



*Original article*

## Morphological study of Metopic suture in adult South Indian skulls

K. Kalyan Chakravarthi,\*<sup>1</sup> Nelluri Venumadhav<sup>2</sup>

<sup>1</sup> Lecturer, Department of Anatomy,

Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation,

Chinnaoutpalli, Gannavaram Mandal, Krishna District (AP), INDIA, 521286.

<sup>2</sup> Lecturer, Department of Anatomy,

MMMC, Manipal, Karnataka (INDIA)-576104

### ABSTRACT

The metopic suture is formed at the meeting of the two halves of the frontal bone, in the midline. Normally it starts to close in the second year of life and within a short duration, gets completely obliterated. The time of the closure of metopic suture varies from one to eight years and it can persist until adult age. The present study was undertaken to observe the incidence of Metopic suture and Metopism in the adult human skulls of South India. This study was carried out on 80 dry human skulls at Dr. Pinnamaneni Siddhartha institute of medical sciences & research foundation (Dr. PSIMS & R.F) Gannavaram; Krishna Dist; A.P and MMMC, Manipal, Karnataka (INDIA). Metopism was found in 6.25% of the studied skulls. The incomplete metopic suture was found in 38%. Morphology of sutures varied from linear (18.75%), 'U' shaped (10%) and 'V' shaped (10%), of which linear was found to be most common. The morphological knowledge of the metopic suture is important for the radiologists and neurosurgeons in day-to-day practice.

**KEYWORDS:** Adult skull, Frontal bone, metopic suture, Metopism.

### INTRODUCTION

The frontal bone is a curved plate of pneumatic flat bone. The two halves of the developing frontal bone remain separate as the metopic suture, which disappears during infancy or in early childhood. Remnants of the metopic suture may persist in some skulls at the glabella or a complete suture extending from the Nasion to the Bregma. Metopism, which is defined as a condition in which the two pieces of the frontal bone fail to

merge in early childhood, displays varying degrees of incidence [1]. Their incidence was 7-8% in Europeans, 1% in Africans and 4-5% in Mongolian population. The frequency may range from 1% to 12% and the incidence is slightly higher in the male population [2]. In a study by Hanihara et al. [3], it was observed that the cranial traits show distinctive patterns of geographic variations. It was reported that these sutures may

be misdiagnosed as vertical traumatic skull fractures extending in the mid-line in head injury patients [4]. According to Del Sol et al. [5], the causative factors of metopism include the abnormal growth of cranial bones, hydrocephalus, growth retardation, sexual influence, heredity, atavism, stenocrotaphia (abnormal narrowing of the temporal area of the head), plagiocephaly (cranial malformation causing a twisted and asymmetrical head because of the synostosis of the cranial sutures), scaphocephaly (deformed head, projecting forward like the keel of a boat), mechanical causes and hormonal dysfunction.

It is essential to know about metopic suture failing which it can be easily misunderstood as fracture of frontal bone or even for the sagittal suture in radiological images [5, 6]. It is also important for paleodemography and forensic medicine [7]. In the present study, the objectives were to determine the incidence of metopic sutures in south Indian human adult skulls and to study their morphology.

## MATERIALS AND METHODS

This study was carried out on 80 dry human skulls at Dr. pinnamaneni Siddhartha institute of medical sciences & research foundation (Dr. PSIMS & R.F) Gannavaram; Krishna Dist; A.P (INDIA), and MMMC, Manipal, Karnataka (INDIA), Out of these skulls 40 from Dr. PSIMS & R.F and 40 from MMMC, Manipal. The skulls were macroscopically inspected for the presence of the metopic suture and these skulls were divided into three groups as normal skulls without any metopic suture, complete metopic suture and

with incomplete metopic suture. A suture which is found completely between the bregma and nasion is termed as the complete metopic suture or metopism. If it extends to a smaller distance either from the bregma or from the nasion, it is termed as incomplete type. The incomplete ones included linear type, 'V' shape and double (U) type. The method of classification of the metopic sutures is based on the reports of Ajmani et al. [6] Agarwal et al. [8], and Castilho et al. [9]. The incidences of complete and incomplete metopics were calculated (Table 1) and the data obtained were compared with those from earlier studies (Table 2).

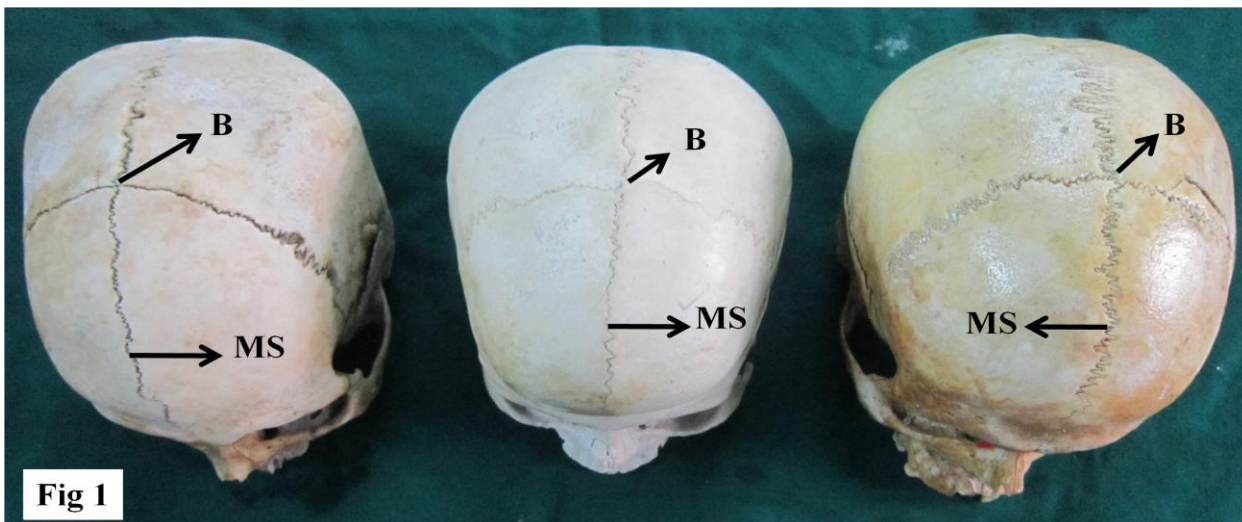
## RESULTS

For the present study, 80 dry human skulls were observed. Forty four (55%) of the skulls had neither complete nor incomplete metopic suture. Thirty six skulls (45%) had metopic suture either in the form of complete or incomplete. Complete metopic suture was found in five skulls (6.25%) (Fig.1 and 2), and incomplete suture was observed in thirty one skulls (38.75%). Three different types of incomplete sutures namely linear (Fig.3), 'U' shaped (Fig.4), 'V' shaped (Fig.5), were identified. Among the incomplete metopic sutures, the incidence of linear incomplete metopic suture was 15/80 (18.75%), 'U' shaped incomplete metopic suture was 8/80 (10%) and 'V' shaped incomplete suture was 8/80 (10%). (Table 1)

Table 1: Incidence of the metopic suture in the present study.

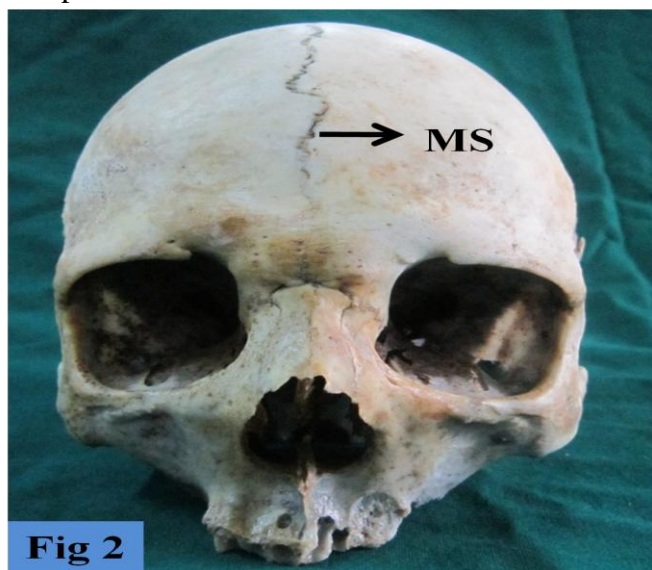
Extent of suture	Number	Percentage (%)
<b>Complete metopic suture (Metopisum)</b>	5	6.25%
<b>Incomplete</b>		
Linear	15	18.75%
'U' Shaped	8	10%
'V' Shaped	8	10%

Fig 1: Superior view of the skulls showing the metopism (Complete metopic suture).



MS- Metopic suture; B- Bregma.

Fig 2: Anterior view of the skull showing the metopism.



MS- Metopic suture.

Figure 3: Morphological variants of incomplete metopic sutures, showing the linear (L) shaped metopic suture in the lower part of the frontal bone

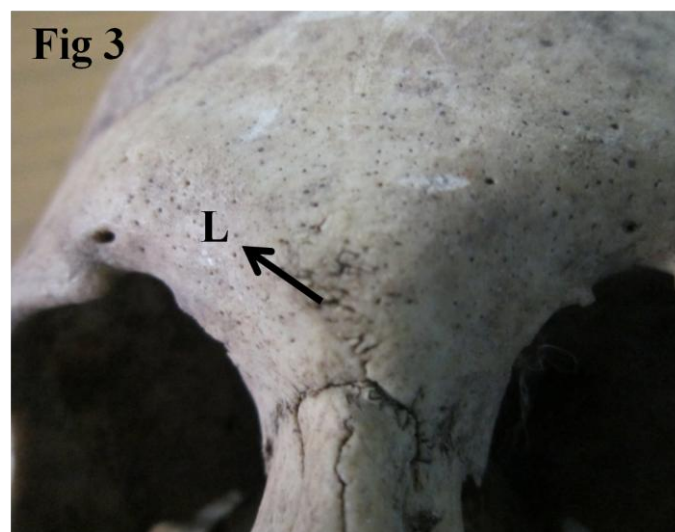


Figure 4: Morphological variants of incomplete metopic sutures, showing the 'U' shaped metopic suture in the lower part of the frontal bone

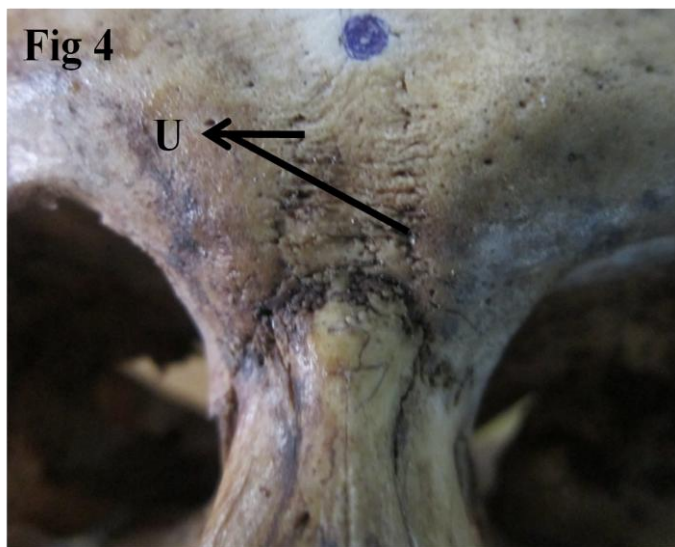
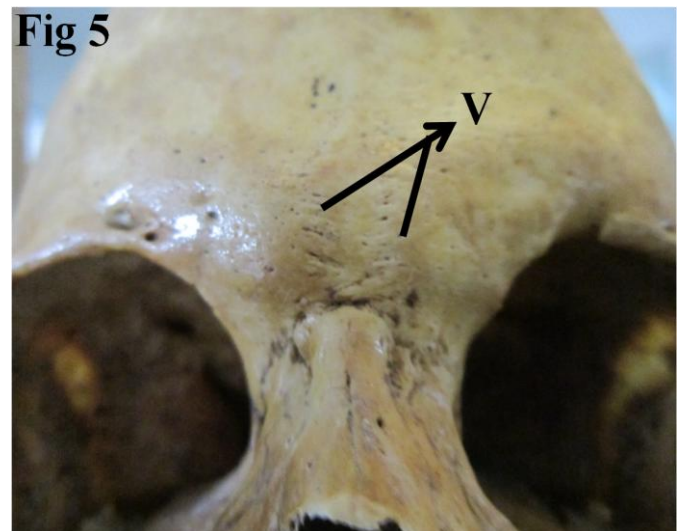


Figure 5: Morphological variants of incomplete metopic sutures, showing the 'V' shaped metopic suture in the lower part of the frontal bone



## DISCUSSION

The cranial sutures and their evolution form one of the questions most interesting in the field of cranial growing and shaping. Metopic suture is a kind of dentate suture extending from the nasion to the bregma. Its timing of closure is still controversial. Impaired closure of the metopic suture is common in Apert syndrome [10]. Persistent metopic suture may be misdiagnosed as a vertical traumatic skull fracture extending in the mid-line in head trauma patients. Therefore the surgeon should be aware of this anatomical condition in the primary and secondary surveillance of the traumatized patient and during surgical intervention including especially frontal craniotomy.

Incidence of Metopism in Indian skulls was reported as 5% by Gupta R et al [11], 5% by Shanta Chandrasekaran [12], 1.2% by Murlimanju BV et al [13], 2.66% by Agarwal et al., (1979); 3.31% by Das et al [14], 2.53% in U.P. skulls Dixit and shukla [15], 5.00% by Jit & Shah et al [16], 2% by Fakhruddin and Bhalerao [17]. In the present study, Incidence of Metopism was observed in 5 cases (6.25%) which are higher than the previous Indian study and also higher than the incidence reported in Nigerians, Nepalese, Yellow races, Africans, Australian and Negroids. But the incidence of metopism is lesser than Europeans [18, 19, 20], Brazilian, Scottish [20], and Mangoloids [21], (Table 2).



Table 2: Incidence of metopism as reported by various Research Workers.

Research Workers	Race	Percentage
M. L. Ajmani. et al.,(1983) [6]	Nigerians	3.40%
Agarwal. et al., (1979) [8]	Indian (Kanpur)	2.66%
Castilho et al. (2006) [9]	Brazilian	7.04%
Gupta R. et al. ,(2012) [11]	Indian(U.P)	5.0%
Shanta Chandrasekaran (2011) [12]	India(South India)	5.0%
Murlimanju BV. et al (2010) [13]	Indian	1.2%
Das. et al. (1973) [14]	Indian(UP)	3.31%
Jit & Shah. et al., (1948) [16]	Indian (Punjabi)	5.00%
Romanes. et al., (1972) [18]	Europeans	Up to 8.00%
Breathnach.et al.,(1958) [19]	European	7-10%
Breathnach.et al.,(1958) [19]	Yellow races	4-5%
Breathnach.et al.,(1958) [19]	Africans	1.00%
Bryce. et al., (1915) [20]	European	8.70%
Bryce. et al., (1915) [20]	Scottish	9.50%
Bryce. et al., (1915) [20]	Mongolian	5.10%
Bryce. et al., (1915) [20]	Negro	20.0%
Bryce. et al., (1915) [20]	Australian	1.00%
Woo. et al., (1949) [21]	Mongoloids	10.0%
Woo. et al., (1949) [21]	Negroids	2.0%
Keith. et al., (1948) [22]	Subject to race	3.0%
Bilodi et al. (2003) [23]	Nepalese	3.92%
<b>Present study</b>	<b>South Indians</b>	<b>6.25%</b>

The information about metopic sutures is enlightening for the medicolegal consultants and forensic experts. Their morphological details are important for the clinician from radiological and surgical point of view. While reading the X-ray/CT and MRI films, the possibility of the metopic suture should be kept in mind. This will prevent

confusion and a wrong diagnosis in emergency situations. We believe that the present study has provided some important data which will contribute to the scientific literature, providing the anatomical data of metopic suture in the Indian adult population.

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\*Corresponding author: K. Kalyan Chakravarthi

E-mail: kalyankosuric@gmail.com