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Original Research Article

STUDY OF METOPISM AND WORMIAN BONES IN DRY SKULLS OF HUMAN CADAVERS IN NEPAL

Surendra Kumar Sah *[1], Deepak Chaudhary [1], Nivedita Pandey [2].

[1] Department of Anatomy, Nobel Medical College, Biratnagar, Nepal.

[2] Department of Anatomy, BP Koirala Institute of Health Sciences, Dharan, Nepal.

ABSTRACT

Introduction: Metopism is partial or complete persistence of suture in the frontal bone extending from the nasion to the anterior angle of the bregma. Wormian bones are the extra irregular and isolated pieces of bones also known as intrasutural bones which appears in addition to the usual centres of ossification within the sutures of cranium. The formation of these bones are associated with the decreased rate of suture closure and considered as the hypostatic and epigenetic traits.

Materials and Methods: The present study was conducted on 80 dry skulls collected from the Department of Anatomy, Nobel Medical College, Biratnagar and BPKIHS, Dharan dated from April 2016 to July 2016.

Results: Out of 80 skulls, in three skulls (3.75%) complete metopic sutures (metopism) were found. The wormian bones were observed in 55 skulls (68.75%). Out of 55 skulls with wormian bones, 35 (63.63%) skulls showed wormian bones at the lamboidal suture, at the asterion in 11 (20%) skulls, at the pterion in 7 (12.72%) skulls, at saggital suture in two (3.63%) skull, none of the skulls showed the wormian bones at coronal suture and bregma.

Conclusion: From the study it can be concluded that the study may be useful for the clinical diagnostic purpose particularly during frontal craniotomy. The knowledge of wormian bones may also play a major role for the neurosurgeons, neuro-anatomists, radiologists, anthropologists and morphologists.

KEY WORDS: Astrion, Bregma, Lamboidal suture, Metopism, Pterion, Trauma, Wormian bones.

Address for Correspondence: Surendra Kumar Sah, Assistant Professor, Dept. of Anatomy, Nobel Medical College, Biratnagar, Nepal. **E-Mail:** suren.anat2010@gmail.com

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INTRODUCTION

The metopic suture is a type of dentate suture, extending from the nasion to the anterior angle of bregma. The metopic suture is present at birth and usually obliterated approximately at the age of second year, but it may extend up to the age of 6 to 8 years [1]. Sometimes there may be complete absence of fusion, which may remain open resulting in metopic frontalle and there may be the presence of wormian bones [2].

When complete metopic sutures are present from naison to the bregma then it is called as the Metopism. The metopism is more common in the higher races and in brachycephalics [3]. Metopism can be due to various causes such as abnormal growth of the cranial bones, heredity, growth interruptions, hormonal influences, atavism, cranial malformations and hydrocephalous [4].

Different authors have suggested the obliteration of metopic sutures at different periods, Williams 6 to 8 years, Hamilton at 7th year, anatomical knowledge of persistence of metopism is important because its existence in

radiological images can be mistaken as cranial fracture [5].

The wormian bones are the irregular, isolated peaces of bones found at the sutures and fontanelles of the skull, most commonly at the lamboidal sutures. They are named after the Danish anatomist, Olaus Wormius. The alternative names of wormian bones include Schaltknochen, intercalary, sutural and intrasutural bones [6]. The formations of wormian bones are associated with the alterations in the normal development of the flat bones of the skull, insufficient rate of suture closure and regarded as the "epigenetic" and "hypostatic" traits [7].

Regarding the existence of the wormian bones, differences exist among the various ethnic groups, with highest incidence rate in the Chinese individuals (80%). Ethnic variations in wormian bones may be due to genetic influences and environmental influences. Though the occurrence of the wormian bones is quiet common, the observational data on them are less reported [8]. The theme of the present study was to report the incidence of metopism and wormian bones in Nepalese skulls along with their topographical distribution.

MATERIALS AND METHODS

The present study was conducted at the department of Anatomy of Nobel Medical College, Biratnagar and BPKIHS, Dharan, Nepal, dated April 2016 to July 2016. 80 dry human skulls of unkown sex without any gross damage were used for the present study.

Inclusion criteria:

Dry skulls of unknown sex, Intact calvaria, Erupted 3rd molar tooth, Well defined sutures.

Exclusion criteria:

Damaged skulls, Newborn, infants and children skulls, Very old skulls with obliterated sutures.

The following parameters were recorded in relation to the metopism and Wormian bones in all the collected skulls.

1. Presence or absence of complete metopism.
2. Only complete metopic suture were recorded.
3. Presence or absence of Wormian bones.
4. Locations of the wormian bones.

RESULTS

In the present study out of eighty dry skulls, only three skulls shown complete metopic suture along with the presence of wormian bones at the lamboidal suture. Remaining 77 skulls had no any complete suture (Fig. 1, 2, Table 1).

Fig. 1: Presence of metopism.

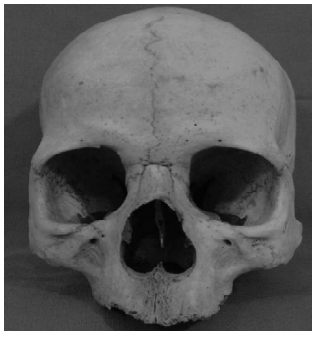

Fig. 2: Absence of Metopism.

Fig 3: locations of Wormian bones.

Table 1: Showing the incidence of Complete Metopism.

S.N.	Complete Metopism	No. of skulls (N=80)	Percentage
1	Present	3	3.75%
2	Absent	77	96.25%

Out of 80 skulls, the wormian bones were observed in 55 skulls (68.75%). Out of 55 skulls with wormian bones, 35 (63.63%) skulls showed wormian bones at the lamboidal suture, at the asterion in 11 (20%) skulls, at the pterion in 7 (12.72%) skulls, at saggital suture in two (3.63%) skull, none of the skulls showed the wormian bones at coronal suture and the bregma. (Table 2, 3)

Table 2: Showing the incidence of Wormian bones.

S.N.	Wormian bones	No. of skulls (N=80)	Percentage
1	Present	55	68.75%
2	Absent	25	31.25%

Table 3: Topographical distribution of the wormian bones.

S.N.	Topography of WBs	No. of skulls (N=55)	Percentage
1	At Lamboidal suture	35	63.63%
2	At Asterion	11	20%
3	At Pterion	7	12.72%
4	At Saggital suture	2	3.63%
5	At Coronal suture	Nil	0%
6	At Bregma	Nil	0%

DISCUSSION

In the present study, there were 3 skulls that shown complete metopism and 55 skulls that shown the presence of wormian bones. Incidence of persistence of metopic sutures in Nepalese populations were observed by Bilodi A.K. et al (2004) found that the incidence of metopism was 3.92% [9]. The present study also shown the incidence of metopism as 3.75% which is quiet similar to study done by Bilodi A.K. et al. When compared with the studies of Das et al (3.31%) in U.P. [10]. skulls and Dixit and Shukla studies (2.53%) also done in U.P. subjects [11]. The present study shown higher incidence.

Contrary to this it showed low incidence compared to the studies of Rau (1934) 4% in Madrasi skulls and in Inderjit & Shah (1948) 5% in Punjabi skulls and 11% in Linc & Fleischman (1969) of Czech skulls [12].

Table 4: Showing the incidences of complete metopism reported by the various authors.

S.N.	Author	Year	Subjects	Incidence of Metopism
1	Bilodi AK et al [9]	2004	Nepalese	3.92%
2	Das et al [10]	1973	U.P.subjects	3.31%
3	Dixit & Shukla [11]	1967	U.P.subjects	2.53%
4	Rau [12]	1934	Dravidean	4.00%
5	Inderjit &Shah [12]	1948	Punjabi	5.00%
6	Linc &Fleischman [12]	1969	Czech skulls	11%
7	K.Arumugam MD et al [4]	2015	Chinnai skulls	4.00%
8	Present study	2016	Nepalese	3.75%

Wormian bones are the irregular, isolated island of bones whose formations are associated with the insufficient rate of closure of the suture and it is regarded as the "epigenetic " and hypstatic" traits [13]. It was suggested that the wormian bones are not under the direct control of gene, but instead represent secondary sutural characteristics which are brought about by the stress [14]. The growth of the skull is affected by dural attachments and is related to the brain development. The developments of the wormian bones occur at an early membranous stage of skull growth and it is difficult to correlate this with brain disorders or relate specifically to any one type. It was also reported that the wormain bones and skull growth are not affected by any mechanical distortion, which is traditional practice in some of the tribal communities [15].

Sanchez et al (2007), suggested that the wormian bones may arise as a consequence of mechanical factors that spread sutures apart and affect dural strain within sutures and fontanelles [16]. Parker (1905) suggested that the number of wormian bones increases with the capacity of the skull and a similar relationship exists with the total length of sutures, greater the sutural length greater the number of wormian bones [17]. In the present study, the locations of wormian bones was most common at the lamboidal suture (63.63%), second common at the asterion (20%) and third common site at the pterion (12.72%). Study done by various authors also showed the similar observation. None of the skull showed the presence of wormian bones at the coronal suture and bregma in the present study.

It was also reported that the presence of wormian bones at the pterion may lead to complications in making burr holes at the pterion [18]. The data reported by Brothwell (1963) the prevalence of wormian bones among different populations is shown in the table (4) [19]. Sometimes the wormian bones may look like fracture and may confuse the surgeons and radiologists and may be misinterpreted as the fracture of skull and the patient may loose the appropriate treatment. Hence the knowledge of accessory bones like wormian bones is of much importance for the doctors practicing on day to day clinical life. One thing noted in the present study was that the skulls in which complete metopism was found had the presence of

wormian bones at the asterion.

Table 5: Prevalence of Wormian bones in different populations.

S.N.	Populations	Prevalence (%)
1	Chinese	80.32%
2	German	75%
3	Australian	72.58%
4	Romano-British	71.03%
5	Melanesian	64.15%
6	Lachish	63.41%
7	Anglo-Saxon	55.56%
8	Indian	73.10%
9	Nepalese (in present study)	68.75%

CONCLUSION

From the present study it can be concluded that the knowledge of metopism and wormain bones are of much importance for the radiologists and neurosurgeons. The current showed the prevalence of 3.75% of metopism and 68.75% incidence of Wormian bones in the Nepalese skulls. Relation between metopism and wormian bones were also reported, in which we observe that the skulls showing complete metopism had the presence of large number of wormian bones, which might be due to environmental and genetic factors.

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Conflicts of Interests: None

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