Original Article

A Study of Cranial Capacity and Cranial Index for Sex Determination in Indian Skull

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Abstract

Introduction: The present study was carried out to enhance the accuracy of sexing the skull which will be helpful in anthropometric and medico legal studies. **Methods:** Adult human dry skull of known sex (100 male and 100 female) were obtained from different medical colleges of Maharashtra. The parameters like cranial capacity and cranial index were studied. **Results:** Cranial capacity is significantly higher in male skull than in female skull. Cranial index is significantly more in female skull than in male skull. **Conclusion:** Both parameters cranial capacity and cranial index are more reliable for determination of sex of skull.

Keywords: Cranial capacity; Cranial Index; Skull.

Introduction

Identification of human skeletal remains as a major important tool in medico-legal practices like criminal identification, mass disasters and violation of human rights. One of the principal biological indicators of identity is the sex of the individual.

Skull is one of the common and authentic parts of the skeleton used to detect the sex of an individual next to pelvis. Sexual dimorhism exhibited by the skull is mainly dependent on changes that occur in the male at puberty that reflect increased muscle attachment whereas the female skull tends to retain pedomorphic features.[1] In India, studies on sexual dimorphism of skull are but. a few; so the present study is undertaken which enhances the accuracy of sexing the skull which will be helpful in anthropometric and medico legal studies.

Material and Methods

For the present study, adult human skulls of known sex were collected from different medical colleges of Maharashtra from Dept. of Anatomy.100 male and100 female skulls were taken for the study. All the bones were fully ossified, dry and without any damage or deformity.

The following instruments were used for the measurement of various parameters-

1. Sliding vernier calliper
2. Spreading calliper
3. Scale.
4. 2000cc Measuring cylinder.
5. Funnel.

The following parameters were studied, tabulated and analysed by statistical methods.

1. Cranial capacity
2. Maximum cranial length
3. Maximum cranial breadth

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4.   Cranial index

Cranial Capacity

We have selected Breitinger's mustard seed technique for calculation of cranial capacity.[2,3,4] This method appears to be more reliable and free from errors.

Procedure – First all the foramina of the skull were blocked by cotton and the cranial cavity was filled through the foramen magnum by means of a funnel with mustard seeds. The skull was shaken from time to time to fill the cavity entirely. When the skull was filled entirely, then the seeds were poured into a 2000 cubic centimetre measuring cylinder through a funnel. The measuring cylinder was

then agitated until it was thoroughly packed and the reading was taken directly. The procedure was repeated for three times for every skull. Mean of the three observations was taken as a reading of cranial capacity of each skull. It was recorded in cubic centimetre.

Maximum Skull Length

Maximum distance between the glabella and opisthocranion. It was measured with spreading caliper. It was recorded in millimetres.

Maximum Skull Breadth

Maximum transverse breadth at the level of the parietal eminences. It was measured by sliding vernier caliper. It was recorded in millimetres.

$$\frac{\text{Maximum skull breadth}}{\text{Maximum skull length}} \times 100$$

Table 1: Shows Cranial Capacity in Cubic Centimetre

		Males	Females
1	Number of bones	100	100
2	Range	1060-1450	1020-1300
3	Mean	1192.20	1117.10
4	Standard Deviation	73.575	53.960
5	Statistically significant or not (Yes or No)	Yes	
6	't' value	8.231	
7	p (significance) value	<0.001	

Cranial Index

Results

Parameters were studied and analyzed statistically using a standard computer programme. The analyzed data was tabulated

Table 2: Shows Cranial Index

		Males	Females
1	Number of bones	100	100
2	Range	62.84-87.27	61.62-87.33
3	Mean	75.13	76.28
4	Standard Deviation	3.78	4.17
5	Statistically significant or not (Yes or No)	Yes	
6	't' value	2.045	
7	p (significance) value	<0.05	

as follows- Table 1 shows that cranial capacity is significantly higher in male skull than in female skull. Table 2 shows cranial index is significantly more in female skull than in male skull.

Discussion

Identification of the deceased from bones is the most critical and important problem faced by anatomist, medico legal experts and anthropologist.

Skeletal remains have been used sexing the individual as bones of the body are last to perish after death, next to enamel of teeth.

Each parameter is discussed by comparing them with the findings of previous workers. Present study correlates with the findings of previous worker. Table 3 and 4 showing comparative study of different workers The findings of present study on cranial index agree with study of Sangvichien *et al* (2007)[5] and Parsons and Keene (1920).[6] The findings of present study on cranial capacity are nearer to the findings of Hwang *et al* (1995)[7], who found that cranial capacity is significant. According to Sahana (1993), cranial capacity of female skulls is 10% less than the male skulls. [8] Our findings go in favour with Sahana.

Conclusions

Cranial index is significantly more in female skull than in male skull.

Cranial capacity is significantly higher in male skull as compared with that in the female skull.

Thus the present study shows that the above

Table 3: Comparison between Previous and Present Study on Cranial Index

Author's name	Males				Females				S.S.
	N	X	R	S.D.	N	X	R	S.D.	P Value
Sangvichien *et al* (2007)	65	83.1	73.7-91.2	4.1	35	85.8	75.7-95.5	4.8	0.003
Parsons and Keene (1920)	120	75.8	----	---	40	78.2	---	----	----
Present Study (2010)	100	75.1	62.8-87.3	3.8	100	76.3	61.6-87.3	4.2	<0.05

Table 4: Comparison between Previous and Present Study on Cranial Capacity

Author's name	Males				Females				S.S.
	N	X	R	S.D.	N	X	R	S.D.	p Value
Hwang *et al* (1995)	64	1470	1240-1715	107	23	1317	1050-1515	117	<0.05
Present Study (2010)	100	1192.2	1060-1450	73.6	100	1117.1	1020-1300	54	<0.001

Key:
N = Number of Specimen   S.D. = Standard deviation
X = Mean   S.S. = Statistical significant
R = Range

parameters are much useful as far as the sex identification of skull is concerned.

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