ORIGINAL ARTICLE

VALIDITY OF ANTHROPOMETRIC STUDY OF ANATOMICAL FEATURES OF GREATER SCIATIC NOTCH FOR GENDER DETERMINATION: A DISTINCT AND VALUABLE TOOL FOR FORENSIC IDENTIFICATION

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Background: Forensic Medicine has challenging dynamics particularly in identification of gender from bones. Pelvic bone is one of them which is commonly used in gender estimation due to variety of its features. The greater sciatic notch is the best part of pelvic bone for gender determination as its location makes it resilience to trauma even for many years. The aim of this study was to validate the various features such as width, depth angles etc. of greater sciatic notch for sex determination of the deceased. **Methods**: This validation study was carried out in department of Forensic Medicine and Anatomy of Ayub Medical College from June 2023 to December 2023. A sample of 70 dry unidentified pelvic bones were studied by measuring the width, depth, anterior and posterior segments, anterior and posterior angles of the greater sciatic notch. Based on these measurements, the bones were then segregated as male and female bones. After initial gender identification, the standard features of the pelvic bones as per Krogman's classification were used for final confirmation of the gender. **Results**: Result showed width, Anterior segment and posterior angle of greater sciatic notch greater in females while depth of notch deeper, posterior segments, anterior angle greater in males. These parameters and measurements give a unique importance for determining the gender of individual. **Conclusion**: Our study shows that there is a significant difference between gender on the basis of different mentioned parameters of estimation. By using these parameters of greater sciatic notch anthropometric measurements, investigators can easily conclude important milestones of identity and determine the truth.

Keywords: Greater sciatic notch; Gender identification; Pelvic bone

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INTRODUCTION

Human Pelvic bone is made up of different parts. Ilium is one of these bony parts and has notch in it known as greater sciatic notch. It is above the ischial spine and below the posterior inferior iliac spine. This notch is converted into greater sciatic foramen by sacrospinous ligament. Contents of this notch include muscles, veins, arteries and different nerves. Hip bone is unique in its features due to gender identification.[1] During forensic investigation and in many other investigations where individuality of person is a challenging task and individual characteristics identification needs study of the available limited bones the hip bone is very beneficial for all the investigators.[2] This question of gender identification in case of skeletal remains is solved by the help of various characteristics including naked eye examination, biometric measurements of skeletal parts, radiological examination & Microscopic examination.[3] As a general rule the pelvis is more massive with more prominent ridges and muscular markings in the male skeleton as compared to female. But most of times it is also possible that important features of bones are missing especially when we see exhumed body or other conditions where we have limited bony skeleton, but greater sciatic notch usually escapes the trauma.[4] These anatomical features are also affected by various factors including environment, inborn features and personal adoptions.[5] Therefore for the accuracy of findings, the Anthropometric methods are used based on uniqueness in both sexes.[6]

It is worth to mention here that the accuracy of identification for skeletal remains depends on the percentage presence of skeletal parts as per classification of Krogman, which states that there is complete accuracy if all skeleton is available that declines to 95%, 92% & 98%, 80%, 98% with the presence of pelvis, skull, pelvis and skull together, long bones, long bones and pelvis as skeletal parts present for study.[7] Pelvis alone is best for gender identification and as per above discussion due to its resistance to damage and multiple criteria greater sciatic notch is the single best part of the pelvis that can

be used for this purpose. In western and Indian literature many attempts have been made for explaining the importance of greater sciatic notch but in Pakistan very little work has been done. This attempt is for the purpose of highlighting its significance in identification.

MATERIAL AND METHODS

This validation study was conducted on a sample of 70 dry adult human pelvic bones without gender identification/labelling. The bones were taken from the skeletal collection of departments of anatomy and department of Forensic Medicine of Ayub Medical College Abbottabad from June to December 2023. The damaged and pathologically damaged bones were excluded from the study. Adult human anatomically normal pelvic bones were used for the study as recommended by Kumar *et al*.[8] and the bones were numbered for their identification. The features of greater sciatic notch advocated by Kumar *et al*[7] with respect to its width, depth, anterior and posterior segments and angles were studied. Depth and width of greater sciatic notch were measured by taking different landmarks as described in Table 1. Measurements were taken with the help of pencil and stainless-steel scale and the required drawings were drawn on the white paper. Images were taken and the data were entered and analysed using Microsoft excel.

After sex determination based the features of the greater sciatic notch, the bones were further evaluated for sex determination based on known parameters as Krogman's criteria.

RESULTS

The study of 70 adult human pelvic bones on the basis of greater sciatic notch features revealed that 38 bones were of male adults and 32 were of female adults. Different parameters of greater sciatic notch used for initial identification of the gender is presented in Table 2. The data revealed statistically significant difference between all parameters except the Anterior angle.

After initial assessment of the gender based on the greater sciatic notch, the gender of these bones were then finally confirmed by studying obturator foramen, acetabulum, subpubic angle and ilium. The analysis confirmed the validity of gender determination based on the features of the greater sciatic notch.

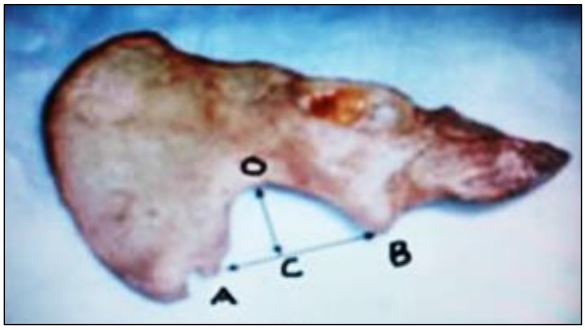

Figure-1: Land marks for greater sciatic notch

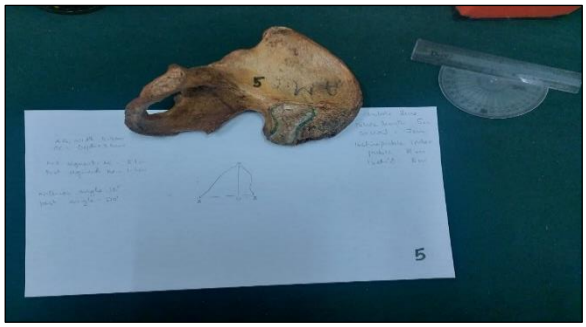

Figure-2. Measurements of greater sciatic notch

Table-1: Landmarks used for the measurements.

Landmarks	Position on the pelvic bone
Anterior part defined by anterior segment and anterior angle	Point A was taken from the tip of ischial spine to the imaginary point C that lies on the line showing width of the notch (Fig. 1), and further sub-classified into Anterior segment (AC) and Anterior Angle (ACO).
Posterior part defined by the posterior angle and segment	Point B taken from termination of posterior border of greater sciatic notch to the imaginary point C, and further sub-classified as Posterior Segment BC and Posterior Angle BCO (Fig. 1)
Deepest part of the notch	Designated as" O", which is measured from point C on the imaginary line. (Fig. 1)

Table-2: Dimensions of parameters

Parameters	Male (n = 38)			Female (n = 32)			
	Range	Mean	Std. Dev.	Range	Mean	Std. Dev.	*P value*
AC Segment (cm)	2.01 – 3.01	2.45	0.22	2.01 – 3.36	2.80	0.46	0.000***
BC Segment (cm)	1.29 – 3.78	2.45	0.38	1.20 – 3.10	1.95	0.63	0.000***
Anterior angle	19 – 49	35.53	9.61	19 – 42	33.06	6.05	0.21
Posterior angle	12 – 42	24.82	8.90	22 – 45	34.50	6.94	0.000***
Width AB (cm)	4 – 4.80	4.46	0.22	4.10 – 6.20	4.88	0.58	0.000***
Depth OC (cm)	2.90 – 4	3.39	0.37	1.90 – 4.20	3.00	0.68	0.003**

DISCUSSION

Gender determination in putrefied bodies is a big challenge faced by the forensic experts besides valid collection of evidences for meeting the ends of the justice. This study was designed to highlight the importance of greater sciatic notch in gender determination. Various parameters of greater sciatic

notch studied showed a significant statistical difference between the bones of male and female individuals, which provide scientific evidence for using these features particularly when only pelvic bone with intact greater sciatic notch is only available.

In our study there was statistically significant difference between the mean depth of greater sciatic notch in males and females (p=0.003). is 3.39 cm with the range of 2.9–4 cm as compared to females with mean value of 3.00 cm with the range of 1.9–4 cm. In females we found Mean width of 4.88 with the range of 4.10–6.20 compared to males having mean width of 4.46 cm with the range of 4–4.80 of 3.08 cm with significance statistical difference between both genders with (p=0.000). Our study shows that width of greater sciatic notch is greater in females comparative to males. Our study is shows that greater sciatic is deeper in males comparative to females. This means there is significant difference between two segments of greater sciatic notch while width is greater in females but at the same time depth is lesser in females in comparison to male having greater depth and lower width.

Kumar *et al* [7] & Shah *et al* [8](p=0.0001). showed that the greater sciatic notch has greater breadth in females compared to males with (p = 0.0001) which is significant value. The same is in consistency with the findings of Derry *et al.*[9] Breadth of female bones is more in females as compared to males due to the fact that nature has given the role of child bearing to the females and these findings also correlates with the natures building of bone structure. Regarding the depth of greater sciatic notch our findings are similar to the findings of Sarac *et al*[10](p=0.9*)* with depth of the notch greater in males as compared to the females. Jovanovic *et al*[11] showed slightly higher values of difference for male compared to female hip bones. These differences are valuable parameters in relation to the landmarks as per discussion of Akshaya K *et al*[12].While Soltani S *et al* [13] is of the view that there are no significant differences between both sexes. But Antony *et al*[14] (p=.001) after observing 40 bones & Prasad *et al*[15] showed consistent results with our findings. These reference studies also show significant difference with (p=0.0001). This showed that the greater sciatic notch is very accurate tool for measurement of sex differences as per our study. Posterior segment is more in females of posterior segment with p value of 0.0001. Davivongs[4] showed the same difference in its study with (p=0.000). Our findings show that the anterior segment is higher in females compared to males (p=0.000) and vice versa for posterior segment similar to the study of Davivongs V *et al* [4] (p=0.0001) Singh *et al*, Shah S *et al*[8] (p=0.0001).and Suma *et al* (p value less than 0.05)

Our study shows that there is greater anterior angle in males than in females but posterior angle is higher in females than in males with (p=0.21). Posterior angle is higher in females with (p=0.000) and higher values significance in females is also highlighted by Takahashi H *et al*[16], Shah S*et al*[8]*(p*=0.0001*)* and Suma *et al*. The present study also shows the same results. While Thomas k *et al* study showing no significant difference in anterior angle difference contrary to difference shown by our study. Total angle AOB is also higher in females as per similar findings of Takahashi H *et al*[16]*(p*=0.32*)*, Shah S *et al*[8] (p=0.0001) & and Sarac *et al*[10]*(p*<0.05).

It is worth mentioning that the best bone in gender identification is pelvic bone and in pelvic bone greater sciatic notch as got greatest significance due to various parameters in gender estimation if individually all segments are studied.

CONCLUSION

The parameters of Greater sciatic notch provide valid evidence for gender estimation, which can be valuable in cases where only pelvic bone remains with greater sciatic notch is only the available specimen.

AUTHORS' CONTRIBUTION

OKJ: Concept, writing. SJ: Data collection. SS: data collection. HI: data collection, proof reading. SJ: data analysis. SA: writing. AA: proof reading, data analysis RI: proof reading data analysis. AI: Data collection

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