



STUDY OF ACETABULULAR PARAMETERS OF HIP BONE IN NORTH INDIAN POPULATION

Kalpna Purohit

Assistant Professor, Department of Anatomy, Hind Institute of Medical Sciences, Mau, Ataria, Sitapur, U.P.

Vipul Kant Singh*

Statistician, Heritage Institute of Medical Sciences, Varanasi, UP *Corresponding Author

Kamil Khan

Assistant Professor, Department of Anatomy, Hind Institute of Medical Sciences, Mau, Ataria, Sitapur, U.P.

Ankita Purohit

Tutor cum PG Student, Department of Biochemistry, SCB Medical College, Cuttack, Odisha.

ABSTRACT

INTRODUCTION: The acetabulum of the hip bone is an important parameter for determination of sex. Morphometry of hip bone is of interest to anatomist, forensic experts and anthropologist. The parameters are also of clinical importance for orthopaedic surgeons.

AIM OF THE STUDY: The aim of the study is to find the Diameter of acetabulum, Depth of acetabulum, Diameter of acetabular Notch and Shape of the anterior ridge of the acetabulum in North Indian population.

MATERIALS AND METHODS : 57 human ossified adult hip bones were included from the Anatomy and forensic Department in this study. After determination of sex, the measurements were taken with the help of digital vernier calipers and a metallic scale.

RESULTS: In this study the measurements of diameter of acetabulum is larger in female in both sides than that of male and significant statistically. The Acetabular Depth in female is more in left side but slightly less in right side than male. The Acetabular Diameter and Acetabular Depth in left side is more than right side. The anterior acetabular ridge in this study is more (43.9%) of curved type.

CONCLUSION: Morphometric study will help detection of disputed sex by Forensic Experts & Orthopedic Surgeons for planning the total hip replacement. The Acetabular Depth in female is more in left side but slightly less in right side than male. The measurements are more in left side than that of right side.

KEYWORDS : Acetabulum, Acetabular Diameter, Acetabular Depth, anterior ridge, Notch

INTRODUCTION

The acetabulum of the hip bone is the junction of three pieces of bone, ilium, ischium and pubis. It comprise of an articular & a non articular part. The non articular, rough part forms the central floor & called the acetabular fossa. The articular part is called the lunate Surface. The lunate Surface is widest above through which weight is transmitted to the femur^[1]. The width, depth & Notch width of acetabulum is variable. Hence to understand mechanics of hip joint, the anatomical knowledge of acetabulum is necessary. Total hip replacement surgery is now done successful. Minor Abnormalities in normal anatomical shape of acetabulum & joint congruences are frequent^[2]. An incongruous joint is more prone to develop degenerative changes like osteoarthritis than a normal joint^[3,4]. Prosthetic loosening is one of the cause of failure of hip replacement which may be due to weak cemented interface or the interface was weak originally^[5]. Assessment of acetabular depth ratio to study the acetabular morphology helps the surgeons to diagnose the hip dysplasia^[6].

MATERIALS AND METHODS

The study was conducted in the department of Anatomy, Hind Institute of Medical Sciences, Mau, Ataria, Sitapur. 57 human ossified adult hip bones were included in this study. Bones included are from the Department of Anatomy and Forensic. There are 30 right side and 27 left side bones. The sex of the hip bones was decided on the basis of visual morphological features like, angle of greater sciatic notch, ischiopubic ramus, shape of obturator foramen, prominence of pre-aicular sulcus and acetabular diameter. Deformed & broken bones are not included in the study. Measurements were performed with the help of digital vernier calipers and a metallic scale.

The parameters studied are

- Diameter of acetabulum: - The maximum antero-posterior distance of acetabulum, measured by the digital vernier calipers.
- Depth of the acetabulum:- The maximum vertical distance from the brim of the acetabulum to the deepest point in the acetabular fossa. It was measured by placing a metallic scale across the brim of the acetabular cavity and then the distance from the metallic scale to the deepest point in the acetabulum was measured with the pointed end of the vernier calipers.
- Notch Width of acetabulum- The distance between the anterior

and posterior end of the lunate shaped articular part of the acetabulum, measured by the digital vernier calipers.

- Shape of the anterior ridge of the acetabulum. Shape of the anterior ridge of the acetabulum was evaluated visually and classified as curved, irregular, angular or straight.

Fig 1 Measurements of acetabulum

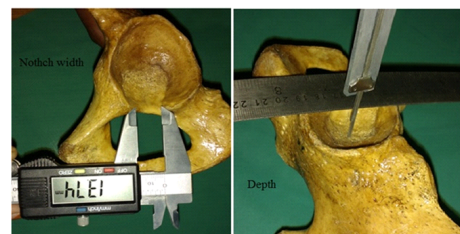
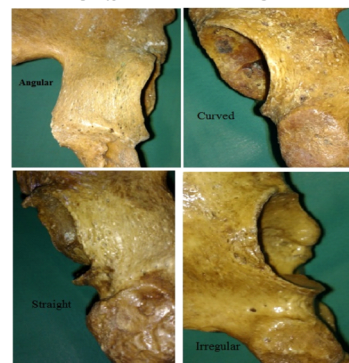


Fig 2 Types of anterior acetabular ridge



RESULTS

In this study the measurements of diameter of acetabulum is larger in female in both right and left sides than that of male and statistically significant (table 1). The acetabular depth in female is more in left side but slightly less in right side than male (table 1). The notch width in female is more than male in both in left side and right side and statistically significant (table 1). When the values are compared between both sides irrespective of sex, the acetabular diameter and acetabular depth in left side is more than right side and no difference found between the two sides in acetabular notch diameter (table 2). The anterior acetabular ridge in this study are 25 (43.9%) curved type, 22 (38.6%) are of angular type, 7 (12.3%) are of irregular type, 3 (5.3%) are of straight type (table 3). The anterior acetabular ridge in this study is more of curved type.

Table 1: Acetabular measurements in cm in male and female

		Number	Mean	SD	t value	p
Acetabular Diameter (Right)	Male	12	5.18	0.33	-2.07	0.048
	Female	18	5.49	0.45		
Acetabular Diameter (Left)	Male	18	5.41	0.27	-3.67	0.001
	Female	15	5.82	0.37		
Acetabular Depth (Right)	Male	12	2.41	0.20	2.00	0.056
	Female	18	2.15	0.41		
Acetabular Depth (Left)	Male	18	2.46	0.33	-3.30	0.002
	Female	15	2.89	0.43		
Notch Width (Right)	Male	12	2.04	0.28	-2.15	0.041
	Female	18	2.38	0.50		
Notch Width (Left)	Male	18	2.00	0.31	-2.52	0.017
	Female	15	2.30	0.39		

Table 2: Acetabular measurements in cm in left and right side

Parameters	side	mean	SD
Acetabular Diameter	Right	5.3	0.43
	Left	5.5	0.38
Acetabular Depth	Right	2.3	0.36
	Left	2.6	0.43
Notch Width	Right	2.2	0.45
	Left	2.2	0.50

Table 3: Comparison of shape of the anterior acetabular ridge in different studies

Shape of the anterior acetabular ridge	Present study	Govsa et. al.	Maruyama et al	Kintu Vyas et al	Gaurang parmara et al(18)	Thoudam Bedita Devi et al(16)	Funda Tastekin Aksu et al.(17)
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
Curved	25 (43.9)	98 (43.3)	121 (60.5)	57 (37.5)	20 (61)	60 (60)	71 (46.1)
Angular	22 (38.6)	64 (28.3)	51 (25.5)	19 (12.5)	20 (20)	4 (4)	26 (16.8)
Irregular	7 (12.3)	37 (16.3)	19 (9.5)	28 (18.4)	Not found	27 (27)	21 (13.6)
Straight	3 (5.3)	27 (11.9)	9 (4.5)	48 (31.6)	19 (19)	9 (9)	36 (23.3)

DISCUSSION

Acetabular parameters are used by Orthopedic surgeons for operative treatment of hip joint^[6,7]. Direct damage to the hip can be caused by variations in size, shape and orientation of the head of femur, acetabulum or in combination of both [8-10]. Preoperative evaluation the diameter of the Acetabulum is necessary to estimate the size of the acetabular cup in hip surgery especially in total hip arthroplasty^[12]. In this study the Acetabular Diameter in left side is more than right side in both sexes, similar to study by Chauhan et al. The Acetabular Diameter is more in female than male in both sides, similar to the study by K Yuges et al & Chauhan et al. The values of measurement of diameter of the Acetabulum in this study are equal to the study by Dhindsa et al. & Lander et al. and these are more than study by Kintu Vyas et al (table 4).

The acetabular depth has been regarded as an important measurement to prevent acetabular dysplasia by Loder et al & many other authors^[13]. An acetabular depth of less than 0.9 cm is considered to be dysplastic.

The Acetabular Depth in this study is more in left side than right side, similar to the study by Chauhan et al. The Acetabular Depth in left side in female is more than male. But it is slightly more in male in right side than female. According to study by K Yuges et al & Kintu Vyas et al. acetabular depth in left side is less than right side & acetabular depth in male is more than female. There is no difference in acetabular notch width between the two sides in this study. In this study the notch width in female is more than male in both right side and left side. In study by Werner Kohnlein et al.^[14] in Switzerland population & Kintu Vyas et al and K Yuges et al notch width is also more in female.

Table 4: Acetabular measurements in cm in left and right side in different study

Parameters	Side	Present study	Lander et al.	Dhindsa et al.	Kintu Vyas et al.
Acetabular Diameter	Right	5.3	5.60	5.13	4.83
	Left	5.5	5.70	5.03	4.79
Acetabular Depth	Right	2.3	-	2.67	2.71
	Left	2.6	-	2.64	2.65

The anterior acetabular ridge is one of the important aspects of acetabulum over which the iliopsoas tendon extends to leave the pelvis. Painful iliopsoas impingement can result if there is discrepancy between the natural acetabulum and the implant^[15]. Maruyama et al also has evaluated the morphology of anterior acetabular ridge for getting correct hip joint implants.

CONCLUSION

Biomedical Engineers are trying to make the best possible prostheses for planning the total hip management by Orthopedic Surgeons. Morphometric study will help detection of disputed sex by Forensic Experts. It will also help to understand the etiopathogenesis osteoarthritis of hip joint. In this study the measurements of diameter of acetabulum & acetabular notch width is larger in female in both side than that of male. The Acetabular Depth in female is more in left side but slightly less in right side than male. The measurements are more in left side than that of right side.

INTRERST OF CONFLICT- None

REFERENCES

- Leena Khobragade, P. Vatsalawamy. A study on morphometric measurement of volume of acetabulum, Int J Anat Res 2014, 2(3):549-52. ISSN 2321-4287
- Govsa F, Ozer MA, Ozgur Z. Morphological features of the acetabulum. Arch Orthop Trauma Surg.2005; 125(4): 453-461
- Kintu Vyas,Bhavesh Shroff,Kalpesh Zanzrukiya, An osseous study of morphological aspect of acetabulum of hip bone, Int J Res Med 2013;2(1);78-82
- Murray RO. The aetiology of primary osteoarthritis of the hip. Br J Radiol.1965; 38(6): 810-24.
- Gray's anatomy, The anatomical basis of medicine and surgery. 38th edition. Total hip replacement. 689-691.
- Delatunay S, Dussault RG, Kaplan PA, Alford BA. Radiographic measurements of dysplastic adult hips. Skeletal Radiology. 1997; 26:75-81.
- Chibber SR, Inderbir Singh. Asymmetry in muscle weight and one sided dominance in human lower limbs. Journal of Anatomy. 1970; 106(3):553-556.
- Armubster TG, Guerra J Jr, Resnick D, Georgen TG. Feingold. The adult hip: An anatomical study. Part 1: The Bony Landmarks, Radiology.1978; 128:1-10.
- Hans CD, Yoo JH, Lee WS, Chose WS. Radiographic parameters of acetabulum for dysplasia in Korean adults. Yonsei Med J. 1998; 39:404-8.
- Chauhan R, Paul S, Dhaon BK. Anatomical Parameters of North Indian Hip joints- Cadaveric study. Journal of Anatomical Society of India. 2002; 51(1):39-42.
- Stulberg SD, Harris WH. Acetabular dysplasia and development of osteoarthritis of hip. In: Harris WH. The hip proceedings of the second open scientific meeting of the hip Society. St Louis, MO: Mosby, 1974, 82-93. 12. Bavornrit Chuckpaiwong, Jedsada Puangsaichai, Thossart Harroongroj. A Comparison of Acetabular diameter using direct and indirect Measurement. Sriiraj Med J2009; 61:2.
- Loder RT, Mehbod AA, Meyer C, Meisterling M. Acetabular depth and race in young adults; A potential explanation of the differences in the prevalence of slipped capital femoral epiphysis between different racial groups. J Pediatric Orthop. 2003; 23:699-702.
- Werner Kohnlein MD, Reinhold Ganz MD, Franco M. Acetabular morphology, Implications for joint preserving surgery. Clin Orthop Relat Res. 2009; 467:682-689.
- Vandenbussche E, Saffarini M, Taillieu F, Mutschler C. The asymmetric profile of the acetabulum. Clin Orthop Relat Res. 2008;466(2):417-423.
- Thoudam Bedita Devi, and Chandra Philip X Acetabulum- Morphological and Morphometrical Study RJPBCS ISSN: 0975-8585 5(6) Page No. 793-99