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Research Article

Morphometric Study of The Greater Sciatic Notch for Sex Determination: A Radiological Study

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Abstract

The unique structure of the human skeleton and its obvious differences between sexes render it significant from anatomical, forensic, obstetric, radiological, and anthropological perspectives. The hip bone, being comparatively vigorous, is safe to harm and one of the most protected skeletons of the human skeleton. It additionally broadly constitutes the greater sciatic notch, which holds the most prominent degree of sexual dimorphism. The present study was carried out in the radiology department to assess the morphometry of the greater sciatic notch by utilising abdominopelvic CT scan film of the patients residing in the upper western region of Nepal. Various metric parameters of the greater sciatic notch were calculated, including breadth, depth and posterior segment breadth and indices I & II. A total of 138 adults were recruited as subjects for this study, including 64 males and 74 females. The study revealed that the width of GSN is wider in females when compared to males, with a p-value<0.001. The depth of GSN was greater in females on the right side, but no significant difference on the left side (p=0.156). Right index II (P 0.000) was comparatively significant in females than in males, but left index II was not found to be significant. The metric method utilising 3D-CT scan will be beneficial in determining the gender in a partially decomposed, semi-fleshed and charred body recovered from a mass disaster.

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KEYWORDS: Greater sciatic notch, hip bone, Sexual dimorphism

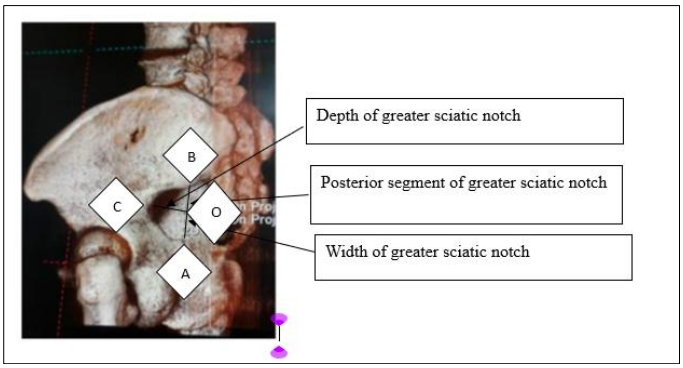
1. INTRODUCTION

The unique structure of the human skeleton and its obvious differences between sexes render it significant from anatomical, forensic, obstetric, radiological, and anthropological perspectives.[1]Skeletal remains are valuable tools for medicolegal experts as well as for anthropologists in gender idenfication .[2]Many identification data of human being can be assessed by use of skeletal remains.[3]Pelvic bone is one of the most reliable bone for gender identification .[4]It has been reported from various studies that Greater Sciatic Notch(GSN) shows the remarkable significant in gender identification.[5] The shape and dimension of the GSN are directly proportional to the dimension of the pelvic inlet.[6] So, many researchers have revealed the importance of GSN as the most important anatomical landmark present in the pelvic bone in determining gender when used alone. [7]Multiple approaches have been used by various scholars to study GSN parameters in the determination of sex.. [8]This study aims to find out the sexual dimorphism among the Nepalese population from the GSN of the hip bone as a parameter using 3D figures provided by MDCT.[9] As in the upper part of the Karnali region of our country, this type of study has not been conducted until now, the study will surely provide important facts regarding sexual dimorphism, which will be helpful for forensic experts of the country to deal with medicolegal issues .[10]

2. MATERIAL AND METHODS

The observational study was conducted from September 2023 to August 2024 among 138 individuals, including 64 males and 74 females, at the Department of Radiology, Karnali Academy of Health Sciences. The sample size calculated from formulae: [n=Z2p(1-p)/e2, where value of p=0.4] [3]The proposal to conduct, this study was submitted to the Institutional Review Committee, Karnali Academy of Health Sciences (IRC-KAHS) and ethical approval was granted with Reference 080/081/20. Exclusion criteria were set not to include CT scans of any congenital or acquired anomaly, restricting to the dimension of bone, fractures and prosthetic replacement. Width (AB) is calculated using point A, which was the tip of the ischial spine, to point B, the piriform tubercle. A perpendicular line was drawn from the baseline (AB) to the deepest point (C) of the greater sciatic notch, forming the maximum depth (OC). As depicted in Figure1, the posterior segment was demonstrated by (OB). OCX100 divided by AB gives the Index I, and OB X100 divided by AB gives the Index II. To reduce observational bias, the same observer was tasked to measure each variable. Each parameter is calculated in millimetres. A blind trial method was used to test the result of the parameter by another observer. An independent sample t-test was applied to measure various variables, and the p-value ≤ 0.05 was considered significant.

Fig. 1



3. RESULTS

The present cross-sectional study was conducted on abdominopelvic CT scans of 138 (64 males and 74 females), as shown in Table 1. The mean age of the subjects was 42.16±17.49 and 41.41±17.13 in males and females, respectively, the minimum age was 18 years, and the maximum age was 84 years, as shown in Table 2

Table 1: Demographic distribution of individuals

Sex	Number	Percentage
Male	64	46.37
Female	74	53.62
Total	138	100%

Table 2: Descriptive statistics for age (n=138)

Sex	Min(yrs)	Max(yrs)	Mean age(yrs)	SD
Males	19	79	42.92	17.85
Females	18	84	41.41	17.13
Average	18.5	81.5	42.165	17.49

Table 3: Distribution of subjects according to age group (n=138)

Age group	Number of subjects (%)
18-28	33(23.9)
29-40	34(24.6)
41-54	35(25.4)
55 and above	36(26.1)
Total	138(100)

Table 4: Descriptive statistics of the right greater sciatic notch in mm (n=138)

Parameters	Min	Max	Mean±SD
Width (AB)	41	68.70	56.26±5.6
Depth (OC)	16	39.60	27.20±4.44
Post. Seg. (AC)	14	27.85	21.63±2.82
Index-I	32.12	71.87	48.52±7.71
Index-II	34.15	40.54	38.32±1.20

Table 5: Descriptive statistics of the left greater sciatic notch in mm (n=138)

Parameters	Min	Max	Mean±SD
Width AB	26.00	67.40	55.97±5.92
Depth OC	20.00	47.70	27.49±4.18
Post.Seg. AC	13.25	26.95	21.23±2.96
Index-I	18.34	72.34	48.59±6.86
Index-II	24.04	39.99	37.77±1.68

Table 6: Comparison of the mean value of the right sciatic notch of males and females in mm (n=138)

Parameter	Male			Female			P-value
	Min	Max	Mean ±SD	Min	Max	Mean ±SD	
Width AB	41.00	68.00	53.59±5.02	44	67.60	58.57±5.14	0.000
Depth OC	16.00	38.60	26.19±4.65	18.10	39.60	28.07±4.08	0.014
Post. Seg. AC	14.00	27.85	20.29±2.51	15.85	27.30	22.78±2.57	0.000
Index-I	33.90	71.87	49.06±8.78	32.12	64.88	48.06±6.67	0.445
Index-II	34.15	40.54	37.76±1.13	35.46	40.38	38.81±1.04	0.000

Table 7: Comparison of mean value left sciatic notch of males and females in mm (n= 138)

Parameter	Male			Female			P value
	Min	Max	Mean ±SD	Min	Max	Mean ±SD	
Width AB	41.50	67.40	54.73±5.50	42.10	68.76	57.04±6.10	0.021
Depth OC	20.00	35.80	26.95±3.94	20.00	47.70	27.96±4.36	0.156
Post.Seg. AC	14.00	26.95	20.61±2.75	13.25	26.00	21.77±3.05	0.021
Index-I	37.35	72.34	49.48±7.38	18.34	63.00	47.81±6.32	0.160
Index-II	24.04	39.99	37.54±1.25	33.73	39.99	37.97±1.97	0.129

Table 8: Comparison of mean values of the sciatic notch of males and females in mm (n= 138)

Parameter	Male			Female			P value
	Min	Max	Mean ±SD	Min	Max	Mean ±SD	
Width AB	44.70	67.55	54.16±4.48	38.80	66.40	57.80±4.75	0.000
Depth OC	21.05	35.80	26.57±3.60	20.80	39.30	28.01±3.28	0.016
Post. Seg. AC	15.73	27.15	20.45±2.24	12.78	26.58	22.27±2.37	0.000
Index-I	36.58	71.58	49.27±6.93	32.33	63.39	47.94±5.13	0.206
Index-II	35.08	40.19	37.65±1.01	30.72	40.02	38.39±1.23	0.000

4. DISCUSSION

Methods applied for the identification of an individual mostly depend upon the set of conditions for a definite subject.[8] Skeletal Gender identification can be found out by skeletal remains using metric as well as non–metric analysis in anthropological studies, both have their strength and weaknesses. [9]The genetically inherited growth is one of the important non-metric tools that doesn't need any measurement and solely depends upon inspection. [10]So skilful observers can easily point it out as being subjective. [11, 12.] Such observations are appropriate mainly for the extreme genders. [13]On the other hand, metric analysis is a simple, easy and dependable method, not having much observer bias. .[7, 8, 9]When measurement tools are used to predict gender from bones, theyshow high variation in inter- and intra-population. [14,15]Gross bones as well as radiological images are used by various scholars for metric analysis for sexual dimorphism worldwide. [7,8,9,10,12]But as an investigator, we must use a specific and reliable technique while measuring the points of anatomical landmarks to determine the sex from bones.[16] Shape and measurements of the

The greater sciatic notch and its parameters have been mostly taken into consideration by various scholars in Genderidentification [10]The countries where there is a lack of documented collection of bones, the metric analysis by radiological methods will be very beneficial.[8,7] Radiological images of skeletal can be repeated and verified by the researchers at any time. [12]No significant variations were found by researchers while using gross bones or 3D-CT images.13,14,15 Therefore, this method will be beneficial in determining the gender in partially decomposed, semi-fleshed and charred bodies recovered from a mass disaster. [17, 18]Preparing a fresh bone by defleshing is a hectic task that can be avoided. [15]Nonetheless, reciprocation of both methods needs to be assessed further. [19]

Width of the greater sciatic notch

The study revealed that the width of GSN is wider in females when compared to males, with a p-value<0.001. The results shown by other studies are similar to this study [10,13,14]. In a side-by-sidecomparison of the width, it is significantly different in females and maleson both sides(p<0.001).[11] In contrast to this

study, the studies conducted by other scholars in Varanasi, American whites and blacks and Nigerian populations, respectively, did not showa significant difference between the width of males and females.[17,18,19]

Depth of the greater sciatic notch

The result of this study has depictedthat the depth of GSN was greater in femalesonthe right side, but there wasno significant difference on the left side (p=0.156). This study reports resemble the other studies, which show the depth of the greater sciatic notch significantly varies among both sexes [20, 21.] In contrast to our study, other studies did not show any significant differences. .[22]

Posterior segment of the greater sciatic notch

The posterior segment of GSN shows significant differences in both sexes on both sides, with a p-value <0.001.The other studies have revealed similar results where the posterior segment was larger in females when compared with males. [1,3,10,16,17] study conducted by others showed no significant differences between males and females. [14, 24]

Index-I of the greater sciatic notch

The males had a smaller width, and they had a larger Index 1, but not significantly different. The result revealed similar findings, and the fact resembled other studies.[9,10,11] In contrast to this study, other studies showed a significantly different index I between males and females.[1,13,14]

Index-II of the greater sciatic notch.

The Index 2 parameter is comparatively higher in females and showed a significant difference between both genders on the right sides (p<0.001). Similar findings were obtained by other researchers in studies carried out at different places.[1,11,15,24] In other studies, the result was opposite, where there was no significant differencein index II between the two genders.[17,18,23]

5. CONCLUSION

Our study reaffirms the utility of morphometric evaluation of the greater sciatic notch using CT scans for sex estimation in a contemporary Nepalese population. Significant sex-based differences were observed for most parameters, particularly width, posterior segment, and Index II. However, parameters like Index I and depth (on the left side) showed less discriminatory power. The results highlight the potential of these indices for forensic and anthropological applications, though population-specific validation remains crucial. The use of CT imaging allows for non-invasive, repeatable assessment of skeletal morphology, particularly valuable in mass disasters, forensic investigations, and regions with limited access to skeletal collections. Further studies involving larger, more diverse samples and inter-population comparisons will help enhance the reliability and applicability of CT-based morphometric sex estimation methods.

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There are no funds for this study.

CONFLICT OF INTEREST

There is no conflict of interest.

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