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Original Research Article

INCIDENCE OF WORMIAN BONES IN SOUTH INDIAN SKULLS: A STUDY ON CADAVERIC DRY SKULLS

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ABSTRACT

Background: Wormian bones, also called as sutural bones, are small bones found in the sutures of skull. These bones may be found as normal variants in the skull or may be associated with some of the congenital abnormalities.

Materials and Results: In our study, done on 110 dry adult human cadaveric skulls, we have identified 76 skulls with wormian bones (69.09%). Highest number of wormian bones was at the lambdoid suture, with 50.04% and next at the lambda, with 9%.

Conclusion: The current study on wormian bones will add further knowledge to the available data about wormian bones and it will be of help for neurosurgeons, orthopedic surgeons, pediatricians, radiologists and anthropologists for proper diagnostic and therapeutic purposes.

KEY WORDS: Wormian Bones, Suture, Lambda, Osteogenesis Imperfecta.

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INTRODUCTION

Wormian bones are accidental bones that made their existence along the suture or at fontonellae of skull, also called as sutural bones, are small bones found among the sutures between the various skull bones [1]. These intrasutural bones, most often found in lambdoid suture were described for the first time by Paracelsus (1460-1541 CE , Common Era), but the term "wormian bones" is derived from Olans Worm, a Danish anatomist who described them in a letter to Thomas Bartholin in 1643 [2].

These bones are separated parts of the primary ossification centers of adjacent flat bones of the skull. These bones were identified in normal healthy individuals, but a correlation was also found between the incidence of wormian bones and congenital diseases like osteogenesis imperfecta, cleidocranial dysostosis, progeria etc [2]. The incidence of wormian bones is variable, being 10% in Caucasians, 40% in Indians and 80% in Chinese skulls [3]. They are frequently found in lambdoid sututre and less common at other locations [2,3].

This study is aimed at contributing more to the available knowledge of wormian bones, their incidence, with their relevance as far as clinical aspects are concerned. Further, the data

concerned with the information about these bones is needed for anthropologists, neurosurgeons, radiologists and orthopedic surgeons.

MATERIALS AND METHODS

This study was conducted on 110 dry adullt human cadaveric skulls in the department of anatomy. All the sutures were examined systematically for the occurrence of wormian bones. Their numbers in relation to sutures was recorded.

RESULTS

Sutural bones were observed in 76 out of 110 skulls (69.09%). These were highest on the lambdoid suture, with an incidence of 50.04%. Next in frequency was at the lambda 9%, followed by those at the asterion 4.5%, at the saggital suture 2.7% and 1.8% at pterion. No wormian bones were found in coronal suture and at bregma, in our study.

Fig. 1: Wormian bones in saggittal and lambdoid sutures.

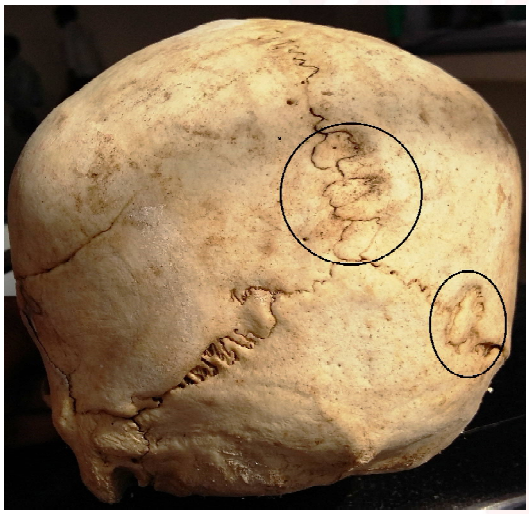

Fig. 2: wormian bones in the Asterion and Pterion.

Table 1: Showing the incidence of wormian bones.

Suture	No.of skulls	Frequency (in %)
Lambdoid suture	56	50.40%
Lambda	10	9%
Asterion	5	4.50%
Saggital suture	3	2.70%
Pterion	2	1.80%
Coronal suture	0	0
Bregma	0	0

DISCUSSION

Wormian bones are a matter of discussion in several researches since decades. In 16th century Andernach and Vesale were the first to associate wormian bones with cerebral disorders.[2,3] The increased interest in the skull during the past century has resulted in many studies and reports describing the associated diseases and hypothetical causes [3-5].

In his monograph, Parker [2] mentioned several synonyms, that were used as follows:

1. According to the discoverer : ossicula Andernaci, ossa Grethiano

2. According to shape : ossa triquetra, ossa triangularis, ossa quadratum

3. According to localization : suturaux, fontanellaires, insules, intercalaria, raphogeminantia, apicis

4. According to function : complementaria, ossa accessorii

In a study by Pryles and Khan [3] in 1979, it was found that the prevalence of wormian bones in humans varies from 8% to 15% in random population and reaches 54% in mentally impaired population. As a topic of research for several years, many causes have been proposed for wormian bones, but none is universally accepted. Some of the causes can be – as racial feature, as a consequence of skull deformation, an adaptation to cranial enlargement, metabolic disorders of mesoderm, autosomal dominant traits [4]. Dorsey [6] and Bennett [7] specified that although sutural bones could have been of artificial origin, they may also have been pathological, indicating, for example hydrocephalus. A study on wormian bones by Ell Najjar and Dawson [8] concluded that there was no significant difference between those with skull

deformities and without. Bergman et al. [9] suggested that wormian bones may develop due to rapid cerebral expansion, for example in hydrocephalus. However a study of wormian bones in a general pediatric population by B.Marti [10], hydrocephalus group did not present greater numbers of wormian bones than other groups.

Pryles and Khan [3] attributed wormian bones with a particular significance. In their study, the prevalence of CNS abnormalities (micro and macrocephaly, hydrocephalus, craniosyostosis, cerebral palsy, epilepsy and learning difficulties) in a population of children with wormian bones varied from 93% to 100% in a randomizes group. But Janty [11] identified wormian bones in several fetuses on sonography without any abnormality being found. B. Marti [10] concluded that wormian bones are very common and sometimes occur in high numbers in children, even when there is no background of osteogenesis imperfecta and they must usually be considered to be a simple anatomical variant, whose mechanism of development is not entirely understood. Several studies were done on sutural bones, Radha K et al [12] found 23 skulls with sutural bones out of 66 (34.84%), with highest incidence of 18.1% at the lambdoid suture. Murlimanju et al [13] studied 78 skulls for wormian bones and found 57 skulls positive (73.1%) and highest being at the lambdoid suture in 44 skulls (56.4%).

In our study, incidence of wormian bones was 69.09%, which was slightly lower than that reported by Murlimanju et al [13] (73.1%) and higher than that by Radha K et al [12] (34.84%). Majority of the studies on wormian bones showed that the incidence is more along the lambdoid suture. Bergman et al [9] reported 40% incidence of wormian bones along lambdoid suture, Murlimanju et al [13] reported 56.4% of wormian bones in the same location. In our study, we got 50.9% of lambdoid sutural bones.

In the current study, we have observed Inca bones with a frequency of 9.09% which is lower than that reported by Radha K et al [12] (12.12%) and more than that by Vivek N et al [15] (4.05%) and Robert Gazel et al [16] (1.9%). We have identified 4.54% sutural bones incidence at the asterion, which is lower than that observed by Murlimanju et al [13] (17.9%)s. Incidence of wormian bones along the saggital suture was 2.72% and at the pterion was 1.81%, whereas we did not find any sutural bones at coronal suture and at bregma.

CONCLUSION

With an incidence of 69.09% in our study, wormian bones are an important variants in the human skull. Frequent studies were done with an insight into this aspect. We would like to conclude that, presence of wormian bones should be kept in mind in case of any intervensions or investigations on skull or cranial cavitiy. Knowledge of sutural bones, their incidence and features are of greater help for radiologists, neurosurgeons, anthropologists and in many other fields to arrive at a proper diagnosis and to plan management of the same. We hope that current study has added more information about wormian bones.

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Conflicts of Interests: None

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