Sexual Dimorphism of Human Skull by Different Parameters

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Abstract: *Various studies have clearly demonstrated sexual dimorphism in human skeleton. Therefore the purpose of the study is to compare morphometric measurements of important bony landmarks on skull for determination of sex. Adult 150 (89 male and 61 female) skulls were studied for seven parameters. Out of 7 parameters maximum cranial length, maximum cranial breadth, cranial height, maximum cranial circumference, biasterionic breadth, bregma-lamda length were found to be significant. The result are similar to those obtained by previous workers.*

Keywords: skull, sexual dimorphism, cranium, morphometry, anthropometric parameters

1. Introduction

To identify the deceased person from bone is most common and critical problem faced by Anatomists, Forensic experts and Anthropologist.[1] Skeletal remains have been used for sexing the individual as bones of the body are last to perish after death next to enamel.[1]Traditionally skull is most studied bone in physical anthropology.[2] Traditional studies by non-metrical methods were not reliable.So morphometry and statistical methods were introduced[1].. The purpose of this study is to establish standards for sex determination from cranium by various metrical parameters.[3] With the above aim, seven measurements were taken and statistically analyzed and compared with the results of the other workers who had carried out similar studies.

2. Aims and Objectives

The study was carried out with the following aims and objectives:
- To compare morphometric measurements of important bony landmarks on skull between male and female which will be helpful in determination of sex in medico legal cases.
- To compare values of present study with that of previous workers in different population.

3. Material and Method

The material consisted of 150 intact adult skulls .The skulls were taken from Anatomy and Forensic department of various medical institutions and from the bone set possessed by medical students. All the skulls used for the study were dry, fully ossified and free of damage or deformity. The skulls were differentiated into male and female on the basis of certain classic anatomic characteristics like glabella , supraorbital ridge, nuchal line, mastoid process, muscular markings , external acoustic meatus etc. (Olivier,1960[4]; Testut and Latarjet,1977[5] Gray 1985[6]).With this 89 male and 61 female skulls were differentiated. Instruments used for the measurements of various parameters of skull were sliding vernier caliper, standard flexible steel tape, weighing machine, thread, chalk, marker and scale.

4. Technique of Taking Skull Measurements

The techniques of taking skull measurements and landmarks on the bone were studied and taken from the text books of practical anthropometry by various authors (Keen J.A.1950[7], Deshmukh A.G.2006[1]). The bony points were first localized and then measurements were taken with the sliding vernier caliper. A straight distance between two bony points was measured. The measurements were repeated twice in two separate occasions and the mean was taken to get accurate result and then recorded. The thread was used for measuring cranial circumference. Weighing machine was used for measuring the weight of skull.

Various Landmarks on the skull for taking measurements were[6] :
1) Asterion → It is the point where lambdoid suture, occipito mastoidal suture and parietomastoidal sutures meet
2) Basion → It is the point where the anterior margin of the foramina magnum is cut by the mid-sagittal plane.
3) Bregma → It is the point where sagittal suture meets the coronal suture.
4) Glabella → It is the points which lies on the root of the nose between the supra orbital ridges of the forehead. It is the most projecting point on the mid-sagittal plane.
5) Lambda → It is the point where lambdoid suture meet the sagittal suture.
6) Opisthocranion → It is the most posteriorly projecting point in the mid-sagittal plane

Anthropometric Parameters [1]
1) Maximum Cranial Length (MCL)→ It is the straight distance between glabella and opisthocranion.
2) Maximum Cranial Breadth (MCB) → It measures the maximum breadth above the level of supramastoid crest at right angle to mid-sagittal plane.
3) Cranial Height (CH) → It measures the straight distance between basion & bregma.

4) Maximum Cranial Circumference (MCC)→ It measures the horizontal circumference over glabella–opisthocranion-glabella, taken in maximum cranial length plane and at right angle to the mid-sagittal plane . It is measured with the help of thread and steel tape.

5) Biasterionic Breadth (BB) → It measures straight distance between two asterion.

6) Bragma–Lambda length (BLL) → It measures straight distance between bregma and lambda.

7) Weight (W)→ It is measured with weighing machine. It is recorded in grams.

All measurements except weight were taken in millimeters.

5. Result

89 male & 61 female skulls were differentiated & studied. Seven dimensions were measured between various landmarks on the skull. All the measurements were statistically analyzed. Mean, standard deviation, standard error of mean, t value & p value were calculated for each parameter. Statistical analysis of the parameters shows following results:

Parameter	Gr	N	Mean	S.D.	S.E.	t value	p value	Result
MCL	M	89	174.31	3.32	0.35	17.60	0.000	S
	F	61	163.63	4.07	0.52			
MCB	M	89	133.05	3.62	0.38	11.72	0.000	S
	F	61	124.85	4.93	0.63			
CH	M	89	137.03	4.50	0.47	11.81	0.000	S
	F	61	127.08	5.79	0.74			
MCC	M	89	495.75	14.79	1.56	10.98	0.000	S
	F	61	471.44	10.76	1.37			
BB	M	89	103.61	4.74	0.50	8.97	0.000	S
	F	61	97.11	3.72	0.47			
BLL	M	89	110.33	8.13	0.86	3.47	0.001	S
	F	61	105.75	7.60	0.97			
Weight	M	89	511.79	36.13	3.83	1.94	0.054	NS
	F	61	500.32	34.44	4.41			

p value for maximum cranial length maximum cranial breadth, cranial height, maximum cranial circumference, biasterionic breadth, bregma lamda length was less than 0.05 so these parameters were significant. The p value for weight was 0.054 so weight was found to be non significant.

6. Discussion

Skull is one of the commonest part of skeleton used to opine on sex of an individual.In present study,150 skulls (89male, 61female) are studied for 7 parameters.Mean values of the parameters in present study are compared with mean values obtained by previous workers.

Parameters		KEEN J.A.(1950)[7]		DESHMUKH A.G. et al(2006)[1]		PRESENT STUDY	
		MEAN	p VALUE	MEAN	p VALUE	MEAN	p VALUE
MCL (mm)	M	185.6	<0.05 (S)	173	<0.001 (S)	174.31	<0.001 (S)
	F	178.6		166		163.33	
MCB (mm)	M	135.4	>0.05 (NS)	131	<0.001 (S)	133.05	<0.001 (S)
	F	133.0		127		124.85	
CH (mm)	M	131.4	<0.05 (S)	132	<0.001 (S)	137.03	<0.001 (S)
	F	127.1		127		127.08	
MCC (mm)	M	516.2	<0.05 (S)	496	<0.001 (S)	495.75	<0.001 (S)
	F	498.3		479		471.44	
BB (mm)	M	_	_	101.98	<0.05 (S)	103.61	<0.001 (S)
	F	_		98		97.11	
BLL (mm)	M	126.5	<0.05 (S)	125	<0.05 (S)	110.3	<0.05 (S)
	F	121.7		120		105.7	
WEIGHT (g)	M	618	>0.05 (NS)	526	>0.05 (NS)	511.79	>0.05 (NS)
	F	572		494		500.32	

Findings of present study are correlated with findings of Deshmukh A.G.et al(2006)[1].

7. Conclusion

From the above study following conclusions are made.
1) Mean values of almost all parameters are more in males than in females.
2) Parameters which are statistically significant are maximum cranial length, maximum cranial breadth, cranial height, maximum cranial circumference, biasterionic breadth and bregma-lamda length.
3) Sex determination of skull is helpful in medicolegal cases.

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