

Morphology of metopic suture and its clinical significance in human adult skull

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SUMMARY

Introduction: Metopic suture is a dentate type of suture extending from the nasion to the bregma of the skull bone. It is otherwise known as median frontal suture. The metopic suture normally closes at the age of 8 years sometime even after 8 years it persists due to non-union of two halves of frontal bones. The incidence of metopism varies with race. Hence the present study was undertaken.

Aim of the Study: To find out the incidence of metopism in South Indian population.

Materials and Method: 70 dry adult skulls were observed for the presence of metopic suture. Metopic suture were classified into complete metopic suture (metopism) and incomplete metopic suture type.

Results: In the present study the incidence of metopism was 5.71% in South Indian population.

Conclusion: The knowledge of metopic suture is significant for radiologist (which is usually mistaken as cranial fracture), neurosurgeons, forensic medicine and anthropologist.

Key Words: Suture; Metopism; Frontal bone; Nasion; Bregma

INTRODUCTION

Frontal bone is a pneumatic single flat bone of the calvaria. It has a two parts, squamous part involved in the formation of forehead whereas orbital part forming the roof of the orbit (1). The median suture between the two halves of frontal bone usually closes in the first postnatal year but may persist as the metopic suture in some individuals and various ethnic groups (2). It is located anterior to the coronal suture.

It develops by the union of two halves of frontal bone. Each half of frontal bone ossifies from one primary centre in the membrane at the frontal tuber by 8th week of intrauterine life. Ossification extends from this centre in different directions superiorly, posteriorly and inferiorly. The suture between the frontal bone is known as metopic suture, dentate type of suture. The fusion of suture during ossification proceeds from the bregma towards the nasion (3). The term metopic is a greek word means "in the middle of face" (4). At birth both the halves of frontal bone united by the metopic suture, which is completely replaced by bone at the age of 2 years. Remnants of this suture may persist at the glabella (1).

Sutures play an important role in the growth of brain and also for normal growth of the skull (5). Persistence of metopic suture may not be pathological, but its anatomy and incidence are important from clinical point of view. Metopism is also significant for paleodemography and in forensic medicine (6).

A.K. Dutta (4) reported that at birth the 2 halves of the frontal bone are separate as the metopic suture, replaced by bone at the age of 2 years. Remnants of the metopic suture may persist in some skulls at glabella. G.J. Romanes (5) says the metopic suture closes by 5-6th year leaving traces above and below. Brethnach (6-11) concluded that the incidence of metopic suture varied in different race in Europeans 7-10%, 4-5% in Yellow races whereas 1% in African population. The present study was undertaken to analyse the incidence rate of metopic suture complete or incomplete in South Indian population which helps clinically to rule out frontal bone fracture from metopic suture this knowledge is necessary for radiologist, orthopedician and neurosurgeons. It throws a light on etiology for delayed union at molecular level for embryologist.

MATERIALS AND METHODS

70 dry adult cadaveric skulls of unknown sex were collected from the

Department of Anatomy, Subbaiah Institute of Medical Sciences and Govt Vellore Medical College. The non-mutilated complete adult skull examined for metopic suture. The metopic suture classification followed by Agarwal et al., (7) Ajmani et al., (11) and Castilho et al., (12) were applied. The classification is as follows

Complete metopic suture: Metopic suture extending from bregma to nasion.

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

Further incomplete metopic suture is sub-classified, depending upon site from where metopic suture arises either into Nasion Incomplete type of metopic suture and Bregma Incomplete type of metopic suture.

Based on the shape, Nasion Incomplete metopic suture type is described as linear type, V-shape and U-shape.

OBSERVATIONS AND RESULTS

In the present study out of 70 dry adult cadaveric skulls 4 skulls (5.71%) showed complete metopism. The nasion type of metopic suture was seen in 22 skulls (31.4%) whereas bregma type of metopic suture was not observed. Out of the 22 nasion type of incomplete metopic sutures, 15 linear types, 5 U-shaped and 2 V-shape were noted. The observation of metopic suture were showed in Figure 1 and tabulated in Table 1. The incidence of complete metopism in my study and other studies were tabulated in Table 2.

DISCUSSION

In our study out of 70 skulls incidence of complete metopic suture were 5.71% the values were similar to other studies tabulated in Table 2 of 70 skulls incidence of bregma type incomplete metopic suture were zero but the incidence of nasion type incomplete metopic suture were 31.40%. Incidence reports of present study were similar to report of other Indian authors which were tabulated in Table 3 for comparison purpose. The incidence of metopic suture varies from 1-10%.

The sutures of the skull ensure its proper shape during development. Premature ossification results in abnormal growth and shape of the skull e.g. "tower skull" (midface hypoplasia and ocular proptosis) scaphocephaly (also known as dolichocephaly) is the most common form of craniosynostosis (13-

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Figure 1) Showing types of Metopic Suture

TABLE 1:
Incidence of complete and incomplete metopic sutures

Type of suture	Number(70)	Percentage %
Complete	4	5.71
Incomplete	22	31.40
Linear type	15	21.42
U shape	5	7.14
V shape	2	2.80

TABLE 2:
Incidence of metopism in different races-comparison

Author	Incidence (%)	Population/race
Agarwal(11)	2.66%	Indians
Ajmani(10)	3.4%	Nigerians
Das(13)	3.31%	Indians (UP)
Breathnach(9)	7-10%	European
Breathnach(9)	4-5%	Yellow races
Breathnach(9)	1%	African population
Hussain Saheb(14)	3.2%	Indians (South India)
Shanta Chandrasekaran(15)	5%	Indians (South India)
William F Masih(16)	6.5%(in all age groups)	Indians (Western Rajasthan)
Manjunath Halagatti etal(17)	6.02%	Indians (Karnataka)
Present study	5.71%	Indians

TABLE 3:
Comparison of incidence of nasion types of incomplete metopic suture

Nasion incomplete metopic suture	Agarwal(11)	Ajmani(10)	Das(13)	Pankaj R(20)	Masih(21)	Shanta Chandrasekaran(15)	Manjunath Halagatti(17)	Our study
Total %	35.51	31.57	17.57	22.5	34	40	32.62	31.40
Linear %	23.12	24.27	~	16.25	20	17	24.46	21.42
U type %	~	~	~	1	12	15	7.44	7.14
V type %	3.25	0.49	1.01	5	~	7.5	3.19	2.80

18). It is often associated with agenesis or hypoplasia of frontal sinus (19,20). Many researchers are of the opinion metopism has genetic influence (12) Consideration should be given at the level of molecular biology.

CONCLUSION

The knowledge about metopic suture is essential for the neurosurgeons, radiologists and anthropologists. The present study provides the data about incidence of metopic suture in South Indian population which helps the radiologist to differentiate between vertical frontal bone fracture and metopic suture and neurosurgeons to treat a head injury patient and during frontal craniotomy procedure. Further study should be carried at molecular level by embryologist to know the etiology for metopism.

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