



ANTHROPOMETRIC STUDY OF DEPTH OF ACETABULUM

Anatomy

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ABSTRACT

Anatomy of hip bone is morphologically different in two ways due to different reproductive functions which are influenced by sex hormones. Therefore, shapes of hip bones are different in males and females that makes it interesting anthropologically and in surgical approaches. Though non metric methods such as visual examination of bone morphologically for sex determination is entirely dependent on experience and expertise. But anthropometry plays a role in creating data which can be useful for sex determination in forensic sciences and in clinical application like in orthopedic implant size determination. Study material consisted of hip bone (female = 34, males = 66). The material was retrieved from the bone store of department of Anatomy, PGIMS Rohtak. Depth of acetabulum was measured on these hip bones on both the sides and statistical analysis was done. The mean depth of the acetabulum in male was 28.67mm and in female was 27.01mm. The mean depth of the acetabulum on right was more than the left side in all the bones. Depth of the acetabulum was greater in male than females. Depth of the acetabulum was greater in males than in females and the right side acetabulum was more deep than the left in all the hip bones.

KEYWORDS

anthropometry, hip bone, acetabulum, innominate bone.

BACKGROUND

Hip bone which is a very important part of the human body in between the trunk and lower limbs. Bone is a regular clinical presentation in old age people. Major aim of this research is to create and contribute data of the north Indian region which can be useful in manufacturing of surgical implants required in hip surgeries.

INTRODUCTION

Hip bone or innominate bone is large irregular and shaped like a propeller, centrally constricted bone which is expanded above and below. Lateral surface of the hip bone has an acetabulum which is cup shaped, articulating with the femoral head. Antero-inferior to this is large obturator foramen, which is oval or triangular. In front, pubic part of the bone bearing pubic tubercle and body articulates with its other side to form pelvic girdle¹.

Hip bone usually displays differences in morphology independent of size due to different sexual and reproductive functions which are influenced by sex hormones. Therefore, morphology of hip bone and its differences in shape are different in males and females that makes it interesting anatomically and anthropologically². To determine the sex of an unknown individual is a challenging task in forensic investigations when human skeleton remains are found. Here pelvic bone has a role to play in determining the sex.

A hip bone is considered as ideal bone for sex determination as it provides the highest accuracy level for sex determination. Hence the hip bone is considered as the most reliable sex indicator in the human skeleton. Morphometric measurements done on the right and left sided hip bones indicate that there is bilateral asymmetry of hip bone³.

Subsequently researchers adopted osteometric methods to qualitatively differentiate between male and female hip bones⁴.

This study was done to measure the depth of acetabulum which is also a differentiating feature in humans and it will be a handy data in anatomical, anthropological and forensic studies. This data will also be a great help in determining the size of various implants used in hip surgeries.

MATERIAL AND METHOD

This study was cross sectional type and the material used for the study

consisted of 100 dry hip bones of known gender (male hip bones were 66 and female hip bones were 34). Gender was assessed through the records maintained by the department of anatomy at post graduate institute of medical sciences Rohtak (PGIMS).

Method Of Measurement Used For Depth Of Acetabulum⁵.

Centre of acetabulum

Line drawn from anterior superior iliac spine to the most prominent part of the ischial tuberosity crosses the of the acetabulum i.e. midpoint of anteroposterior diameter.

Depth of acetabulum

A thin metallic strip was placed across the anteroposterior diameter of the acetabulum. Depth of the acetabulum was measured in millimeters using dial caliper from the centre of the acetabulum was measured in millimeters using dial caliper from the centre of the acetabulum to the metallic strip. Measurements could be made as accurate as 1/10 of a millimeter by this scale.



The Data Obtained For Depth Was Analysed In The Following Manner:

1. Measurements of males were compared with measurements of females.
2. Measurements of the right side were compared with measurements of the left side.
3. In males, right side measurements were compared with left side measurements.

4. In females, right side measurements were compared with left side measurements.

RESULTS

Table 1: Showing Depth Of Acetabulum In Male And Female.

Sex	Mean in mm	SD in mm	p value
Male	28.67	3.27	0.028
Female	27.01	3.19	

p value < 0.05

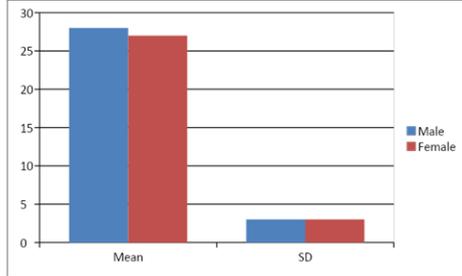


Table 2: Showing Depth Of Acetabulum On Right And Left Side.

Side	Number	Mean in mm	SD in mm	p value
Right	50	28.73	3.29	0.135
Left	50	27.74	3.29	

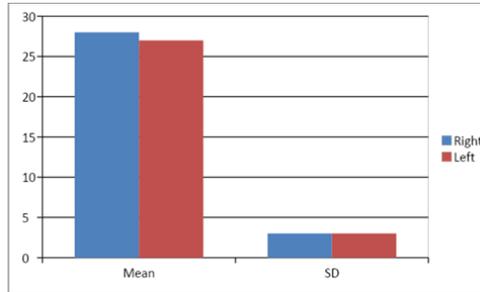
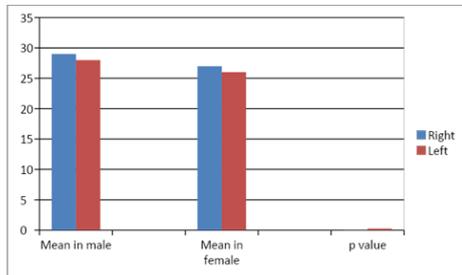


Table 3. Showing Depth Of Acetabulum On Both The Side In Each Sex.

Side	Mean in male (mm)	Mean in female (mm)	p value
Right	29.28	27.18	0.05
Left	28.05	26.84	0.25



DISCUSSION

Table 4. Showing The Comparison Of Depth Of Acetabulum With Other Studies

Authors	Mean in mm		Standard deviation in mm	Standard deviation in mm	
	All	Right Left		All	Right Left
Stojanka ⁶ ARSIC et al	24.16	-	6.7	-	-
Mukopadhya ⁷ B et al	27.1	-	-	-	-
Salamon A ⁸ et al	30.0	-	3.2	-	-
Saikia KC ⁹ et al	25.0	-	8.2	-	-
Khobragade L ⁵ et al	26.17	-	2.8	-	-
Dayasal GA ¹⁰ et al	-	10.6 11.5	-	2.5	2.8

Stojanka ARSIC et al	-	24.20	24.12	-	6.87	6.66
Present study	-	28.73	27.74	-	3.29	3.29

Table 5. Showing The Comparison Of The Depth Of The Acetabulum In Male And Female With Other Studies.

Authors	Sex				p value
	Male		Female		
	Mean in mm	SD in mm	Mean in mm	SD in mm	
Lang C ¹¹ et al	29.0	3.8	26.64	2.93	≤ 0.05
Kim Y H ¹² et al	20.3	-	18.1	-	-
Arsuaga JL ¹³ et al	25.1	2.6	22.8	2.2	-
Murtha PE ¹⁴ et al	22.7	-	19.5	-	-
Saikia KC ⁹ et al	25.0	8.0	25.0	6.0	-
Khobragade ⁵ et al	26.89	2.77	25.31	2.68	0.01
Present study	28.67	3.27	27.01	3.19	0.028

Table 6. Showing Comparison Of Depth Of Acetabulum Of Each Side In Male And Female With Other Studies.

Authors	Sides	Mean in males in mm	Mean in females in mm	p value
Chauhan R ¹⁵ et al	Right	27.49	24.68	0.02
	Left	28.18	25.70	0.06
Msamati BC ¹⁶ et al	Right	31.7	29.5	0.01
	Left	31.8	29.8	0.02
Present study	Right	29.28	27.18	0.05
	Left	28.05	26.84	0.25

Normal development of hip and its acetabulum is an essential precondition for its normal anatomical shape that guarantee the normal biomechanics in hip joint. Acetabulum develops on the lateral side of the hip bone. In the period from the 4th to 6th week of gestation, the appearance of the hip bone starts^{18,19,20}. Acetabulum is the acetabular component of the hip joint²¹.

Acetabular depth is important in restoring normal mechanics and establishing a good range of movement. It is considered a contributing factor in component dislocation. So to get better knowledge, the study was compared with that of other workers.

Mukopadhaya et al. reported the mean depth of acetabulum to be 27.1mm. Salmon et al measured 30 macerated anatomical specimens of pelvic bones and found acetabular depth to be 30±3.2mm⁴. Saikia KC et al reported the mean depth of acetabulum to be 25mm⁹. Whereas Khobragade et al reported the mean depth of acetabulum to be 26.17mm¹⁰. Dayasal et al reported the mean depth of the acetabulum separately on the right and left side. He reported the mean depth on the right side to be 10.6 and that on the left side to be 11.5mm⁷. Stojanka et al reported the mean depth of acetabulum on the right side to be 24.20mm and that on the left to be 24.12mm⁶. In the present study mean depth of acetabulum was found to be 28.73mm on the right side and 27.74mm on the left side. The finding in the present study coincided with that of Stojanka et al's finding, which showed that there is not much difference in depth of right and left when compared.

Other comparison was done on the depth of acetabulum in male and female with other studies. Lang C et al studied a sample of 45 dry hip bones and found the mean acetabular depth in male to be 29.00mm and that in the female to be 26.64mm¹¹. Kim YH measured the equatorial and meridian diameter of acetabulum in 655 Korean adult cadavers and reported the mean depth in male to be 20.3mm and that in the female to be 18.1mm¹². Arsuaga JL et al studied 34 linear variables and 10 non-metrical characters in series of 418 adult hip bone. The mean acetabular depth in male and female was reported to be 25.1mm and 22.8mm respectively. They found that acetabulum was deeper in men than in women in both hips which was statistically significant (<0.05)¹³. Murtha et al reported the mean depth of acetabulum in males to be 22.7 and that in females to be 19.5mm¹⁴. Saikia et al reported the mean depth in male and female to be the same as that to be 25.0mm⁹ whereas Khobragade reported the mean depth of acetabulum in male to be 26.89mm and 25.31mm in the female⁵. In present study mean depth of male and female acetabulum almost coincided with mean depth reported by Lang C. It came out to be 28.67mm in male and 27.01mm in female which showed that acetabulum were deeper in male than in

female which was also statistically significant ≤ 0.05 .

However when compared with studies done by Chauhan R et al on 54 cadaveric hip joints belonging to age group 50-70. He reported the average depth of acetabulum on right side and left side of male to be 27.49mm and 28.18mm respectively and Masamati et also giving the finding that the left side was deeper in both males (31.8mm) and females (29.8mm). But in present study, findings are opposite in that, the right side is more deeper in male (29.2mm) and females (27.18mm) comparing the depth on left side which was (28.05mm) in male and (26.84mm) in female. In the present study it was also observed that the depth of the acetabulum was greater in males on both right and left side in comparison with females. However the result came out to be statistically significant on the right side only.

CONCLUSION

In the present study significant findings were found in which the right side was found to be more deeper in male and female comparing the depth on left side in male and in female which was opposite to the previous two studies done on this aspect. Considering that total hip replacement is a common surgery performed now a day, awareness of the dimensions of the acetabulum is of immense importance to the orthopaedic surgeons. So the findings of the present study can provide a guideline for further studies on acetabulum. It will assist prosthetists to construct suitable prostheses. It will also help in detection of disputed sex by forensic experts.

Conflict Of Interests

Author(s) have no competing interests.

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