



Study of a Trochanteric Length of Femur

Authors

Ashish Pandya¹, Dangar Khima², Singel Tulshi³

¹Associate Professor, Anatomy Department, P.D.U. Govt. Medical College, Rajkot, Gujarat

²Assistant Professor, Anatomy Department, P.D.U. Govt. Medical College, Rajkot, Gujarat

³Professor and Head, B.J. Medical College, Ahmedabad, Gujarat

Corresponding Author

Dangar Khima

Anatomy Department, P.D.U. Govt. Medical College, Rajkot, Jamangar Road, Gujarat 360001

Email: kpdangar@gmail.com, +91-9825107010

ABSTRACT

Introduction: *Trochanteric length of the femur is useful in selection of size of the nail in fracture of femur. It might be useful as a tool of sex determination and racial character.*

Aims and objectives: *Present study aims to obtain values of trochanteric femoral length and to evaluate its possible usefulness in determining correct sexual identification and as a racial characteristic.*

Material and Methods: *Study sample consisted of 242 dry, human, adult femora [176male (87 right, 89 left) and 66 female (32 right, 34 left)] from skeletal collections of Anatomy departments of medical colleges.*

Observations and Results: *Trochanteric length was measured with the help of osteometric board. Mean Values obtained were, 422.92 and 415 for right male and female, and 425.5 and 419.2 for left male and female respectively. Higher value in male was statistically significant ($P < 0.05$) on right side and insignificant on left side. Demarking point (D.P.) analysis of the data showed that right femora with trochanteric length more than 468.83 were definitely male and less than 344.13 were definitely female. Trochanteric length identified 5.74% of right male femora and 0.00% of right female femora.*

Keywords: *Trochanteric length, Sexual dimorphism, Femur*

INTRODUCTION

Trochanteric length of a femur is a distance between the highest point of the greater trochanter and the lowest point of the medial condyle.

Length of the femur is useful in selection of size of the nail in fracture of femur. As these nails are inserted through the greater trochanter of femur, mean value of trochanteric length of femur in given population will assist the implant maker in proper

designing of implant and it will also be helpful to surgeon in selection of proper nail size in a given population.

Sex determination is relatively easy if the entire skeleton is available, pelvis and skull are the most reliable bones for this purpose.^[1] Nevertheless, in medicolegal cases one does not always have a complete pelvis or skull, and therefore it is

necessary to be able to identify sex from the other parts of the skeleton also.

Trochanteric length of femur is studied by several workers in different populations [Kate B. R. (1970) in the India, Madras, Nagpur, Poona, Amritsar, Lucknow and Hyderabad ^[2], Kate B. R. (1976) in the Ceylonese, Formosa, Korea, Japan, China, Australia and Andaman ^[3], Ziylan T., & Murshid K.A (2002) in Anatolian ^[4], Ismail Ö. and K. Katayama (2008) in Ancient Japanese ^[5].

According to Krogman and Iscan^[1] standards of morphological and Morphometrical attributes in the skeleton may differ with the population samples involved and this is true with reference to dimensions and indices (average and range) and as a general rule standards should be used with reference to group from which they are drawn and upon which they are based they are not interchangeable.

AIMS AND OBJECTIVES

Present study was carried out to establish mean values of trochanteric femoral length in femora from Gujarat region and to ascertain its role in sexual identification and racial characteristic.

MATERIAL AND METHODS

Study sample consisted of 242 dry, human, adult femora [176 male (87 right, 89 left) and 66 female (32 right, 34 left] from various medical colleges. Femora showing pathological abnormality were not included in the study.

It is a distance between the highest point of the greater trochanter and the lowest point of the medial condyle. It was measured using osteometric board ^[2 & 6] (Image: 1)



Image 1: Measurement of trochanteric length

Each bone was measured thrice and measurement was repeated by two independent observers, mean of these observations was taken as a final reading to nullify any intra and inter-observer error. Data collected was tabulated and analyzed statistically sidewise & sexwise by demarking point (D.P.) analysis.

OBSERVATION AND RESULTS

Right Femur

The trochanteric length of the right male femur ranged from 351mm-485mm with an average of 422.92mm and standard deviation (S.D.) of 26.26 and the trochanteric length of the right female femur ranged from 402mm-444mm with an average of 415mm and standard deviation of 17.94.

Thus, mean value of trochanteric length was higher in male as compared to female. Calculated z-value and P value showed that the difference in the mean

trochanteric length in male and female was statistically significant with $P < 0.05$. Calculated range can be obtained by $\text{mean} \pm 3 \text{ S.D.}$, and with it we can calculate demarking points.

For right male bone calculated range was 344.13mm-501.70mm, and for right female bone it was 361.16mm-468.83mm (Table: 1). With the demarking point for male right bone ($>468.83\text{mm}$) we can correctly identify a sex of 5 bones out of 87 (5.74%) and for female right bone, demarking point (344.13mm) will definitely identify a sex of 0 bone out of 32 (0.00%). (Chart: 1)

Left femur

The length of the left male femur ranged from 359mm-480mm with an average of 425.5mm and standard deviation (S.D.) of 25.06 and the length of the left female femur ranged from 400mm-454mm with an average of 419.2mm and standard deviation of 21.46.

Thus, mean value of trochanteric length was higher in male as compared to female. Calculated z-value and P value showed that the difference in the mean trochanteric length in male and female was statistically insignificant with $P > 0.0$. With the demarking point for left male bone ($>483.59\text{mm}$) we can correctly identify a sex of 0 bones out of 89 (0.00%) and for female left bone ($<350.32\text{mm}$), demarking point will definitely identify a sex of a 0 bone out of 34 (0.00%). (Chart: 1)

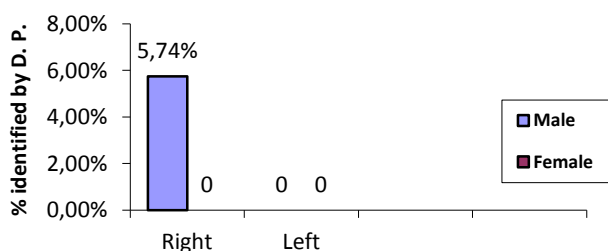


Chart 1: Bones Identified by D.P. for Trochanteric length

Table: 1 Statistical values of Trochanteric Length (All dimensions in mm)

Statistical values	RIGHT		LEFT	
	MALE (n=87)	FEMALE (n=32)	MALE (n=89)	FEMALE (n=34)
Range	351-485	402-444	359-480	400-454
Mean	422.92	415	425.5	419.2
S.D.	26.26	17.94	25.06	21.46
z-value	1.97		1.39	
P value	$P < 0.05$		$P > 0.05$	
Calculated range $\text{mean} \pm 3\text{S.D.}$	344.13-501.70	361.16-468.83	350.32-500.70	354.80-483.59
D.P	>468.83	<344.13	>483.59	<350.32
% & no. identified by DP.	5.74% (no=5)	0.00% (no=0)	0.00% (no=0)	0.00% (no=0)

DISCUSSION

The trochanteric length of the right male femur ranged from 351mm-485mm with an average of 422.92mm and standard deviation (S.D.) of 26.26 and the trochanteric length of the left male femur ranged from 359mm-480mm with an average of 425.5mm and standard deviation (S.D.) of 25.06. Calculated z-value and P value showed that the difference of the mean between right & left male was statistically insignificant with $P > 0.05$.

The trochanteric length of the right female femur ranged from 402mm-444mm with an average of 415mm and standard deviation of 17.94 and the trochanteric length of the left female femur ranged from 400mm to 454mm with an average of 419.2mm and standard deviation of 21.46. Calculated z-value and P value showed that the difference of the mean between right and left female was statistically insignificant with $P > 0.05$.

Generally male bones are longer and massive, and this difference is reflected by the greater values of the mean trochanteric femoral length in male on both sides.

Table2: Comparison of Trochanteric Length in various populations

Population & Study		Trochanteric Femoral Length (in mm)						
		Male			Female			
		Mean	S.D.	% Identified	Mean	S.D.	% Identified	
Kate B. R. (1970), India		41.8	-	-	37.9	-	-	
Kate B. R. (1970), Madras		43.4	-	-	38.2	-	-	
Kate B. R. (1970), Nagpur		41.8	-	-	38.0	-	-	
Kate B. R. (1970), Poona		40.3	-	-	38.0	-	-	
Kate B. R. (1970), Amritsar		42.2	-	-	39.0	-	-	
Kate B. R. (1970), Lucknow		42.0	-	-	36.2	-	-	
Kate B. R. (1970), Hyderabad		41.2	-	-	38.5	-	-	
Kate B. R. (1976), Ceylonese		Mean: 40.8, S.D.:2.4						
Kate B. R. (1976), Formosa		Mean: 40.4						
Kate B. R. (1976), Korea		Mean: 38.6						
Kate B. R. (1976), Japan		Mean: 38.7						
Kate B. R. (1976), China		Mean: 41						
Kate B. R. (1976), Australia		Mean: 36.7						
Kate B. R. (1976), Andaman		Mean: 34.5						
Ziylan T., & Murshid K.A (2002), Anatolian		Rt.	Mean: 405.4, S.D.: 22.9					
		Lt.	Mean: 402.6, S.D.: 28.1					
Ismail. & Katayama (2008) Ancient Japanese		394.09	-	-	362.06	-	-	
present study (n=242)		Rt (119)	422.92	26.26	5.74%	415	17.94	0.00%
		Lt.(123)	425.5	25.06	0.00%	419.2	21.46	0.00%

Calculated z-value and P value showed that the difference in the mean trochanteric length in male and female was statistically significant with $P < 0.05$ on the right side and it was insignificant on the left side $P > 0.05$ (Table: 1).

For right male bone calculated range was 344.13mm-501.70mm and for right female bone calculated range was 361.16mm-468.83mm. With the help of these demarking points, right femur with trochanteric length more than >468.83 mm can be correctly classified as a male and right femur with trochanteric length less than <344.13 mm can be correctly classified as a female. However if the length of bone is between 344.13mm and 468.83mm, sexing was not possible due to overlapping. Demarking point analysis when applied to study group, identified sex of 5 right male bones out of 87 (5.74%) and for right female bone definitely identify a sex of 0 bone out of 32 (0.00%).

For left male bone calculated range was 350.32mm to 500.70mm and for left female bone it was 354.80mm to 483.59mm. With the demarking point for left male bone (>483.59 mm) we can correctly identify a sex of 0 bone out of 89 (0.00%) and for female left bone (<350.32 mm), demarking point will definitely identify a sex of a 0 bone out of 34 (0.00%).

Comparison of trochanteric femoral length of male between present study and other studies has been shown in table: 32. Mean trochanteric femoral length value of male in present study was 422.92mm (right) & 425.5mm (left). In other studies it varied from 394.09mm to 434.0mm.

Mean trochanteric femoral length of male in present study was higher than the ancient Japanese^[5]; and it correspond with the values in India^[2], Madras^[2], Nagpur^[2], Poona^[2], Amritsar^[2], Lucknow^[2], and Hyderabad^[2]. Values reported by Kate B. R. (1976)^[3] in Ceylonese, Formosa, Korea, Japan, China, Australia & Andaman and work by Ziylan T., & Murshid K.A (2002)^[4] in Anatolian did not

mention sexwise mean values, but mean trochanteric length of male in present study was higher than the mean values reported by these studies.

Table: 1 show that mean trochanteric femoral length of female in present study was 415.0mm (right) & 419.2mm (left). In other studies it varied from 362mm to 382mm.

Mean trochanteric femoral length of female in present study was higher than the values reported from India^[2], Madras^[2], Nagpur^[2], Poona^[2], Amritsar^[2], Lucknow^[2], Hyderabad^[2] and ancient Japanese^[2].

If we compare with the studies which did not mention sexwise mean values, mean trochanteric length of female in present study was higher than the mean values of Korea^[3], Japan^[3], Australia^[3] & Andaman^[3] and it was corresponding with the Ceylonese^[3], Formosa^[3], China^[3] and Anatolian population^[4].

The persons from different race differ in various factors affecting bone morphology like genetic constitution, diet, nutrition status, environment and physical activity. This could be the reason for different values of trochanteric length in a different population.

CONCLUSION

Mean Values of trochanteric length of femora in study population were, 422.92 and 415 for right male and female, and 425.5 and 419.2 for left male and female respectively. Higher value in male was statistically significant ($P < 0.05$) on right side and insignificant on left side. Difference between mean values of right sided & left sided femora was statistically insignificant. Demarking point (D.P.) analysis of the data showed that right femora with trochanteric length more than 468.83 were definitely male and less than 344.13 were definitely female. Trochanteric length identified 5.74% of right male femora and 0.00% of right female femora. Trochanteric length is not a useful parameter of sex determination from left sided femora

REFERENCES

1. Krogman, W. M. and Iscan, M. Y. Human Skeleton in Forensic Medicine. 2nd Edition, Charles C. Thomas, Springfield, 1986.
2. Kate B.R., Measurements of the Femur for Orthopaedic Surgeons. *Indian Journal of Medical Research* July. 1970; 58: 896-905.
3. Kate B.R., The Ceylonese Femur and Its Comparisons with Indian and Other Asian Femur. *Journal of Anatomical Society of India*. 1976; 25(3): 124-127.
4. Ziyilan T., & Murshid K.A, An analysis of Anatolian human femur anthropometry, *Turkish Journal of Medical science*. 2002; 32: 231-235.
5. Ismail Özer and Kazumichi Katayama, Sex determination using the femur in an ancient Japanese population, *Coll. Antropol.* 32 (2008) 1: 67-72
6. Singh I.P. & Bhasin M.K., Manual of biological anthropology in Osteometry, 1st Edition, Kamla-Raj Prakashan, Delhi, 2004, pp: 79-83.