

STUDY OF METOPIC SUTURE

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ABSTRACT

Background: Cranial sutures and their evolution is interesting in the field of cranial growing and shaping. It is a dentate suture extending from nasion to bregma. Metopic suture normally closes at 1 – 3 yrs, but is allowed up to 8 yrs. Incidence varies in different races from 1% - 12%.

Aim: The present study was done to know the incidence of Metopic suture in south Indian skulls.

Materials and Methods: 100 skulls from the Anatomy Dept museum at Shridevi Institute of Medical Sciences Tumkur were collected for the present study. The skulls with persistent metopic suture were thoroughly observed.

Results: Metopic suture was present in 38%. Complete suture was seen in 3% and incomplete in 35%. Among the 3 complete sutures one was linear and continue with sagittal suture measuring 12.3 cm and 2 were H shaped measuring 11.0 cm and 12.1 cm. Incomplete sutures were classified depending on the shape U, V, Y and linear. Linear suture was seen in 26 skulls, U shape in 4 skulls, V shape 4 skulls, Y shape 1 skull.

Conclusion: The presence of metopic suture is important from a clinical point of view. It must be included in differential diagnosis of suspected skull fracture particularly frontal bone. It is not a pathological entity but most certainly should be noted as an incidental finding on an X ray. The suture is best identified in A -P view of skull.

KEY WORDS: Metopic Suture (M S), Frontal Bone, Ossification,

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INTRODUCTION

The metopic or frontal suture is formed at the meeting of the two halves of frontal bone in the midline. Normally it starts to close in the second year of life and within a short duration, gets completely obliterated. At times there may be a partial or complete failure of obliteration. Metopism is referred as complete suture extending from nasion to bregma. When metopic suture is persistent it is a dentate suture about

2 cm anterior to coronal suture it becomes simple and direct known as pars bregmatica. Usually the posterior end of the metopic suture does not meet the sagittal suture and may miss it by an interval as great as 15 mm. Similarly the anterior end fails to meet intranasal suture [1]. Focusing on the development, frontal bone ossifies in membrane from 2 primary centers which appear by the end of second month of fetal life and fuse first at the inner surface of

skull by chondroid tissue[2].

Routine assessment of fetal faces in detection of malformations by using three- dimensional (3D) ultrasound has made it possible to assess reliably skull bones with their sutures. Ossification of frontal bones starts at 9 wks in the middle of each supraorbital region and then spreads medially and laterally, so that by 11 wks the frontal bones appear as 'thick eyebrows'. Between 11 and 20 wks, ossification spreads upwards in a radial fashion. At 11 wks frontal bones reach the midline at the nasal area and subsequently extend superiorly towards the future anterior fontanelle. Similarly the gap between the two frontal bones starts closing at around 16 wks in a supranasal region and with advancing gestation the two frontal bones enlarge and converge in the midline as if being zipped together. At 32 wks there is apparent closure of the metopic suture starting from the glabella and then moving upwards towards the anterior fontanelle[3].

Metopism can be related to various causes, such as abnormal growth of cranial bones, pathologic metopism triggered by hydrocephalus, growth interruption, heredity, atavism, stenocrotaphia (abnormal narrowing of the temporal area of the head), plagiocephaly (cranial malformation causing a twisted and asymmetrical head because of synostosis of cranial sutures), mechanical causes and hormonal dysfunction. The genetic influence is currently the factor most accepted by the scientific community[4].

According to the classical anatomic literature, there are different incidences when ethnic groups are compared. The incidence of metopism in Alpine skulls is 63.2%, while the smallest was reported in Australian and Scottish skulls [4]. Many factors are attributed or the persistence of metopic suture in adults which include abnormal growth of skull bones, hormones, cranial malformations, hydrocephalus, atavism, genetic causes. Knowledge regarding metopic suture is essential in studying the radiographs to avoid misinterpretation as fractures and also it is useful in evaluating medico-legal cases[2]. Marco Antonio [4] reported a study in South Brazilian population 34.97%, Ajamani et al[5]. reported in Nigerian skulls 31.57%. Janusz Skrzat et al [6]. evaluated the detailed morphology of 24 adult skulls with persistent metopic suture

with application of fractal dimension.

It has been reported by various workers that the incidence of metopism is different in different races throughout the world. According to Brace (1915) metopism is present in 9.5% of Scottish skulls, 8.5% European crania, 5.1% in Mangolian subjects, 1.2% of Nigroes and 1% in Australian skulls. Breathnach (1958) reported it to be 7-10% in Europeans, 4.5% in Yellow races[5].

Similar studies made in North Indian population Anjoo Yadav et al [1] reported metopism in 18.04%, Neelima Pilli et al² reported in South Indian population 43.5%, Dr Pankaj Wadekar et al⁷ reported 23.75% in Maharashtra population.

MATERIALS AND METHODS

In the present study 100 skulls were observed in the museum of Anatomy department SIMS and RH Tumkur. Macerated skull and deformed skull were excluded from the study. The skulls with persistent metopic suture were thoroughly inspected and shape extent and length of the suture were noted the length was measured with the help of thread spread from nasion to bregma.

Fig. 1a: Metopic suture meeting, end-to-end, with the median Sagittal suture at Bregma (arrow). **b)** Metopic suture, not meeting end-to-end with the median Sagittal suture, at Bregma (arrows).

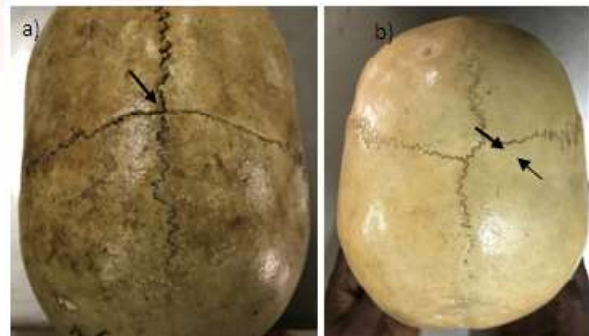


Fig. 2: Partial Metopic suture in the lower part of Frontal bone (just above Nasion) a) linear, b) U-shaped, c) V-shaped d) Y- shaped



RESULTS

Among the 100 skulls studied metopic suture was present in 38 skulls, 3 were complete and

35 were incomplete. One of the linear complete suture continue with sagittal suture measures 12.5 cm, and the other 2 were 'H' shaped measures 11.0 cm and 12.1cm. Remaining 35 skulls with incomplete suture, 26 were linear, 4 were 'U' shape, 4 were 'V' shape, 1 was 'Y' shape.

Table 1: Details of metopic suture.

Sl no	Type of suture	number	%	measurement
1	Complete	3	2%	
	Linear	1		12.3 cm
	'H' shape	2		11.0cm, 12.1cm
2	Incomplete	35	35%	
	Linear	26		
	'U' shape	4		
	'V' shape	4		
	'Y' shape	1		
	Total	37	38%	

Table 2: Measurements of incomplete linear sutures.

Sl no.	measurement	No of skull bones
1	0-1 cm	15
2	1.1-2 cm	10
3	2.1-3	1
	Total	26

Table 3: Showing the incidence of metopic suture in various Indian studies.

Sl no	Authors	% of complete M S	% of incomplete M S	Total %
1	K Kalyan et al [11]	6.25	38.25	45
2	Pankaj et al [7]	1.25	22.5	23.75
3	Neelima P et al [2]	5	37.5	42.5
4	Hussain S et al [10]	3.2	26.4	29.6
5	Anjoo Y et al [1]	3.5	14.6	18.04
6	Dilip K et al [12]	2	44	46
7	Present study	3	35	38

Table 4: Comparing the results with International studies.

Sl no	Authors	% Complete M S	% Incomplete M S	Total %
1	Marco A et al [4]	7.04	32.39	39.43
2	Ajamani et al [5]	3.4	31.57	34.97
3	Ivon do et al [8]	4.48	5.22	9.7
4	Kimapora et al [9]	2.83	4.67	7.5
5	Present study	2	35	37

DISCUSSION

According to different investigators, the most commonly observed shape of metopic suture is linear type and only in isolated cases have other forms of suture being found. These suture patterns have been described as radiating or having a wide side to side excursion[6].

Marco Antonio et al [4] reported a study of 71 skulls belonging to South Brazilian population. Complete M S was seen in 5 (7.04%) skulls, and incomplete M S in 23 (32.39%) skulls. Janusz et al[6] reported an analysis of 24 adult skulls with persistent M S in Jagiellon University, with detailed morphology and complexity denoted by fractal dimensions. Ajamani et al [5] reported a study of 206 Nigerian skulls, complete M S was seen in 7 (3.4%) skulls, and incomplete M S in 65 (31.57%) skulls. Ivon do et al [8] reported a study of 134 skulls in Macei AL, complete M S in 6 skulls (4.48%) and incomplete in 7 skulls (5.22%). Kimapora et al [9] reported a study of 706 skulls collected from grave yard in Thailand and found complete M S in 20 skulls (2.83%) and incomplete M S in 33 skulls (4.67%).

Anjoo Yadav et al [1] reported a study of 1020 skulls belonging to North Indian population, complete M S in 184 (18.04%) skulls and incomplete M S in 148 (14.5%) skulls. Pankaj Wadekar et al[7] reported a study of 80 skulls, complete M S in 1 (1.25%) and incomplete M S in 18 (22.5%). Hussain sahib et al[10] reported a study 125 skulls of south Indian population, complete M S seen in 4 (3.2%) and incomplete M S in 33 (26.4%). Neelima P et al² reported a study of 180 skulls belonging to South Indian population complete M S was seen in 9 (5%) and incomplete M S in 68 (37.77%). K Kalyan et al[11] reported a study of 80 skulls of South Indian population, complete M S in 5 (6-25%) skulls and incomplete M S in 31(38.75%) skulls. Dilip Kumar et al [12] reported a study of 50 skulls complete M S in 1 and incomplete M S in 22 skulls.

Average length of complete metopic suture in different studies, Marco A et al⁴ 12.92 cm, Aksu et al [13] 12.3 cm, Janusz et al [6] 12.31 cm, Anjoo Y et al[1] 12.8 cm. In the present study it is 11.8 cm, less when compared with other studies.

Commonest type of incomplete M S was linear in various studies, Marco A et al [4] 69.57%, Aksu et al[13] 39.4%, Ajamani et al [5] 24.27%, Neelima et al [2] 8.8%, K Kalyan et al [12] 18.75%. In the present study 26 skulls showed linear incomplete M S in 26%.

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. Persistent metopic suture can be diagnosed by X ray of skull A-P view. To avoid wrong diagnosis in emergency conditions 2D and 3D CT scans are strongly recommended. Multiplanar reformat of CT scans also give valuable information about the shape, extent and closing status of metopic suture. Hence neurosurgeons should be aware of this anatomical variation while performing frontal craniotomy.

Conflicts of Interests: None

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