features and morphometry of the acetabulum is vital to understand the mechanics of hip joint. Present study was aimed for morphometric study of acetabulum in adult dry human pelvic bone.
Material and Methods: Present study was prospective, observational study, conducted in hip bones which were dry, complete and showing normal anatomical features.
Results: In present study, 100 Indian adult dry hip bones of known sex (50 male and 50 female) (50 right & 50 left) were studied. In male hip bones, mean acetabular Diameter was 5.13 ± 0.4 mm, mean acetabular depth was 2.82 ± 0.3 mm, mean notch width 2.17 ± 0.9 mm & mean acetabular capacity was 30.83 ± 4.6 mm. while in female, mean acetabular diameter was 4.34 ± 0.3 mm, mean acetabular depth was 2.59 ± 0.5 mm, mean notch width 1.61 ± 0.8 mm & mean acetabular capacity was 22.12 ± 4.2 mm. Difference between all parameters was statistically significant. In right hip bones, mean acetabular Diameter was 4.67 ± 0.4 mm, mean acetabular depth was 2.72 ± 0.3 mm, mean notch width 1.9 ± 0.5 mm & mean acetabular capacity was 27.74 ± 6.2 mm. while in left hip bone, mean acetabular diameter was 4.71 ± 0.4 mm, mean acetabular depth was 2.63 ± 0.3 mm, mean notch width 1.89 ± 0.4 mm & mean acetabular capacity was 26.86 ± 6.4 mm. Difference between all parameters was statistically not significant.
Conclusion: The morphometric assessment of the acetabulum has a myriad of utilities for Anatomists, anthropologists, experts in forensic medicine and Orthopaedic surgeons for better alignment of acetabular cup placement during total hip Arthroplasty.

Keywords: Acetabular diameter, morphology of acetabulum, forensic experts, acetabular cup

Introduction
The hip joint is one of the major weight bearing joints of the body. The knowledge of normal anatomical features and morphometry of the acetabulum are prerequisites for complete understanding of the mechanics of hip joint. This information acts as a basis for the making of hip joint prosthesis [1].
The acetabulum is a cup shaped cavity present on the lateral aspect of the hip bone. It faces laterally, forward and downward. The acetabulum is formed by the contribution from three parts of the hip bone i.e. ilium, ischium and pubis. The depth of acetabulum (DH) is increased by the attachment of fibro cartilaginous rim known as acetabulum Labrum. It holds the femoral head and maintains the joint stability [2].
The knowledge of normal anatomical features and morphometry of the acetabulum is vital to understand the mechanics of hip joint. The acetabular images aid the surgeon to determine the correct size of the acetabular cup during total hip Arthroplasty and to realign the acetabulum back to normal position [3]. Present study was aimed for morphometric study of acetabulum in adult dry human pelvic bone.

Material and Methods
Present study was prospective, observational study, conducted in department of anatomy, at Srinivas Institute of Medical Sciences, Mangalore. Study duration was of 1 years (July 2014 to June 2015).

Hip bones which were dry, complete and showing normal anatomical features were selected, while bones showing gross osteoarthritic changes, evidence of any previous trauma or skeletal disorders were excluded from the study. Total of 100 Indian adult dry hip bones of known sex (50 male and 50 female) were studied.

The following parameters were observed

- **Diameter of the acetabulum:** The maximum Antero-posterior distance of acetabulum, measured by the digital Vernier calliper.
- **Depth of the acetabulum:** The maximum vertical distance from the brim of the acetabulum to the centre deepest point in the acetabular fossa. It was measured by placing a metallic scale across the brim of the acetabular cavity.
- **Width of acetabular notch:** The distance between the two ends of the lunate shaped articular part of the acetabulum.
- **Capacity of the acetabulum**: It is the volume of the cavity of acetabulum measured with Plasticine.

All study measurements were taken with the help of digital Vernier callipers. Two readings were taken for each parameter at different times and the average was recorded. Mean, standard deviation and standard error of mean and t-value, p-value, were determined for each parameter.

Results

In present study, 100 Indian adult dry hip bones of known sex (50 male and 50 female) (50 right & 50 left) were studied. In male hip bones, mean acetabular Diameter was 5.13 ± 0.4 mm, mean acetabular depth was 2.82 ± 0.3 mm, mean notch width 2.17 ± 0.9 mm & mean acetabular capacity was 30.83 ± 4.6 mm. while in female, mean acetabular diameter was 4.34 ± 0.3 mm, mean acetabular depth was 2.59 ± 0.5 mm, mean notch width 1.61 ± 0.8 mm & mean acetabular capacity was 22.12 ± 4.2 mm. Difference between all parameters was statistically significant.

Table 1: Acetabular measurements in cm in male and female (in mm).

Parameters	Male	Female	p-value
Acetabular Diameter	5.13 ± 0.4	4.34 ± 0.3	<0.001
Acetabular Depth	2.82 ± 0.3	2.59 ± 0.5	<0.001
Notch Width	2.17 ± 0.9	1.61 ± 0.8	<0.001
Acetabular capacity	30.83 ± 4.6	22.12 ± 4.2	<0.001

In right hip bones, mean acetabular Diameter was 4.67 ± 0.4 mm, mean acetabular depth was 2.72 ± 0.3 mm, mean notch width 1.9 ± 0.5 mm & mean acetabular capacity was 27.74 ± 6.2 mm. while in left hip bone, mean acetabular diameter was 4.71 ± 0.4 mm, mean acetabular depth was 2.63 ± 0.3 mm, mean notch width 1.89 ± 0.4 mm & mean acetabular capacity was 26.86 ± 6.4 mm. Difference between all parameters was statistically not significant.

Table 2: Acetabular measurements in cm in right and left side (in mm).

Parameters	Right	Left	p-value
Acetabular Diameter	4.67 ± 0.4	4.71 ± 0.4	<0.001
Acetabular Depth	2.72 ± 0.3	2.63 ± 0.3	0.292
Notch Width	1.9 ± 0.5	1.89 ± 0.4	> 0.05
Acetabular capacity	27.74 ± 6.2	26.86 ± 6.4	> 0.05

Discussion

The size, shape and depth of the acetabulum are variable, therefore, the knowledge of various parameters of acetabulum would be helpful in performing surgical procedures such as acetabular reconstruction and planning reorientation procedures using spikes and screws for fixation [4]. The various disease of the hip can be diagnosed by measuring the variations in hip morphology. Femoroacetabular impingement and dysplastic hip are associated with abnormalities in the depth, orientation, and diameter of acetabulum [5].

In study by Gangavarapu S [6], the mean diameter of acetabulum on right and left sides is 49.40±3.5mm, 48.06±5.65mm respectively and mean depth on right and left sides is 24.09±2.69mm, 25.16±2.84mm. The width of acetabular notch on right and left sides were 22.25±2.97mm, 22.52±2.46mm respectively. Anterior acetabular ridge was curved in 43.75% (35), straight in 27.5%(22), angular in 22.5%(18), and irregular in 6.25%(5) of bones and 64 (80%) hip bones showed pointed anterior end and lunate posterior end, in 12 bones (15%) anterior and posterior ends of labrum are lunate shaped, in 4 bones (5%) both anterior and posterior ends of labrum are pointed.

Conclusion

The knowledge of acetabular diameter & morphology of acetabulum would help the radiologists, forensic experts, anthropologists, Orthopaedicians and prosthetists. The morphometric assessment of the acetabulum has a myriad of utilities for Anatomists, anthropologists, experts in forensic medicine and Orthopaedic surgeons for better alignment of acetabular cup placement during total hip Arthroplasty.

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