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**Original Research Article** 

# Study of Greater Sciatic Notch of Hip Bone in Sex Determination by Metric Method in South Indian Population

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### Abstract

**Background:** The estimation of sex from skeletal remains is of great medico legal and anthropological importance. The bony pelvis is sexually dimorphic and it is affected by parturition and reproduction. So the hip bone is considered as an ideal bone for sex determination and it provides the highest accuracy level.

**Materials and Methods:** 48 Adult dry hip bones (28 Male&20 Female) of known sex were collected for the study. All the bones were fully ossified and free from defect. Data were tabulated according to gender and sides are statistically analysed using unpaired student t-test and measurements are measured using triflanged stainless steel calliper. The following parameters of Greater sciatic notch were considered and measured in millimetre. The parameters are Maximum width (AB), Maximum depth (OC), Posterior segment width (OB), Index I and Index II.

**Results:** A significant difference is noted both in maximum width and maximum depth of Greater sciatic notch of male and female on right (P<.01) while difference in posterior segment width was significant on right side (P<.01). A significant difference were found in indices of I & II of Greater sciatic notch of right and left sides.

**Conclusion:** The Greater sciatic notch was found to be wider in female on the right side and also on left side as compared to male.

Keywords: Sexual dimorphism, Greater sciatic notch, Vernier calliper.

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#### Introduction

Sex determination from skeletal remains plays an important role in anthropology and in medicolegal cases. Pelvic bone is sexually dimorphic [1,2] provides the highest accuracy level. Because of distinctive morphology, this study will create interest in forensic and in anatomical fields for determination of sex, often attributes to pelvic dimorphism. The human skull and pelvis are the most important source for identification of sex.[2,3] In the past many workers have evolved various parameters and indices for sexing of hip bone whereas the features of Greater sciatic notch of hip bone are commonly used for sexual dimorphism.[4,5]. The size and shape of greater sciatic notch is directly related to pelvic inlet size [6]. Non metric traditional methods such as bone morphology and visual examination depend mainly on experience and ability of the expert [7]. This study has been done with an aim to find out the sex differentiation in Greater sciatic notch by using metric method. This metric method provides simplicity and highest accuracy to determine the sex.[8] The present study aims to find out the sex differentiation in a greater sciatic notch of adult pelvis based on Maximum width, Maximum depth, Posterior segment width, Index I and Index II in a South Indian population.

## **Materials and Methods**

The study was conducted in 48 adult dry hip bones (28 Male& 20 Female) of known sex were collected from the Department of Anatomy, Government Dharmapuri Medical College, Dharmapuri. All the bones were fully ossified and free from congenital or structural defect. Data collected were tabulated according to gender and sides are statistically analysed using unpaired student t-test and measurements are measured using triflanged stainless steel calliper.

In a hip bone the following bony points are marked as tip of Ischial spine (A), Piriformis tubercle (B) and Maximum depth in between ischial spine and piriformis tubercles (O). The following parameters of Greater sciatic notch were considered for the study and it is measured in millimetres. The parameters are (1). Maximum width (AB). (2). Maximum depth (OC). (3). Posterior segment width (O). (4). Index I and Index II were measured.



Figure 1: Parameters of Greater Sciatic Notch

Greater sciatic notch width [AB] is measured with the distance in between tip of ischial spine (A) and Piriformis tubercle (B).Greater sciatic notch depth [OC] is taken as deepest point in the notch to width i.e perpendicular to width. For Greater sciatic notch posterior segment width [OB], point "O" was taken from maximum depth of greater sciatic notch width and point (B) at Piriformis tubercle. Index I is calculated by using depth and width of greater sciatic notch. Depth (OC)/Width (AB)X 100. Index II is calculated by using posterior segment width and width of Greater sciatic notch. Posterior segment (OB)/Width (AB) X100. All the parameters data were tabulated and analysed by Unpaired Student t –test. The comparison of the parameters of right and left side Greater sciatic notch among males and females are shown in Table1 and 2.

Parameters	Gender	N	Mean	Std deviation	P value
Maximum width AB	Male	14	4.97	0.579	<.00001
	Female	10	6.33	0.629	
Maximum depth OC	Male	14	3.78	0.585	0.0058
	Female	10	3.0	0.440	
Posterior segment	Male	14	1.79	0.343	<.0001
width OB	Female	10	2.95	0.573	
Index I	Male	14	62.75	8.157	0.0356
OC/AB	Female	10	56.19	7.344	
Index II	Male	14	35.90	4.921	0.0002
OB/AB	Female	10	46.33	6.304	

 Table 1: Comparison of the parameters of right side Greater sciatic notch among males

 and females using Unpaired Student t- test

## **Observation and Results**

Hip bone plays an important role in determination of sex and it is the most dimorphic bone for differentiation. The size of the pelvis varies not only in two sexes but also in different members of same sex. The sciatic notch are wider and shallower in females. The pelvic bone is the most important bone for age and sex determination. In the present study, the mean value of maximum width of greater sciatic notch in right and left side male hip bone shows 4.97 and 5.23. The mean value of maximum width of greater sciatic notch in right and left side female hip bone shows 6.33 and 5.67. A significant difference is noted in maximum width of greater sciatic notch of male and female on right side and P value is <.01.

Parameters	Gender	N	Mean	Std. Deviation	P value
Maximum width	Male	14	5.23	0.273	0.0209
AB	Female	10	5.67	0.531	
Maximum depth OC	Male	14	3.26	0.380	0.0103
	Female	10	2.91	0.070	
Posterior segment width OB	Male	14	1.91	0.406	0.0061
	Female	10	2.49	0.480	
Index I OC/AB	Male	14	61.35	6.864	0.0002
	Female	10	50.39	4.020	
Index II OB/AB	Male	14	36.50	7.304	0.0229
	Female	10	43.70	6.025	

 Table 2: Comparison of the parameters of left side greater sciatic notch among males and females using Unpaired Student t- test.

The width of Greater sciatic notch is significantly larger in females when compared to male hip bones. The mean value of maximum depth of greater sciatic notch in right and left side male hip bone shows 3.78 and 3.26. The mean value of maximum depth of greater sciatic notch in right and left side female hip bone shows 3.0 and 2.91. A significant difference is noted in maximum depth of greater sciatic notch of male and female on right side and P value is <.01. The depth of greater sciatic notch is significantly more in males when compared to female hip bones. The mean value of posterior segment width of greater sciatic notch in right and left side of male hip bone shows 1.79 and 1.91. In Table 1& 2 the mean value of posterior segment width of greater sciatic notch in right and left side of female hip bone shows 2.95 and 2.49. A statistically significant difference was observed in male and female right side hip bone, while difference in posterior segment of width of GSN was significant on right side (P<.01).

The posterior segment width of greater sciatic notch is significantly more in females when compared to male hip bones. The mean value Index I of greater sciatic notch in right and left side of male hip bone shows 62.75 and 61.75. The Index I of greater sciatic notch in right and left side of female hip bone shows 56.19 and 50.39. The Index I value is more in right side male hip bone. The mean value of Index II of greater sciatic notch in right and left side of male hip bone shows 35.90 and 36.50. The mean value of Index II of greater sciatic notch in right and left side of female hip bone shows 46.33 and 43.70. Index II is 1 to 1.5 times higher in females. A significant difference were found in indices of I & II of Greater sciatic notch of right and left sides.

## Discussion

Suma Dnyanesh did a study to find out sex of hip bone in greater sciatic notch by metric methods. Traditional non metric methods such as visual examination for sexing of hip bones depends on expert's ability and experience for determination of sex and it is difficult to find the sex of hip bones with 100 % accuracy[7]. In the present study all the parameters were measured by metric method and it provides simple and accurate method to determine the sex of skeletal remains. The study concluded that all the parameters of Greater sciatic notch are highly indicative to determine the sex of hip bones in unknown individuals. The Greater sciatic notch was found to be wider in female on the right side and also on left side as compared to male and same observation were made earlier in the study of DavivongsV and Derry De[2,3]. In 2005 IIknur Ari conducted study in 26 adult male hip bones from a Byzantine, to find out the sex and racial differences in greater sciatic notch. By metric assessment, GSN were carried out for studies sex differentiation. They found that differences in bony measurements in population were because of genetic, environmental, diet, life style, evolutionary differences and racial differences in human beings.

Pelvic abnormalities pathological and changes not affecting the GSN in both sex so GSN is considered as an indicator in these conditions. Based on this study metric assessment of GSN was used for sex determination in archaeology and in forensic fragments. [4] In 2013, Gursharan Singh Dhindsa et al did a study in 50 human hip bones for morphometric analysis. After statistical analysis they noted that robusticity of right hip bone is greater than left hip bone and it shows bilateral asymmetry of hip bone. This variations is because of racial and ethnic variations among populations[5]. А significant difference noted both in maximum width and maximum depth of

International Journal of Pharmaceutical and Clinical Research

greater sciatic notch of male and female on right (P<.01) while difference in posterior segment width of GSN was significant on right side (P<.01). Mean values and significant P value are similar with present study.

In 2017, Devadas P *et al* did study on greater sciatic notch dead foetuses for assessment of sexual dimorphism. It showed females had wider GSN than males and male GSN notches were deeper than female ones with 100% accuracy in sexual dimorphism.[6] The results of the present study correlates with Devadas *et al* study and it shows male GSN were deeper than females.

In 2011, Shaival Shah *et al* conducted a study in 174 male and 94 female hip bones to find the sexual dimorphism in GSN. Various parameters like maximum width, maximum depth, posterior segment width, Index 1 & 2 were calculated. It was noted that the greater sciatic notch width was wider in females than males irrespective of the sides and the data were found to be significant. Posterior segment distance of Greater sciatic notch was also found to be more in females than males and P value was significant that correlated with the present study.[8]

In previous study male notch is deeper on right and left side when compared to female which supports finding of Derry De& Letterman [3,10]. Index I depend on depth &width of GSN, helpful in sexing of hip bones, higher in male right and left hip bone than female, confirm earlier reports[9]. The posterior segment of width& Index II were higher in females[2,9]. The mean length of posterior segment is 1 to 1.5 times higher in females [9,10]. Posterior segment width is more in females and the results are correlated with the Yugenti study [11]. Index II is 1 to 1.5 times higher in females [12,13]. The mean value among Greater sciatic width is significantly wider in females than males

irrespective of sides and the results are similar with that of Sanjeev Kumar Jain study[14,15].

# Conclusion

After statistical analysis, all parameters especially posterior segment width and Index II were found to be highly indicative of sex of hip bone. Our study has shown that widening of Greater sciatic notch, which make the pelvis broad in female have largely occur in posterior segment of Greater sciatic notch.

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