

Detection of multiple variations in human skulls

Dr. Arun Kumar S. Bilodi¹
Mr. G. Shiva Kumar²
Dr. B.N. Sinha³

Abstract

Fifty adult human skulls were studied. Two out of fifty skulls showed multiple variations while other forty-eight skulls showed few anomalies eg, incomplete metopic sutures, wormian bones, absence of supra orbital notch and foramen.

Keywords: mastoid; skulls wormian; cranial fossae; frontalis; calvaria.

Aim

The aim of the present study is to record multiple variations together with few anomalies that came across during the study of fifty adult human skulls.

Introduction

Skull is a term used for cranium with mandible. Cranium is the term used for the skull which contains cranial bones without mandible. It contains brain in its upper part covered by calvaria which is immobile. This calvaria is fixed to the remaining facial bones formed by maxillary bone, zygomatic bones, nasal bones, lacrimal bones and sphenoid bones.³

Embryonic Development

The skull develops from Neurocranium to protect the brain, it is mesenchymal in origin and the facial skeleton is developed from Viscerocranium. Neurocranium is formed by both membrane ossification and endochondral ossification. Endochondral ossification is also known as Chondrocranium. That part developed by the ossification of membranes is called Membranous Neurocranium or esmocranium.²

In the anterior cranial fossa, ethmoid bone gets ossified in cartilage along with bones of middle and posterior cranial fossae. The rest of the skull bones ossify in membrane.¹

Materials and methods

Fifty human skulls were taken for the study from the collection of Anatomy Department of Nepalgunj Medical College, Chisapani. Each skull was examined both externally and internally, and variations were noted. Two out of fifty skulls showed multiple variations while other forty-eight skulls showed some anomalies. Each cranial fossa was examined in detail and variations were detected and recorded.

Observations

The following are the clusters of variation in first skull due to absorption of bone or due to aging.

I. Norma frontalis:

- a. The roots of the canine tooth on the right are exposed to the surface due to absorption of bone and also due to aging.
- b. Bilateral supra orbital notches are present on both sides. The left notch is shallow and the right is deep.
- c. There is round swelling measuring five centimeters above the supra orbital margin on the left, 1.5 cm lateral to the mid line over the frontal bone.
- d. The bone below the infra orbital foramen is very much depressed below which a horizontal border joins the hard palate at right angles just below the zygomatico maxillary suture. This suture

is very prominent on both sides.

e. Alveolar process is V-shaped which shows the presence of four incisor teeth in socket in situ. The root of the canine tooth on the right side is exposed.

f. Infra orbital fissure is very much prominent which is wider in the anterior part.

Norma frontalis

II. Norma-basalis

a. The anterior border of maxilla has become almost horizontal at the level of hard palate on both sides maybe due to absorption of alveolar process as a result of aging or tooth extraction.

b. Styloid process on the right side is unusually long and pointed.

c. On the right, lateral pterygoid plate shows unusual posterior growths in its lower part.

d. Palato maxillary suture is not horizontal but protruded in front having an oblique directions on both sides. Hard palate show a long horizontal axis and short transverse axis which is oblong in shape. This may explain an oblique palato maxillary suture.

e. Foramen Lacerum on both sides are very large, maybe because of absorption of bones.

f. All the foramen in the skull are very large, again maybe due to absorption of bones.

g. On the right, a long axis of the facet over the occipital condyle, is very much longer than the left side.

h. Vomero Vaginal canal shows a hiatus or opening, maybe due to absorption of bone or aging.

Norma basalis

III. Norma-occipitalis

a. Mastoid notch present on the inner surface of mastoid process due to the presence of occipital artery, is very prominent and wide on the both sides.

b. Wormian bone is present superolaterally to the mastoid process on the left.

IV. Norma lateralis

a. Auricular fossa of the squamous part of the temporal bone is separated from tympanic plate of temporary bones by a wide suture and show tubercle in front of external acoustic meatus.

b. The temporal surface of zygomatic bone shows a very deep surface continuing in the body of maxilla in the posterior surface up to the level of zygomatic arch.

Norma lateralis

V. Cranial fossae

a. Posterior condylar canal on the left shows a foramen on the inner surface in the superior aspect of the occipital bone connected by a groove with Jugular Foramen.

b. Jugular Foramen are wide on both sides.

c. Internal acoustic meatus shows a presence of wide sulcus on the right again due to absorption of bones.

d. Middle clinoid process is present which is approximating with anterior clinoid process.

e. The roof for the inferior petrosal sinus at occipito petrous suture is very wide and shallow showing the presence of a large foramen posterior on the left through which the inferior petrosal sinus pass through. On the right, a shallow groove continues with the anterior part of Jugular Foramen.

- f. The middle of the groove for the internal carotid artery, is very deep.
- g. The impression for trigeminal ganglion is very deep due to absorption of bone.
- h. The groove for the internal carotid artery is very wide and shallow.
- i. A very big foramen is formed between the anterior clinoid process and the middle clinoid process through which passes the internal carotid artery reaching the base of the skull. The base is very wide and shallow.
- j. The jugular sphenoidale is very widely separated from the tuberculum sellae.
- k. All the sutures are widely separated inside the skull, maybe due to absorption of bones forming it.
- l. The cribriform plate of ethmoid is very much depressed and also wide.
- m. Segmoid and transverse sulcus are very wide and shallow on the right going through the big notch in the posterior part of the Jugular foramen.
- n. Fossa for the superior bulb of internal Jugular vein is very much deep on the right.
- o. All the muscular markings and impressions due to sulci and gyri, are very prominent on the inner side of the cranial fossae.
- p. Chiasmaticus sulcus is very wide and shallow.

Cranial fossae

The following observations were made in the second skull:

- a. Facet on the occipital condyle are united with one another into bony process which is extended medially in front of the foramen magnum, terminating in the formation of tubercle on the left side, the spine is on the right. Lateral to this is the presence of foramen through which passes the Emissary vein.
- b. The skull shows sutural bone just above the nasion bone, one centimeter wide and long in the metopic suture just below the glabella.
- c. Infra orbital grooves are wide and shallow.
- d. There are two facet measuring two centimetre in diameter on either side of Pharyngeal tubercle.
- e. The left Jugular foramen is very large compared with the right. The right Jugular foramen is separated anteriorly from the foramen by the spicule of bone for inferior petrosal sinus.
- f. Foramen lacerum is quite large oval, more or less round shape on both sides.
- g. Occasionally, the foramen ovale and spinosum are confluent on the right but in our present study on the right, foramen spinosum, showed incomplete foramina communicating foramen ovale and separated by two pointed bony spicule. On the left, bony spicule separates foramina ovale and spinosum which is protruding inside the foramen ovale.
- h. The left mastoid notch is slightly wider when compared with the right posteriorly by the origin of posterior belly of digastrice muscle.
- i. Most of the important foramen diametres are markedly larger.
- j. The anterior surface of the body of maxilla shows a marked depression on the right as compared to the left.

Other skulls showed:

- a. Prominent mastoid processes were seen on both sides with prominent muscular markings in two out of fifty skulls. **4%**
- b. The absence of supra orbital notches/foramens that may have resulted due to injury to supra orbital vessels and nerves, was observed in one out of fifty skulls. **2%**

- c. Sutural bones were found on external surface of skull near lamdiod suture, pterion, asterion in three out of fifty skulls. **6%**
- d. Metopism and rudimentry of metopic (incomplete metopic sutures) suture were seen in four out of fifty skulls. **8%**
- e. Prominent external occipital protuberances were seen in eight out of fifty skulls. **16%**

Absence of supraorbital foramen or notch

Incomplete metopic suture

Wormian bone near asterion

Remanants of metopic suture

Multiple variations might have occurred due to aging or subsequent absorption of bones or due to variations in the formation of skulls. The above variations might be a normal finding without any clinical significance. However, it might give rise to various neuro-vascular signs and symptoms.

Conclusion

The presence of multiple of variations may manifest in the later part of life or it may not manifest at all. These variations, if present, can be detected during surgery or at autopsy. Prior knowledge of possible variations maybe important both to anthropologists and neuro surgeons.

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References

1. Mc. Minn. R.M.H. Last's Anatomy - Regional and Applied - Churchill - Livingstone 9th Edition 655p (1997).
2. Malwatkar S.G. Integrated text book of Anatomy Oxford University Press. New Delhi 388p (1999).
3. William Gray's Anatomy ISE- Churchill - Livingstone - 38 Editions 550-551p (1995).