

Study on persistent metopic sutures in south Indian adult dry skulls

J Jayarani

Associate Professor and HOD, Department of Anatomy, Tirunelveli Medical College, Tirunelveli, Tamil Nadu, INDIA.

Email: drjgynaecs@gmail.com

Abstract

Objective: The present study aims at the presence of persistent metopic sutures in south Indian adult skulls in various forms. The two halves of frontal bones are separated by the persistence of frontal suture in the adult skulls are called Metopism. The fusion of metopic suture starts at around 18 months after birth and is completed by 8-9 years of age. **Methods:** This study was carried on 120 south Indian adult dry skulls, collected from the museum of anatomy department in Tirunelveli Medical College, Tirunelveli. The skulls were inspected at the normal frontalis for the presence of the metopic suture. The sutures were classified as complete and incomplete. The incomplete ones were classified as linear type, 'V' shape and 'U' type. **Results:** 95 out of 120 skulls were found to have no metopic sutures. Complete metopic sutures extending from bregma to glabella was observed in 7 skulls (5.8%) (Figure 1) and the incomplete form was noted in 18 skulls (15%). Among incomplete type 9 skulls (7.5%) were revealed midline linear metopic sutures (Figure 2), 3 skulls (2.5%) showed V shaped metopic sutures. U shaped and inverted U shaped was noted in 2 skulls (1.7%) respectively. Each skull (0.8%) showed the Y shaped & H shaped type respectively. **Conclusion:** 25 (20.8%) out of 120 skulls showed the persistent metopic sutures in various forms with increase incidence of incomplete type (15%) with predominant linear (7.5%) variety. This work was done to contribute the scientific literature, providing Anatomical data and comparison of results with different authors.

Key words: fontanelle, nasion, bregma, metopism.

Address for Correspondence:

Dr. J Jayarani, Associate professor and HOD, Department of Anatomy, Tirunelveli Medical College, Tirunelveli, Tamil Nadu, INDIA.

Email: drjgynaecs@gmail.com

Received Date: 10/10/2016 Revised Date: 15/11/2016 Accepted Date: 18/12/2016

Access this article online	
Quick Response Code:	Website: www.statperson.com
	DOI: 09 March 2017

INTRODUCTION

Metopic sutures are vertical sutures between the two halves of the frontal bone, in the midline, from the anterior aspect of the anterior fontanelle to the nasion, this is obliterated by 6-8 years Weinzweig¹. According to Hamilton² the metopic suture disappears by the seventh year. In some skulls, there may be a partial or complete failure of this obliteration. When the metopic suture persists as a complete suture extending from the nasion to the anterior angle of the bregma, this condition is known as metopism. If the suture is not present throughout and occupies a small area between these two points, they are considered as incomplete metopic sutures. The

obliteration of metopic suture is highly controversial and studied by various researchers. According to Romaneset *et al*³ the metopic suture closes by the fifth or sixth year. Piersol *et al*⁴ concluded that the metopic suture disappears by the end of the fourth year, leaving a faint trace at the lower end but Keith *et al*⁵ mentions that the metopic suture disappears at the end of the first year, or in the beginning of the second year of life. Warwick and Williams⁷ state that the frontal bones are separated by the metopic suture at birth and is usually obliterated by the eighth year. According to Del Soletal⁸, metopism can be due to abnormal growth of cranial bones, growth retardation, heredity, atavism, hydrocephalus, sexual influence, plagiocephaly, scaphocephaly, mechanical causes and hormonal dysfunction. Henry Gray¹⁰ postulated that the median suture usually disappears by about 8 years but may persist as metopic suture. The knowledge of the anatomy of the metopic suture is important because its permanence can be mistaken for a cranial fracture in radiological images, or even for the sagittal suture. It is also important for paleodemography and forensic medicine. In the present study, the objectives were to determine the incidence of persistent metopic sutures and its various forms on 120 south Indian adult dry skulls.

MATERIALS AND METHODS

This study was conducted on 120 south Indian adult dry skulls and inspected for persistence of metopic sutures. A suture which is found completely between the bregma and nasion is termed as the complete metopic suture or metopism. (Romanes GJ *et al*³ If it extends to a smaller distance either from the bregma or from the nasion, it is termed as incomplete type. The incomplete metopic sutures were sub divided into linear, 'V' shaped and 'U' shaped types. (Bilodi Ak⁶, Agarwal Bk *et al*¹⁴ Incomplete metopic suture was further divided into three groups according to their presence, in the lower part, in the upper part, and in the middle part of the frontal bone. (Pankaj R. Wadekar *et al*²⁴, Nelima Pilli *et al*²⁵, The incidences of complete and incomplete metopic sutures were calculated. The results were tabulated and compared with earlier authors.

RESULTS

In our study ninety five (79.2%) out of 120 skulls had neither complete nor incomplete metopic sutures. Metopic suture either in the form of complete or incomplete was found to be present in twenty five skulls (20.8%). Complete metopic suture (metopism) was found in seven skulls (5.8%) (Figure 1), and incomplete suture was observed in eighteen (15%) skulls (Table 1). Five different types of incomplete metopic sutures namely linear, 'U' shaped, 'V' shaped, H and Y were identified. Linear incomplete metopic suture was found in nine (7.5%) skulls, V shaped was in 3 (2.5%) skulls, U and inverted U shaped was noted in each 2 (1.7%) skulls and 'Y shaped, H shaped was observed in one (0.8%) skull respectively . Linear type of incomplete metopic suture was observed in the lower part of frontal bone in nine (7.5%) ((Figure 2)skulls, but no suture remnant was found in the upper or middle part of frontal bone (Table 1).



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6

Legend

Figure 1: Complete Metpic Suture; **Figure 2:** Incomplete Metopic Suture - Linear Shape; **Figure 3:** Incomplete Metopic Suture - H Shape
Figure 4: Incomplete Metopic Suture - U Shaped; **Figure 5:** Incomplete Metopic Suture - V Shaped; **Figure 6:** Incomplete Metopic Suture - Y Shaped

Table 1: Incidence of metopic sutures in the present study

S.No	Types of sutures	Number of skulls	Number of Skulls In %
1	Absent Metopic	95	79.2%
2	Complete (Metopism)	7	5.8%
3	Incomplete	18	15%
	Linear	9	7.5%
	H Shaped	1	0.8%
	U Shaped	2	1.7%
4	Inverted U Shaped	2	1.7%
	V Shaped	3	2.5%
	Y Shaped	1	0.8%
	Total	120	100%

DISCUSSION

Romanes *et al*⁴ reported incidence of metopism in Europeans is up to 8%. M.L. Ajmani *et al*⁹ observed the incidence of 3.4% metopism in Nigerians. Henry Gray (10) stated that incidence of metopic sutures is 9% in adult skulls of various ethnic groups. Bryce *et al* (11) reported metopism is present in 5.1 % of Mongolian skulls, 8.7 % of European skulls, 9.5 % of Scottish skulls, 1.2 % of Negroes and 1% of Australian skulls. The incidence of metopism is about 10% in Whites and Mongoloids, and only 2 % in Negroes. According to Breathnach *et al*¹² the incidence of metopic suture varies from 4-5 % in Yellow races, 7-10% in Europeans, and 1% in African skulls. Among Indian skulls, Das *et al*¹³ reported the incidence of metopic suture as 24.67% and metopism as 3.31 %. Agarwal *et al*¹⁴ reported metopic suture in 38.17% and metopism in 2.66%. Fakhruddin and Bhalerao *et al*¹⁵ observed metopism in 2%. Dixit and Shukla¹⁶. Linear 5 'U' Shaped 1 'V' Shaped 1 In lower part of frontal bone 7 In upper part of frontal bone 0 In middle part of frontal bone 0 reported the incidence of metopism in 2.53% in skulls from Uttar Pradesh. Jit I and Shah¹⁷ reported metopic suture in 32.5% and metopism in 5% in Punjabi skulls. Yadav *et al*¹⁸ reported metopic suture in 18.04% and metopism in 3.5% in north Indian skulls. Shanta Chandrasekaran¹⁹ observed metopism in 5% of south Indian adult skulls where as Chakravarthy and Venumadhav²⁰ observed metopic sutures in 45% and metopism in 6.25% of south Indian adult skulls. Neelima pilli *et al*²⁵ noted 5% metopism and Sathosh *et al*²⁷ observed metopism in 6% in south Indian adult skulls. In the present study, the incidence of metopism was found to be 5.8% which is similar to the study reported by Shanta Chandrasekaran *et al*¹⁹ (5%), Chakravarthy and Venumadhav *et al*²⁰ (6.25%), Neelima pilli *et al*²⁵ (5%) and Santhosh *et al*²⁷ (6%) in south Indian adult skulls, Inderjit and Shah *et al*¹⁷ (5%) in Punjabi skulls, Bryce *et al*¹¹ in Mongolian skulls (5.1%) but it is lesser than the incidence reported by Yadav *et al*¹⁸ in north Indian skulls (14.6%) and

higher than the incidence reported by Hussain Saheb S *et al*²¹ (3.2%) and Pankaj R.Wadekar *et al*²⁴ (1.25%) in south Indian skulls. In the present study, the incidence of incomplete metopic suture was found to be 15% which is not coincided with the other south Indian adult skull study but similar to the study conducted by Yadav *et al*¹⁸ (14.6%) in north Indian skulls (14.6%) and Das *et al*¹³ (17.57%) in Indians Uttar prades. But it is lower than the study conducted by M.L. A Ajmani *et al*⁹ (31.57%), Agarwal *et al*¹⁴ (35.51%), and also by Shanta Chandrasekaran *et al*¹⁹ (40%), Chakravarthy and Venumadhav *et al*²⁰ (38.75%), Pankaj R.Wadekar *et al*²⁴ (22.5%) and Neelima pilli *et al*²⁵ (37.8%), study on south Indian adult skulls. In our study we found linear incomplete metopic suture in 7.5% of the skulls, nearly coincided with Neelima pilli *et al*²⁵ 8.8% and Santhosh *et al*²⁷ (5%). Present study, U' shaped 1' shaped was similar to the study conducted by Das *et al*¹³, Pankaj R.Wadekar *et al* (24) (1.25%), Neelima pilli *et al*²⁵ (1.1%) but is in contrast to the study conducted by M. L. Ajmani *et al*⁹, Agarwal *et al*¹⁴, Jit I and Shah *et al*¹⁷ Shanta Chandrasekaran *et al*¹⁹ (15%), and Chakravarthy and Venumadhav *et al*²⁰. V shaped was noted in (2.5%) which was lower than the Shanta Chandrasekaran¹⁹ (7.5%), Pankaj R.Wadekar *et al*²⁴ (5%) and Neelima pilli *et al*²⁵ (10%). All linear type of incomplete metopic suture was observed in the lower part of frontal bone in 9 skulls (7.5%), none of the incomplete metopic suture was observed in the upper and middle part of frontal bone. Further, the incidence of incomplete metopic suture in the lower part of frontal bone was found higher as compared to the upper and middle part, which is in agreement with previous studies by Agarwal *et al*¹⁴ reported metopic suture in lower part in 35.27% skulls, while in upper and middle parts in 0.8% cases each, Das *et al*¹³ reported metopic suture in lower part in 20.96% skulls, in upper part in 0.28% and none in middle part, and Yadav *et al*¹⁸ reported metopic suture in lower part in 14.02% skulls, in upper part in 0.39% and in middle parts in 0.19% skull.

Table 2: Comparison of present study (incidence of metopic suture on south indian skulls) with other authors:

S.no	Types of Metopic sutures	Shanta Chandrasekaran <i>et al</i> (2010) in (%)	Neelima pilli <i>et al</i> (2013) in (%)	Pankaj R Wadekar <i>et al</i> (2014) in (%)	Santhosh <i>et al</i> (2014) in (%)	Present study in (%)	Chakaravarthy and venumadhav
1	Absent Metopic	55	57.2	76.25	87	79.2%	55%
2	Complete (Metopism)	5	5	1.25	6	5.8%	6.25%
3	Incomplete	40	37.8	22.5	7	15%	38.75%
	Linear	17	8.8	16.25	5	7.5%	
	H Shaped	-	7.7	-	-	0.8%	
	U Shaped	15	1.1	1.25	1	1.7%	
4	Inverted U Shaped	-	6.1	-	-	1.7%	
	V Shaped	7.5	10	5	1	2.5%	
	Y Shaped	-	3.8	-	-	0.8%	
	Total		100%	100%	100%	100%	

Table 3: Incidence of metopic suture on other than South Indian skulls by different authors

S.NO	Author	Race	Incidence of Metopism sutures in %	Incidence of incomplete metopic suture in %
1	Agarwal 1979	Indians(Kanpur)	2.66%	35.51 %
2.	Ajmani1983	Nigerians	3.4%	31.57 %
3.	B.V. Murlimanju 2011	Indians	1.2%	62.9 %
4.	Breathnach (1958)	European	7-10%	----
5.	Jit and Shah 1948	Indian – Punjab	5%	13.75 %
6.	Das 1973	Indians U.P	3.31%	17.57 %
7.	Bryce (1915)	European	8.70%	----
8.	Yadav <i>et al</i> (2010).	North Indian	3.5%	14.6%

CONCLUSION

The present study has shown the incidence of metopic suture in south Indian adult skulls as 20.8% and of metopism as 5.8%. The most common incomplete metopic suture was linear type which was 7.5% and located most commonly in the lower part of the frontal bone(7.5%). On comparing with the results of earlier research workers in India, the incidence of metopism was found higher in skulls from south India. Persistence of Metopic suture is a useful guide in the identification of a person in medico legal aspect. Sometimes it may be easily misdiagnosed as fracture of frontal bone or even sagittal suture in radiological images. It is also important for forensic experts, neurosurgeons during frontal craniotomy, orthopedic surgeons, oromaxillofacial surgeons, ophthalmologists, ENT surgeons and others to know about metopism. Santhosh CS *et al* Metopic Suture.

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Source of Support: None Declared
Conflict of Interest: None Declared