

MORPHOMETRIC ANALYSIS OF ACETABULAR DIMENSIONS FOR SEX DETERMINATION FOR PROSTHETIC SURGERY

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Abstract

Surgical procedure of the acetabulum especially in total hip arthroplasty it is necessary to evaluate the diameter of the acetabulum as a part of the pre-operative planning in order to estimate the size of the acetabular cup. The purpose of this study was to determine the sex from the acetabulum by using various parameters such as Maximum depth, Maximum transverse diameter, articular and non-articular surface. Before measuring the side of each hip bone was determined. A total of 100 hip bones were taken and individual parameters were recorded. In our study mean values of all the parameters measured were more in males than female bones. In contrast to studies reported by previous works, in our study we observed statistical correlation between acetabular dimensions chiloticline with maximum depth of acetabulum showed statistical correlation of $r=0.42$ in female bones. Greater Sciatic Notch with maximum depth of acetabulum showed statistical correlation of $r=0.42$ in male bones. These measurements are of importance during sex determination in medicolegalcases & also important in making prosthesis for hip arthroplasty.

Keywords:Acetabulum, chilotic line, greater sciatic notch, acetabular notch

Introduction

Acetabulum is an approximately hemispherical cavity central on the lateral aspect of the hip bone, it faces anteroinferiorly which is surrounded by an irregular margin deficient inferiorly at the acetabular notch. The Acetabular fossa is the cavity central floor which is rough and nonarticular and has an articular lunate surface, widest above where weight is transmitted to the femur. On this crecenteric surface, covered with cartilage, the head of the femur slides. All 3 innominate elements contribute to the acetabulum in man, but unequally^[1]. The Peripheral Margin is sharp and gives attachment to a Fibrocartilaginous rim, Acetabular labrum except below, where the margin is deficient and forms Acetabular notch. A Horseshoe shaped articular surface, the lunate surface occupies the periphery of the acetabular cavity. The floor of the cavity below the lunate surface is non articular and forms the Acetabular fossa which is filled with a pad of fat. The acetabular fat is covered with synovial membrane therefore it is intracapsular but extrasynovial and is in liquid condition at room temperature^[2]. The Identification of Sex from skeletal^[3]. Remains is of great medicolegal and anthropological importance. Various parameters were commonly used in sexing of the hip bones and also in other parts. Like Chilotic line index was used by Derry in 1923 which was explained as ChiloticLine Index=sacral part of chilotic line/pelvic part of chilotic line*100. Ischio Pubic Index was used by wash burn in 1949. Ischiopubic Index=length of pubic bone/length of ischialbone*100. Acetabulo pubic index was used by Schultze in 1983. Acetabulo pubic index=acetabular diameter/puboacetabulo length*100. In the Surgical procedure of the acetabulum especially in total hip arthroplasty it is necessary to evaluate the diameter of the acetabulum as a part of the pre-operative planning in order to estimate the size of the acetabular cup^[4]

Materials and Methods

The study was done in the department of Anatomy, kempegowda institute of medical science & research centre, Bangalore. About 100 hip bones were taken and parameters such as Maximum depth, Maximum transverse diameter, articular and non-articular surface was measured using measuring tape and vernier callipers. Based on chilotic line index bones were separated into male and female bones. Chilotic line is an anthropometric line extending from the posterior aspect of the iliopectineal eminence to the closest point on the anterior auricular margin and then to the iliac crest.

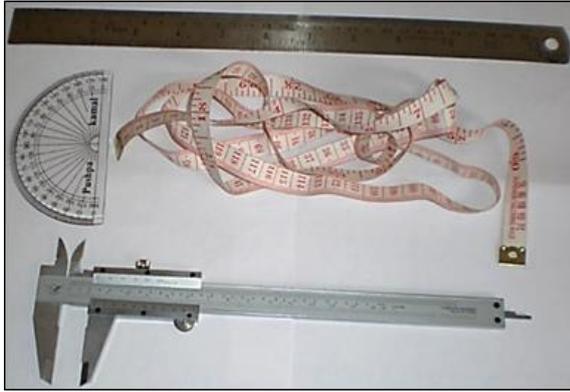


Fig 1: Materials used for the measurement of acetabulum parameters are scale, vernier caliper, tape, protractor



Fig 2: Showing 100 hip bone used for measurement of acetabulum parameters



Fig 3: Showing the measurement of maximum transverse diameter of acetabulum



Fig 4: Measurement showing the depth of acetabulum



Fig 5: Showing the measurement of sacral part of chelotic line



Fig 6: Showing the measurement of pelvic part of chelotic line

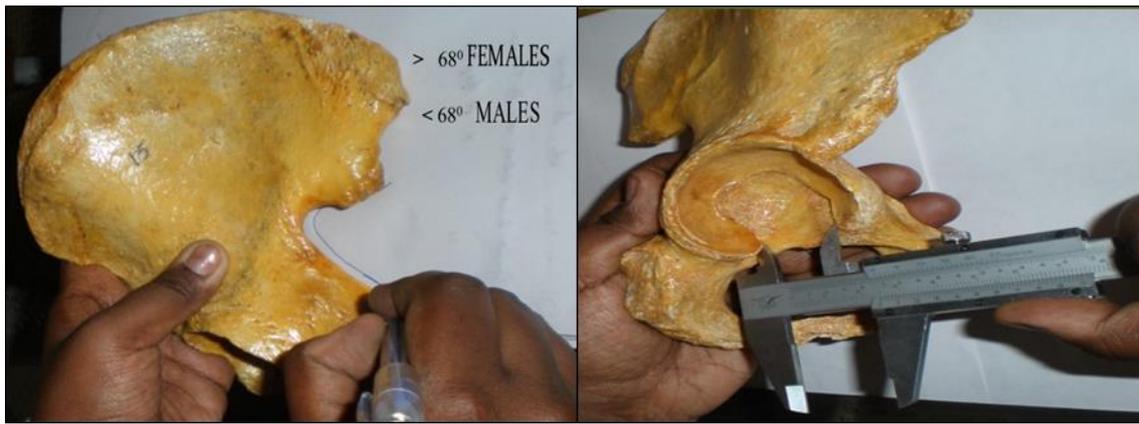


Fig 7: Showing the measurement of greater sciatic notch

Fig 8: Showing the measurement of acetabular notch

Results

Table 1: Showing mean & SD of parameters of acetabulum its depth, transverse diameter, external articular surface, acetabular notch, chilotic line, greater sciatic notch

PARAMETERS	MALES		FEMALES	
	MEAN	S.D	MEAN	S.D
MAX.DEPTH OF ACETABULUM	24.20	3.11	22.35	2.28
MAX. TRANS. DIAMETER OF ACETABULUM	52.22	3.97	49.21	4.34
EXT. ARTICULAR SURFACE OF ACETABULUM	15.30	1.17	14.59	1.33
ACETABULAR NOTCH	23.21	3.79	23.01	3.62
CHILOTIC LINE	7.32	0.53	6.71	0.41
GREATER SCIATIC NOTCH	56.94	14.76	61.90	13.34

Table 2: Showing correlation between parameters of chelotic line & greater sciatic notch (GS notch), chelotic line & maximum depth of notch, chelotic line & maximum transverse diameter of acetabulum, greater sciatic notch & maximum transverse diameter of acetabulum, greater sciatic notch & maximum transverse diameter of acetabulum, greater sciatic notch & maximum depth of acetabulum in male & female

PARAMETER	MALES	FEMALES
CHILOTIC LINE Vs G.S.NOTCH	0.045	0.17
CHILOTIC LINE Vs MAX. DEPTH	0.23	0.42
CHILOTIC LINE Vs MAX. TRANS. DIAMETER	0.33	0.03
G.S.NOTCH Vs MAX. TRANS. DIAMETER	0.31	0.37
G.S.NOTCH Vs MAX. DEPTH	0.42	0.008

From the table no 1 all the parameters of acetabulum its depth, transverse diameter, external articular surface, notch, chelotic line, greater sciatic notch were more in male compared to females. From the table no 2 correlation between different parameters were done of which there was statistical correlation between acetabular dimensions chilotic line with maximum depth of acetabulum showed statistical correlation of $r=0.42$ in female bones and Greater Sciatic Notch with maximum depth of acetabulum showed statistical correlation of $r=0.42$ in male bones.

Discussion

According to Mewalal^[5] (1993) and our study have indicated that the most commonly used indices (chilotic line) were of little value when subjected to demarking points analysis. Many authors have recommended the use of kohlersline^[6] which passes close to the medial wall of the acetabulum as said by Hubbard in 1969 and Sutherland in 1982. According to B.C. Msamati^[7] in their study the ranges of acetabular angles were wider in women (11-38 degree right and 8-40 degree left) than men (24-49 degree right, 20 -40 degree left). Acetabular depth was also greater in men than in women. $p<0.01$ right hip, $p<0.02$ left hip). As said by Krogman^[8] (1946) and Stewart^[9], particular sex can be determined and would be beneficial by the dimensions of acetabulum also and the measurements of acetabulum are scarcely found in the literature. The average diameter of the depth of the acetabulum according to Mukhopadhaya and Burroh^[10] on the right and left sides are 24.7mm and 24.55 respectively. Various parameters of acetabulum measured had a higher value when it was compared to the sides, higher value on left side than the right according to Chibber and Singh in 1970^[11]. Dogra and Singh^[12] in 1971 suggest that left limb is dominant, whether a person is right handed or left handed more people use left lower limb for weight bearing.

Conclusion

In our study mean values of all the parameters measured were more in males than female bones. In contrast to studies reported by previous works, in our study we observed statistical correlation between acetabular dimensions chilotic line with maximum depth of acetabulum showed statistical correlation of $r=0.42$ in female bones. Greater Sciatic Notch with maximum depth of acetabulum showed statistical correlation of $r=0.42$ in male bones. This study is useful for surgeons to carry out the surgical operations on the acetabulum. It could also help surgeons to obtain better acetabular fixation and more easily locate the hip centre of rotation in complex cases. It would also help the basis for more anatomically driven implants such as revision acetabular components, acetabular reconstructive cages, augments and pelvic bone fixation plates. The establishment of a new standard reference point within the acetabulum will also enhance the consistency of interpretation of the location of labral pathology and improve arthroscopic orientation and navigation.

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