



ORIGINAL RESEARCH PAPER

Anatomy

ESTIMATION OF GENDER USING PER-CUTANEOUS TIBIAL LENGTH IN PEOPLE OF GWALIOR REGION

KEY WORDS: Forensic Anthropology, Gender estimation, Percutaneous Tibial Length

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ABSTRACT

Gender estimation is an important part of the identification process of human skeletal remains or body parts to establish individuality of an unidentified dead, body or any mutilated part of such body by the Medico-legal expert. The present study made an attempt to estimate the gender from per-cutaneous tibial length (PCTL). A random sample of 270 male and 270 female students of G.R. Medical College, Gwalior between the age group of 18-21 years was chosen. PCTL of right and left side were measured with the help of spreading caliper. Statistical calculations were done using Graph pad prism and Microsoft word excel softwares. On computing the data, the mean PCTL for male was found to be 38.24±2.3cm which was significantly (p<0.0001) greater than female which was 36.06±2.5cm which indicates a significant positive gender difference between male and female PCTL. It was concluded that the gender of a deceased person whose only body part available is a mutilated leg, can be determined to some extent fairly accurately. Thus the data of this study is recommended in anthropological studies for gender estimation amongst the ethnic group under study.

INTRODUCTION

Sexual dimorphism is the biological base for gender estimation based on the physical and behavioral differences existing between males and females.¹ Personal identification is considered as the most reliable factor in forensic science identifying the gender and stature of a body especially establishing the identity of indefinite dead bodies, parts of bodies, dismembered or mutilated remains, partially fleshed, charred or even skeletal fragments.² In cases of severely decomposed and dismembered dead bodies, determining the sex of the deceased is a challenging task. Although metric studies may appear repetitive in principle and technique, such forensic studies must attempt to answer key questions related to age, sex, stature and race after examining incomplete or fragmentary remains.³

The discriminant function equations for sex identification of skeletal remains are considered a common practice⁴⁻⁵ and reported to be population specific. So, it is essential for every region to develop its own equation.⁶ Many researchers studied the sexual dimorphism of adult skeletons using the dimensions of the skull morphologically or CT scan of head using its bony points,⁷⁻⁹ face¹⁰⁻¹², long bones¹³, digit ratio¹⁴ etc. but still the measurement of hard bony points can give the quick results.

A morphometric method, relies on measurements and statistical techniques. These methods are considered more advantageous for data evaluation and its application to the skeleton.¹⁵ It has been proved by many anthropologists that different body parts can be used to determine the sex of the person. However, many indices depend on direct distances between two bony landmarks.¹⁶⁻¹⁷ Forensic anthropologists while dealing with skeletal remains have very little choice due to non-availability of complete skeleton from a scene of crime in most of the cases. As the degree of sexual dimorphism, and the age at which it occurs in males and females, varies between different populations, sex estimation standards are necessary to be population specific.¹⁸ Hence, our study made an effort to identify the individuality and sex differences from percutaneous tibial length in Indian race of Gwalior region.

MATERIAL AND METHODS

It is a cross sectional study in which we choose a random sample of 540 students, 270 Male and 270 female, in the age group between 18-21 years from Gajra Raja Medical College, Gwalior (Madhya Pradesh). We noted the age, gender and Per-Cutaneous Tibial Length (PCTL) of right and left side in centimeters. We excluded the subjects who had history of major trauma or fracture of leg, achondroplasia or any other congenital or hereditary bony disease, from our study.

For measuring the tibial length (PCTL) subject was asked to stand

and keep his/her foot on a stool to maintain the angle between flexor surface of leg and that of the thigh at 90°. Then two points were marked with skin marking pencil. Upper point was the medial most point on upper border of medial condyle of tibia and Lower point was tip of medial malleolus of tibia. Distance between two points was measured with the help of Spreading Caliper to determine tibial length as shown in Figure 1. The measurements were taken by the same observer and with the same instrument, to avoid any technical and/or inter-observer error and to maintain reproducibility. The measurements were taken three times and their mean value was considered for calculations.

The data was computed, tabulated and statistically analyzed using Graph Pad Prism and Microsoft Excel Windows 2007 softwares. The data obtained were compared with the other similar studies.



Figure 1: Method of measurement of Per-Cutaneous Tibial Length by Spreading caliper.

OBSERVATIONS AND RESULTS

The descriptive statistical analysis of PCTL of right and left side of tibia in male and female was calculated and shown in Table 1 and Graph 1. There was no significant difference (p>0.05) in the percutaneous length of right and left tibia in both genders, thus showing bilateral symmetry in the length of Tibia in both gender.

The mean PCTL for male was 38.24cm and for female was 36.064cm which was significantly (p<0.0001) greater for male compared with female and thus estimates significant gender difference (Table 2) as calculated by student's t-test with t value 10.50.

The mean length of right PCTL in male is 38.26 and the standard deviation is 2.5 whereas the mean length of left PCTL is 38.22 and standard deviation is 2.3. The t-value is 0.18 and p-value is >0.05 which is statistically not significant.

In females the mean length of right PCTL is 36.1 and the standard deviation is 2.4 whereas the mean length of left PCTL is 36.03 and standard deviation is 2.6. The t-value is 0.32 and p-value is >0.05 which is statistically insignificant. Male has higher percutaneous tibial length of both right and left side as comparison to female.

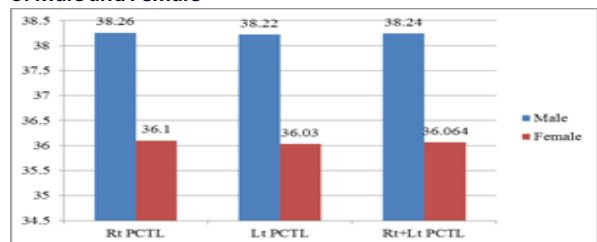
Table 1: Descriptive statistics of Tibial length of Male and Female

Statistcs PCTL	Male (n = 270)	Female (n = 270)				
	Rt PCTL	Lt PCTL	Rt+Lt PCTL	Rt PCTL	Lt PCTL	Rt+Lt PCTL
Range	34 - 45.8cm	34 - 43.7 cm	34 - 43.65cm	32 - 42cm	32 - 48cm	32 - 44cm
Mean	38.26cm	38.22cm	38.24cm	36.10cm	36.03cm	36.064cm
Std. Deviation	2.5	2.3	2.3	2.4	2.6	2.5
Std. Error	0.1492	0.1396	0.1426	0.1479	0.1592	0.1499
t - value	t=0.18	-	t=0.32	-	-	-
p - value	0.8576	-	0.7513	-	-	-
P value summary	Not-significant	-	Not-significant	-	-	-

Table 2: Student t- test between Male and Female Tibial length

t - value	t=10.50
p - value	P<0.0001 (Significant)
Difference between means	2.176 ± 0.2069
Are means signif. different? (P < 0.05)	Yes
95% confidence interval	1.767 to 2.578
R squared	0.1701

Graph 1: Showing Mean Per Cutaneous Tibial length (PCTL) of Male and Female



DISCUSSION

Different body parts are used by the different authors to identify the gender of the individual. In our study we have found that the mean PCTL of right side in male is 38.26cm and in female is 36.1cm whereas the mean PCTL of left side in male is 38.22cm and in female is 36.03cm and we have found that male has more PCTL length as comparison to female. Similar result was found by Khatun et al19 with mean PCTL of right side in male is 37.82 and in female is 34.84 whereas the mean PCTL of left side in male is 37.79 and in female is 34.79. In our study, there is no statistical difference occur between the left and right tibia length of male as well as in female. Our finding correlate with that of Khatun et al,19 Bhavna and Nath,20 Chavan et al,21 Kaore et al,22 as well as Agnihotri et al23 and many others who also have the similar view that no

significant statistical difference occur between the right and left PCTL in male as well in female.

Mukta Rani24 compared the bilateral percutaneous measurement of tibia and expressed that left tibia is longer than right tibia in both sexes.

In our study the mean PCTL for male was 38.24cm and for female was 36.064cm which was significantly greater for male compared with female. Our study also correlates with the study conducted by Saini et al25 in which the PCTL of male was found to be 40.90 cm and that of the female was 38.09 cm. Similarly Mohanty26 observed the PCTL of male was 37.08 cm and that of female was 35.03 cm. Magdy et al27 found the PCTL of male was 38.04 cm and that of female was 36.52cm. Also Sah and Shrestha28 measured the value of PCTL in male was 37.57 cm and of female was 34.90 cm which was similar to our finding. Chavan et al21 estimated the mean PCTL was 37.32cm ±2.18 cm for male and 34.44cm ± 2.10 cm for female.

It is concluded that there were no significant difference in the percutaneous length of right and left tibia in both genders, thus showing bilateral symmetry in the length of Tibia in both genders. It is possible to determine the gender of a deceased person whose only body part available is a mutilated leg, by using the data calculated for people of these region fairly accurately to some extent. However the data derived cannot be generalized to all population groups, hence it is necessary to work on these kind of study region wise and population specific. Thus the data of this study is recommended in anthropological studies for gender estimation amongst the ethnic group under study.

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