



STUDY ON METOPIC SUTURES IN SOUTH INDIAN SKULLS

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Abstract: The midline suture between two halves of the developing frontal bone usually fuses by infancy or early childhood. In some cases it may persist in complete or incomplete metopic sutures with variable morphology. The incidence and morphological pattern of these sutures were being studied using 120 skulls from the Department of Anatomy, Yenepoya Medical College among which 4 skulls (3.33%) showed complete metopism, 98 skulls (81.66%) showed presence of incomplete metopic suture whereas 18 skulls (15%) showed total absence of metopic suture. Of the skulls that showed incomplete metopic sutures, 96 (97.95%) were on the anterior 1/3 starting from nasion extending over glabella, 2 (2.04%) were on the middle 1/3. No suture could be found on the posterior 1/3. The morphological pattern was studied on the sutures present on anterior 1/3 of the skull. Among these, 26 (26.53%) were linear, 13 (13.26%) were double linear, 13 (13.26%) were V shaped, 12 (12.24%) were U shaped, 7 (7.14%) were H shaped, 5 (5.1%) were Y shaped. 2 (2.04%) showed inverted-U pattern whereas 18 (18.36%) showed side to side excursion patterns. The data obtained in this study will be useful in the field of Anatomy, Forensic medicine, radio diagnosis and neurosurgery.

Keywords: Metopism, Suture, Frontal Bone, Skull.

INTRODUCTION

The bones of skull are held together by fibrous type of joints termed sutures. The frontal bone is an unpaired skull bone forming the forehead or the 'frons'. The metopic suture (also known as the frontal suture) is a dentate type of calvarial suture that runs through the midline across the frontal bone¹. Manzanares et al² mentioned that the metopic suture ossifies in membrane from two primary centers which appear by the end of second month of fetal life and fuses at the inner surface of the skull by chondroid tissue. This suture usually disappears during infancy or in early childhood. However, in some cases, it may persist either in a complete or in an incomplete form. The suture, when extends from bregma to nasion in a complete form, it is called metopism or persistent metopic suture or sutura frontalis persistent and if it extends in an interrupted form, it is called an incomplete metopic suture. The remnant suture seldom penetrates deeper than the outer table of the frontal bone, or it may not penetrate the outer table at all²⁰. This remnant, as with the inferior portion of a complete metopic suture, is very tortuous and exhibits various morphological patterns. Though rare, metopism is not considered as pathological,¹⁸ but their premature fusion can result in craniosynostosis and trigonocephaly¹⁹ and is termed as metopic synostosis. Bryce⁸ stated that the metopism is more frequent in the taller individuals.

According to A.K.Datta³ the two halves of the frontal bone remain separate at birth as the metopic

suture and is replaced by bony tissue at about 2 years. Wood Jones (1953) was of the opinion that when the metopic suture persists, it has very definite characteristics. It is a typical dentate suture. The edges of the two bones are finely serrated from the nasion to a point about 2 cm anterior to the coronal suture, where its closure becomes more simple and direct. This simple posterior part is the pars bregmatica and the area is included within the anterior fontanelle. It is commonly said that, even in the adult, some traces of the suture persist at the nasion¹⁶. Moore, Dalley, Agur⁴ stated that frontal suture is obliterated by 8th year and in approximately 8% of the people, metopic suture persists. Warwick & Williams reported that metopic suture is obliterated by 8th year. G.J.Romanes¹⁶ says that the metopic suture closes by 5th or 6th year leaving traces above or below. Similar studies have also been made of Indian skulls and metopism has been found to be 5% (Jit & Shah, 1948), 3.31% (Das, Saxena & Beg, 1973) and 2.66% (Agarwal, Malhotra & Tewari, 1979). Many factors were attributed for persistence of metopic sutures into adult age which include hormones, cytokines, growth factors, cranial malformations, abnormal skull growth, hydrocephalus, atavism, genetic causes, etc.⁷. Hess²⁰ defined "metopica syndrome" of persistent metopic suture with associated cranial and finger anomalies, probably genetically determined. Ossenber²⁰ stated that the trait is presence slightly more often in females than in males. Torgersen²² studied the trait radio graphically in living and determined that the suture is due to a

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dominant gene with varying penetrance. Impaired closure of the metopic suture is common in Apert syndrome²³. Knowledge regarding persistent metopic suture is essential in studying the radiographs to avoid misinterpretation as fractures. It is also useful in evaluating various medico legal cases. This study attempts to reveal the incidence of metopic suture, both complete and incomplete and its morphological variations in adult south Indian skulls.

MATERIALS AND METHODS

This study was conducted in the Department of Anatomy, Yenepoya Medical College, Mangalore. 120 Skulls of unknown age and sex were obtained from the osteology section. Damaged and diseased skulls were excluded from the study. The skulls were observed macroscopically for the presence of metopic suture. Those skulls that showed the suture extending from nasion to bregma uninterruptedly were considered as complete metopism. Those skulls that showed incomplete sutures were analyzed for the position of the suture-whether it is present on the anterior, middle or posterior 1/3 and also for the morphological pattern it showed, using a magnifying hand lens. The data obtained were tabulated and analyzed by descriptive statistics. The percentage of incidence of each type of metopic suture were noted and compared with previous studies.

RESULTS

120 Skulls were studied for metopic suture of which 4 skulls (3.33%) showed complete metopism (figure.1) 98 skulls (81.66%) showed incomplete metopic suture and 18 skulls (15%) showed total absence of metopic suture. Of the skulls that showed incomplete metopic sutures, 96 (97.95%) were on the anterior 1/3 starting from nasion extending over glabella, 2 (2.04%) were on the middle 1/3 and none on the posterior 1/3. The morphological pattern of these sutures were studied. The sutures on middle 1/3 showed linear pattern whereas the sutures present on anterior 1/3 of the skull, showed a variety of morphological patterns.



Figure.1: Skulls showing complete metopic sutures

Among these, 26 (26.53%) were linear, 13 (13.26%) were double linear, 13 (13.26%) were V shaped, 12 (12.24%) were U shaped, 7 (7.14%) were H shaped, 5 (5.1%) were Y shaped. 2 (2.04%) showed inverted-U pattern whereas 18 (18.36%) showed side to side excursion patterns. (figure.2)

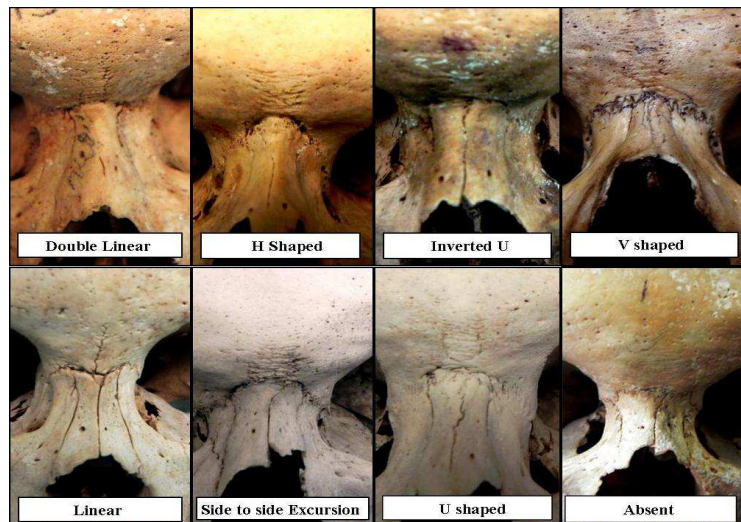


Figure.2: Sutural patterns observed in the study

Table.1: Incidence of metopic sutures

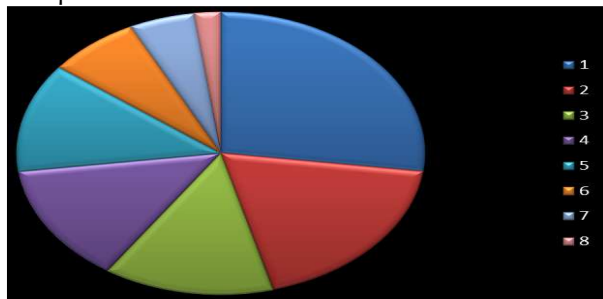
Extent Of Suture	Number	Percentage
Absent Suture	18	15 %
Complete	4	3.33%
Incomplete	98	81.66%

Table.2: Incidence of incomplete suture as per the location

Location Of Suture	Number	Percentage
Anterior 1/3	96	97.95%
Middle 1/3	2	2.04%
Posterior 1/3	0	-

Table.3: Incidence of morphological patterns of incomplete sutures

Pattern Of Suture	Number	Percentage
Linear	26	26.53%
Side-Side Excursions	18	18.36%
Double Linear	13	13.26%
V-Shaped	13	13.26%
U-Shaped	12	12.24%
H-Shaped	7	7.14%
Y-Shaped	5	5.1%
Inverted -U	2	2.04%

Graph.1: Incidence of morphological patterns of incomplete sutures.

1-linear, 2-side to side excursion, 3-double linear, 4-V-shaped, 5-U-shaped, 6-H-shaped, 7-Y-shaped, 8-Inverted U

DISCUSSION

Variations of metopic sutures have been studied by several research workers. Keith¹³ stated that the metopic suture disappears at the end of the first year or at the beginning of second year of life, but Piersol¹⁴ had mentioned that it closes by the end of the fourth year with a faint trace persisting at the lower end. According to Romanes¹⁵, the metopic suture is present at birth but is normally closed by the five or six years. Only traces of it will be left above and below. In our study metopism was found in four cases (3.3%) which is higher than the incidence reported in Negro by Bryce⁸ (1.20%), Australian by Bryce⁸ (1.00%), Indian by Das et al⁹ (3.31%) and Indian by Agarwal¹⁰ et al (2.66%), Ajmani¹¹ et al (3.40%), by Jit and Shah¹⁹⁴⁸, 5%¹², but lower than the European by Bryce⁸ (8.70%), Mongolian by Bryce⁸ (5.10%), Scottish by Bryce⁸ (1915, 9.50%)and Berry¹³(0-7.4%).In the present study, metopism is seen in 4 skulls which accounts to 3.33%.The results of the present study with previous ones are compared in table no.4

In our study, majority of the skulls showed incomplete sutures(81.66%).Of this, most were of linear variety(26.53%) followed by side to side excursion pattern(18.36%).Double linear and V-shaped patterns comes next with an incidence of 13.26% each. This is accompanied by U-shaped (12.24%), H-shaped (7.14%) and Y-shaped patterns. The least observed was inverted U-shape with 2.04% incidence. The incidence of these morphological patterns in previous studies is compared in table no.5

Table.4: Incidence of metopism in different races as reported by various workers

Worker	Race	Percentage
Jit & Shah. et al., (1948)	Indian (Punjabi)	5.00%
Das. et al., (1973)	Indian (U.P)	3.31%
Agarwal. et al., (1979)	Indian (Kanpur)	2.66%
Bryce. et al., (1915)	European	8.70%
	Mongolian	5.10%
	Negro	1.20%
	Australian	1.00%
	Scottish	9.50%
Keith. et al., (1948)	Subject to race	3-8%
Woo. et al., (1949)	Mongoloids	10.0%
	Negroids	2.0%
Breathnach. et al., (1958)	European	7-10%
	Yellow races	4-5%
	Africans	1.00%
Romanes. et al., (1972)	Europeans	Up to 8.00%
Berry. et al., (1975)	Various ethnic groups	07.4%
M. L. Ajmani. et al.,	Nigerians	3.40%
Present Study	India (South India)	3.33%

Table.5: Comparison of the incidence of incomplete metopic suture with other workers

Extent and shape of suture	Agarwal et al. (1979) %	Das et al. (1973) %	Jit & Shah et al. (1948) %	M. L. Ajmani et al. (1983) %	Present study (2013) %
Incomplete	35.51	17.57	—	31.57	81.66%
Linear	23.12	—	—	24.27	26.53%
'H'-shaped	1.57	—	1.25	3.88	7.14%
'U' shaped	—	—	—	—	12.24%
Inverted 'U' shaped	2.43	1.93	11.25	0.97	2.04%
'V' Shaped	3.25	1.01	—	0.49	13.26%
'Y' Shaped	1.96	0.28	1.25	—	5.1%

CONCLUSION

The persistence of metopic suture in adults which separates the frontal bones is of paramount importance in interpreting the radiological images and in evaluating medico legal cases. The morphological knowledge of the metopic suture is important for the radio diagnosticians and neurosurgeons in day-to-day practice Persistent metopic suture can be misdiagnosed as a vertical traumatic skull fracture in head injury patients. Therefore the surgeon should be aware of this anatomical condition in the surveillance of the traumatized patient and during surgical intervention including especially frontal craniotomy. It is also important for paleodemography and forensic medicine¹⁷. Persistent frontal sutures are visible in radiographs they can be useful for the forensic identification of human skeletal remains. Thus, the present study will be useful in the fields of human anatomy, forensic science, neurosurgery, radio diagnosis, trauma and emergency care.

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