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Incidence of metopic suture in dry adult cadaveric skulls its morphology and importance

Manjunath Halagatti[1], Srinivasa Sagar B[2,*], Channabasana Gouda[3]

[1,2]Assistant Professor, [3]Associate Professor, Dept. of Anatomy, KIMS, Koppal, Karnataka

***Corresponding Author:**
Email: drmanjunathhalagatti@gmail.com

Abstract

Introduction: Structurally being a dentate type of suture, the metopic suture is subjected for variant presentations. It extends from nasion to bregma. It is normally closed by 8 years of age. This suture may persist after 8 years due to non union of two halves of frontal bones. It is also called as median frontal suture.

Aim of the study: This study is done to find out the incidence of metopic suture and also the incidence of its types. Further, the study is to discuss the features and importance of metopic suture.

Materials and Method: 282 dry adult skulls were observed for the presence of metopic suture. They are classified into complete and incomplete type.

Results: The study revealed the incidence of 6.02% of persistent metopic suture. Conclusion: This study will be helpful for diagnostic and surgical procedures for radiologists and neurosurgeons.

Keywords: Suture, Metopic, Frontal, Nasion

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Introduction

Frontal bone is one of the bone forming calvaria. It is a pneumatic, flat bone. It has a squamous part, which forms the forehead and orbital plates which form the roof of orbit.(1) Developmentally the frontal bone is formed by the union of two halves and the suture between them is called metopic suture. Structurally, metopic suture is a dentate type of suture. Each half of frontal bone ossifies from one primary centre in the membrane during 8th week of intrauterine life. At birth both the halves of the frontal bone remain separate as metopic suture. This is completely replaced by bone at about 2 years. Remnants of this suture may persist at the glabella.(1) Centre of ossification for each half of frontal bone appear at the frontal tuber. Ossification extends from this centre superiorly, posteriorly and inferiorly. The median suture between the two halves usually closes in the first postnatal year but may persist as the metopic suture in a small percentage of individuals and various ethnic groups.(2) It is located anterior to the coronal suture. The fusion of this suture during ossification proceeds from the bregma towards the nasion.(3) The term metopic is a greek word, which means "in the middle of face".(4)

Different authors have mentioned the age of complete fusion of these two halves of frontal bone and disappearance of the suture between 1-8 years of age. Persistence of this metopic suture from the bregma upto the nasion is termed as metopism. Whereas presence of suture extending from the bregma or from the nasion, only for a short distance is called as an incomplete metopic suture.

Sutures have an important role in proper growth of brain. The duration of sutural persistence is considered as a pre-condition for the continuous growth of bones, thus a factor for the normal growth of skull.(5) Persistence of metopic suture may not be pathological, but its anatomy, incidence is important, as its presence may arise confusion for frontal bone fractures in radiological investigations and even as sagittal suture. Metopism is also significant for paleodemography and forensic medicine.(6)

Aim of the Study

This study has been done to observe the number of skulls with metopic suture, classify the metopic sutures into complete and incomplete type. Further to classify the incomplete verity based on shape. Then to correlate the data with previous studies and discuss the morphology and importance of metopic suture.

Materials and Method

282 dry adult cadaveric skulls of unknown sex were observed for the presence of metopic suture. These skulls have been taken from Department of Anatomy and Department of Forensic Medicine, KIMS, Koppal, Karnataka. Those skulls which had metopic suture are classified as Complete and Incomplete types.

Complete metopic suture: extending from bregma to nasion.

Incomplete metopic suture: extends for a short distance from the nasion or from bregma.

Further, each of the incomplete variety is classified depending upon from where it arises as, Nasion

Incomplete type of metopic suture and Bregma Incomplete type of metopic suture.

The Nasion type is classified depending upon its shape as Linear type, V shape and U shape.

The classification is according to that which is followed by Agarwal et all,[7] Ajmani et al[8] and Castilho et al.[9]

The results thus obtained are mentioned in table formats, compared with previous studies by different authors and morphological significance of the metopic suture has been discussed.

Observations

Table 1: Incidence of Complete and Incomplete sutures

Type of suture	Number	Percentage
Complete	17	6.02
Incomplete	92	32.62
Linear type	62	24.46
U shape	21	7.44
V shape	09	3.19

Fig. 1: Complete metopic suture

Fig. 2: Linear type of incomplete metopic suture

Fig. 3: 'V' shape of incomplete metopic suture

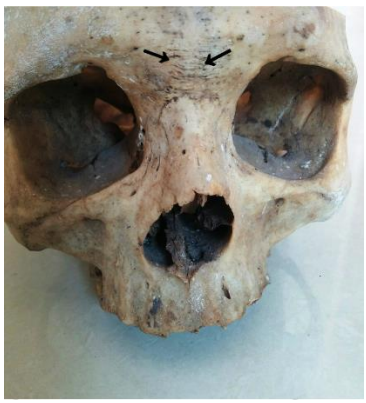

Fig. 4: 'U' shape of incomplete metopic suture

Discussion

The incidence of metopic suture has a variation in its presentation ranging from 1-10%. In our study on 282 dry adult cadaveric skulls, we have observed 17 skulls (6.02%) which were of complete type.

Table 2: Comparison table depicting racial variation of metopism

Worker/Author	Population	Incidence
Agarwal[7]	Indians	2.66%
Ajmani[8]	Nigerians	3.4%
Das[10]	Indians (UP)	3.31%
B.V. Murlimanju[11]	Indians	1.2%
Hussain Saheb[12]	Indians (South India)	3.2%
Breathnach[13]	European	7-10%
Woo[14]	Mongolians	10%
Pankaj R[15]	Indians	1.25%
Ravikumar V[16]	Indians (Karnataka)	5.4%
Hemalatha G[17]	Indians (AP)	2.22%
William F Masih[18]	Indians (Western Rajasthan)	6.5% (in all age groups)
Shanta Chandrasekaran[19]	Indians (South India)	5%
Current study	Indians (Karnataka)	6.02%

The comparison table shows that there is varied presentation of metopism ranging from 1-10%. As in the table, the study on metopism by Agarwal,[7] Ajmani[8] B.V. Murlimanju,[11] Ravikumar V,[16] Shanta Chandrasekaran[19] showed racial and regional variations. Our study revealed 6.02%, a study on 282 dry adult cadaveric skulls in the region of Karnataka, India. The incidence in the current study is more than that by Shanta Chandrasekaran[19] and Ravikumar V.[16]

Many factors have been implicated as the reason behind the persistence of metopic suture. Factors like abnormal growth of cranial bones, hydrocephalus, growth retardation, heredity, plagiocephaly, mechanical factors and hormonal dysfunctions.[20] Many researchers are of the opinion that it is the genetic influence than any other reason which is responsible for the metopism.[9] One of the finding in Apert's syndrome is, defective closure of metopic suture.[21] Falk D,[22] opined that metopism is an adaptation for giving birth to babies with larger brain and is correlated to the shift to a rapidly growing brain after birth and may be due to the expansion of frontal bone. Many authors concluded that it is the racial influence responsible for the metopism. Woo,[14] stated that, metopism is more frequent among whites and Mongoloids (10%) than among Negroids (2%).

Our study observed nasion type of metopic suture which had an incidence of 32.62% (92 skulls out of 282). Whereas have not observed any bregma type of metopic suture. Out of the 92 nasion type of incomplete metopic sutures, 62 were linear type, 21 were U shaped and 9 were V shape.

Table 3: Comparison of incidence of types of Incomplete metopic sutures

Type	Agarwal[7]	Ajmani[8]	Das[10]	Pankaj R[15]	Masih[18]	Shanta Chandrasekaran[19]	Our study
Total %	35.51	31.57	17.57	22.5	34	40	32.62
Linear type	23.12	24.27	--	16.25	20	17	24.46
H type	1.57	3.88	--	--	--	--	--
U type	--	--	--	1	16	15	7.44
V type	3.25	0.49	1.01	5	12	7.5	3.19
Inverted U type	2.43	0.97	1.93	--	--	--	--
Y type	1.96	--	0.28	--	--	--	--

Incidence of incomplete metopic suture in our study was 32.62%. The incidence of linear type, U and V types of incomplete sutures has been mentioned in the table 3. We have not observed inverted U type, Y and H types of incomplete sutures which were reported by some authors as mentioned in the Table 3.

Conclusion

We would like to conclude that information about the metopic suture is significant. Such knowledge is essential for the neurosurgeons, radiologists and anthropologists. The current study reports the 6.02% of complete and 32.62% of incomplete metopic sutures. This study provides an important data of metopism, which should be kept in mind by neurosurgeons during treating a traumatized patient and also during frontal craniotomy. This data will help in avoiding confusion between vertical frontal bone fractures and metopic suture. The details of types and their incidence are needed for paleodemography and forensic medicine.

This study also provides comparative data of incidence of different types of metopic suture, which can be utilized for further investigations on this suture and possible reasons behind it.

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