ANTHROPOMETRIC STUDY OF VARIOUS ACETABULAR DIAMETERS IN THE HIP BONES OF NORTH INDIAN ORIGIN

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 = 32, males = 68). The material was retrieved from the bone store of department of Anatomy, PGIMS Rohtak. Diameter of acetabulum was measured on these hip bones on both the sides and statistical analysis was done. The mean diameter of acetabulum in male was 41.29 ± 3.06 (R), 41.22 ± 3.09 (L)mm and female was 37.15 ± 3.88 (R), 36.75 ± 3.75 (L)mm. The mean diameter of acetabulum on right was significantly greater in male than females.

KEYWORDS

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 hip bone has acetabulum which is cup shaped, articulating with the femoral head. Antero-inferior to this is large obturator foramen, which is oval or triangular. Infront, 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 make 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.

MATERIALS & METHODS

The present study was conducted on 50 paired dry fully ossified human hip bones with known gender. The bones were collected from Department of Anatomy, Pandit Bhagwat Dayal Sharma University of Health Sciences, Rohtak, Haryana. Bones with gross damage or anomalies were excluded from the study. Digital Vernier Calliper was employed for accurate measurements.

Following morphometric measurements were documented in the present study:

- The Horizontal diameter of the acetabulum-** The maximum distance between the anterior and posterior ends of the acetabular cavity.
- The vertical diameter of the acetabulum** –The greatest distance between the upper and lower margins of the acetabular cavity.
- The total acetabular diameter-** The average of both the horizontal and vertical diameter.

In our study, we took three readings of all above diameters and then took out mean of these three readings. Data analysis was carried out by SPSS software (version 20.0). The mean, standard deviation, range

were calculated for all parameters. If p- value was <0.001 , then P-value was considered as statistically significant.

Fig 1: Measurement of Maximum Horizontal Diameter (HD)

Fig 2: Measurement of Maximum Vertical Diameter (VD)

RESULTS:

The present study was carried out on diameters of acetabular cavity, vertical and horizontal diameters of hip bones of both sides in both sexes.

Table:1 Comparison of Total diameter, Vertical and Horizontal diameters of both side in male and female.

Parameters	Male n=68 (Mean±SD)	Female n=32 (Mean± SD)	p-value
Total diameter Right side (TDR)	41.29 ± 3.06	37.15 ± 3.88	<0.001
Total diameter Left side (TDL)	41.22 ± 3.09	36.75 ± 3.75	<0.001
Vertical diameter right (VDR)	43.37 ± 3.32	38.89 ± 3.62	0.001
Vertical diameter left (VDL)	43.14 ± 2.94	38.63 ± 3.52	0.002
Horizontal diameter right (HDR)	39.63 ± 2.40	35.40 ± 3.40	0.003
Horizontal diameter left (HDL)	39.58 ± 2.32	35.25 ± 3.26	0.001

Graph 1. Showing total diameter on right and left side in male and female.

Graph 2: Showing vertical diameter of both side in male and female.

Graph 3: Showing Horizontal Diameter of both side in male and female.

Table:2 Comparison of Vertical and Horizontal diameters of both side hip bones.

Parameters	Left Total Vertical diameter	Right Total Vertical diameter	Total Horizontal diameter (left)	Total Horizontal diameter (right)
Mean±SD	41.53±3.63	41.56±3.55	38.16±3.33	38.37±3.48
Range	35.07-49.21	33.44-49.96	31.52-45.94	32.02-46.85
p-value	0.9668	0.7585		

Table:3 comparison of Total Mean Diameter of both sides.

Parameters	Left side	Right side	p – value
Total mean diameter	39.85±3.86	39.97±3.85	0.619

DISCUSSION-

Total hip replacement is a common surgery performed worldwide, so awareness of average dimension of the acetabulum is essential as it will help the prosthetist and surgeon to determine the correct size of the acetabular cup during total hip arthroplasty. In the present study, the total diameter, the vertical diameter and the horizontal diameter of both the sexes were compared with each other which shows that all the above diameters are significantly more in males.

On comparison, the values of acetabular diameters of both sides of same pelvis showed insignificant values.

On comparing the total acetabular diameters of present study with American, Chinese, South Indian the acetabular diameter is significantly less in present study. Also in South Indian studies in different sample size values did not change. But on comparing with other North Indian study done by Chauhan et al values in present study is still less. (Table 4)

On comparison of vertical diameters of right and left sides of pelvis with study done by Akhlaghi M et al on Iranian population vertical acetabular diameter of right side hip bone of female was more in North Indian region. (Table 5)

Table :4 Comparison of total acetabular diameter with the findings of previous studies.

Authors	Year	Population	Sample size	Diameter	
				Male	Female
Chauhan et al ⁵	2002	North Indian	48	47.10±2.90 47.48±3.05 (L)	44.38±3.01(R) 46.0±2.28 (L)
Krebs et al ⁶	2009	American	100	53.7±3.74	47.0±2.47
Zeng et al ⁷	2012	Chinese	200	55.2±3.11(R) 56.0±3.33(L)	51.4±2.38 (R) 51.4±2.07 (L)
Yugesh & kumar et al ⁸	2016	South Indian	60	48.66±0.33	46.18±0.24

Rajasekhar et al ⁹	2017	South Indian	206	48.1±3.1	45.2±3.5
Present study	2020	North Indian	100	41.29±3.06(R) 41.22±3.09(L)	37.15±3.88(R) 36.75±3.75(L)

Table: 5 Comparison of vertical and horizontal diameters of present study with findings of Akhlaghi M.

S. No	Parameters	Akhlaghi M et al ¹⁰ (2019) Mean±SD		Present study Mean±SD	
		Male	Female	Male	Female
1.	Vertical diameter (right)	47.0±4.0	38.4±8.6	43.37±3.32	38.89±3.62
	p-value	<0.0001		0.001	
2.	Vertical diameter (left side)	46.8±4.2	40.6±2.5	43.14±2.94	38.63±3.52
	p-value	<0.0001		0.002	
3.	Horizontal diameter (right side)	49.2±3.9	42.4±2.1	39.63±2.4	35.40±3.40
	p-value	<0.0001		0.003	
4.	Horizontal diameter (left side)	48.8±4.3	42.4±2.1	39.58±2.32	35.25±3.26
	p-value	0.0001		0.001	

CONCLUSION-

There is significant difference in the size of acetabulum between present study and other studies and also sexual dimorphism is also appreciated in present study. Therefore, significant data is obtained from this study which can be helpful to clinicians, orthopaedicians and forensic experts.

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