

Study of Wormian Bones on Dry human skull and its sexual dimorphism in the region of Andhra Pradesh

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Abstract

This study was aimed at identifying the wormian bone and their overall incidence in respect to their number and location in the region of Andhra Pradesh. Overall incidence of wormian bones was more in female (47.72%) than in male skulls (41.66%). They occurred more frequently at lambdoid suture (38%). Wormian bones along the coronal suture, Bregma and Asterion were seen only in male skulls, while intra-orbital wormian bones and wormian bones at Pterion were seen only in female skulls. This study concludes by stating that, there exists a moderate degree of sexual dimorphism among the wormian bones with respect to overall incidence, number and location.

Keywords- Skull, Sexual dimorphism, Wormian bones, Lambda, Asterion.

Background

Wormian bones, also known as intra-sutural bones, are extra bone pieces that occur within a suture in the cranium. These are irregular isolated bones that appear in addition to the usual centers of ossification of the cranium and, although unusual, are not rare. They occur most frequently in the course of the lambdoid suture, which is more tortuous than other sutures. They are also occasionally seen within the sagittal and coronal sutures and also along the Pterion and Asterion. Wormian bones are a marker for some diseases and important in the primary diagnosis of brittle bone disease: osteogenesis imperfecta.

Past History

Wormian bones (WBs) are accessory bones which occur within the cranial suture and fontanelles, most commonly in the posterior sutures. Wormian bones are named after the Danish anatomist, Olaus Wormius, who described them in a letter to Thomas Bartholin in 1643 (Pendergrass and Schaeffer, 1956; Pryles and Khan, 1979). However, wormian bones had been described in the past, with the first description attributed to Paracelsus (1460 to 1541 CE) (Pryles and Khan, 1979; Parker, 1905). The alternative names of WBs include Schalkt Knochen (Leichner-Weil, 1964) intercalary, sutural and intrasutural bones. These bones are detached portions of the primary ossification centres of the adjacent membrane bones (CREMIN, GOODMAN, SPRANGER et al., 1982).

It was stated that they can be found in healthy individuals (Burgener and Kormano, 1997), however a higher incidence of multiple WBs have been found in a variety of congenital disorders like osteogenesis imperfecta, cretinism (hypothyroidism), cleidocranial dysostosis, progeria, hypophosphatasia, rickets etc. (Burgener and Kormano, 1997). The morphological

knowledge of WBs is important in the diagnosis of these disorders (Cremin, Goodman, Spranger et al., 1982). It was reported that their incidence is well suited for comparative studies as an anthropological marker or an indicator of population distance (Gumusburun, Sevim, Katkici et al., 1997). Their knowledge is of interest to the human anatomy, physical anthropology and forensic medicine imaging (Hernandez and Echeverria, 2009). Regarding their incidence, differences exist among various ethnic groups, with the highest incidence in Chinese individuals, as high as 80% (Jeanty, Silva and Turner, 2000). Ethnic variation in WBs may suggest possible genetic influences, but environmental influences could also play a role. Though the occurrence of WBs is quiet common, the observational data on them are poorly reported. At an orthopaedic meeting a question was asked concerning the nature and significance of WBs (Cremin, Goodman, Spranger et al., 1982). But there was difficulty of giving an exact answer and it was debated that the literature about these bones is very scarce (Cremin, Goodman, Spranger et al., 1982). The current study aimed to report the incidence of WBs in Indian skulls along with their topographical distribution. The morphological and clinical importances were emphasized with relevant review of literature.

Materials and Methods

The study was conducted on 160 human skulls collected from various students of 1st year MBBS and from the Department of Fatima institute of medical sciences. All the skulls were cleaned dried properly and were looked for the presence of wormian bones in respect to its location, number and the sexual dimorphism. Aging and sexing was done using standard methods. The Data collected was tabulated and statistically analyzed.

Table 1: Distribution of age and sex grouped.

Age group years	Male (Total number=72)	Female (Total number=88)	Total skulls (Total number=160)
20-30 Yrs.	18 (25%)	21 (23.86)	39
30-45 Yrs.	32 (44.44%)	26 (29.54)	58
45-60 Yrs.	10 (13.88%)	21 (23.86)	31
>60 Yrs.	12 (16.66%)	20 (22.72)	32

All skulls were looked for the presence of wormian bones. Then, the number of wormian bones per skull and also the location of the wormian bones at Bregma, Lambda, Pterion, Asterion, Parietal notch, Occipito-mastoid notch, Intra-orbital ossicles and along the coronal, sagittal, lambdoid and squamous sutures were noted.

Results

In the present study, the incidence of wormian bones was seen in 72 (45%) out of 160 skulls. We found maximum number of wormian bones at lambdoid suture and in female skulls as compared to male skulls. Among the female skull the incidence was found to be 42 (47.72%) and among the male skull the incidence was found to be 30 (41.66%). Wormian bones occurred more frequently at lambdoid suture 56 (77.77%) with incidence of 22 (39.28%) in male skulls and 34 (60.71%) in female skulls.

Wormian bones along the coronal suture and at bregma and asterion seen only in male skulls, while in intra-orbital and pterion seen only in female skulls.

Table 2: Describing the total number of wormian bones found in male and female skull.

Sex	Present	Absent
Male	30 (41.66%)	42 (58.33%)
Female	42 (47.72%)	46 (52.27%)
Total	72 (45%)	88 (55%)

Table 3: Describing the wormian bones at various sites.

Wormian bones seen in	Males	Females
Lambdoid suture	22	34
Coronal suture	4	0
Intra-orbital suture	0	4
Bregma	2	0
Asterion	2	0
Pterion	0	4
Total	30	42

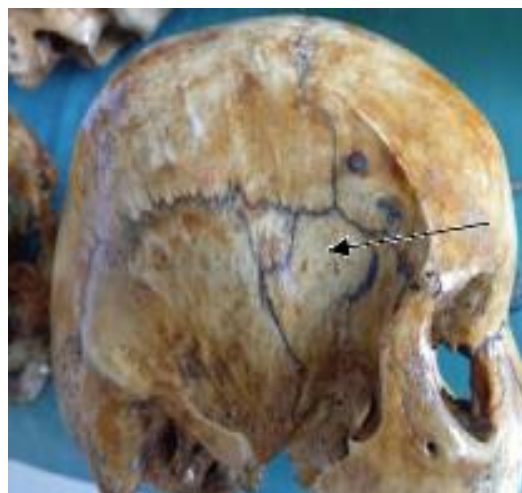
**Fig. 1: Arrow Showing the wormian bone at asterion.****Fig. 2: Arrow showing the wormian bone at Lambda.****Fig. 3: Arrow showing the wormian bone at Pterion.**



Fig. 4: Arrow showing the wormian bone at Asterion.



Fig. 5: Arrow showing the Wormian bone at the coronal suture.

Discussion

Wormian bones or sutural bones can occur in both normal and pathological skulls. Their cause is still undefined; nevertheless it has been related to genetics, in terms of population, as well as external forces, such as stress conditions. The sutural bones are due to imbalance between cranial changes in size and shape during ontogenesis. The number of wormian bones increases with the capacity of skull, regardless of the cause of enlargement. Normally the number of wormian bones does not exceed two or three in a normal skull but they are present in large number in hydrocephalus. The overall incidence of wormian bones in the present study was 72 (45%) which was lower than that reported by Murli Manju BV, Prabhu LV., Ashraf CM., Kumar C Rai R. and Maheshwari C in Morphological and topographical study of Wormian bones in cadaver dry skulls. *J. Morpho. Sci.* 2011, Vol 28, No3, P. 176-179 (73.1%) and Manjula Patil, Santosh Sheelavant in Sexual Dimorphism among the Wormian Bones in Adult Human Skulls. *J Indian Acad Forensic Med.* April-June 2012, Vol.34, No.2 (52.21%). Most of the studies showed that the incidence of sutural bones were

more common along the lambdoid suture, it was reported to be (40%) by Bergman R A, Afifi A K, Miyauchi R. *Skeletal systems: Cranium.* In: *Compendium of human anatomical variations.* Baltimore, Urban and Schwarzenberg. 1988; 197-205 and (56.4%) by Murli Manju BV, Prabhu LV., Ashraf CM., Kumar C Rai R. and Maheshwari C. Morphological and topographical study of Wormian bones in cadaver dry skulls. *J. Morpho. Sci.* 2011, Vol 28, No3, p. 176-179, in the present study it was found to be 56 (77.77%) which is more than the above mentioned studies. The Occurrence of wormian bones along the coronal suture 4 (5.5%) and along the bregma 2 (2.77%) was found in male skull, which is more than that found by *Manjula Patil, **Santosh Sheelavant-they found Coronal suture 1 (1.06%) and Bregma 1 (1.06%) in Sexual Dimorphism among the Wormian Bones In Adult Human Skulls, *J Indian Acad Forensic Med.* April-June 2012, Vol. 34, No. 2. The occurrence of wormian bone in the intra-orbital region was found to be 4 (5.55%) in the female skull, which is less than that found by Manjula Patil, **Santosh Sheelavant-they found intra-orbital suture-9 (9.57%) in Sexual Dimorphism among the Wormian Bones In Adult Human Skulls, *J Indian Acad Forensic Med.* April-June 2012, Vol. 34, No. 2.

Conclusion

The awareness about the occurrence of sutural bones and their topographical distribution will guide the radiologists and neurosurgeons to avoid misdiagnosis. It is matter of academic interest to the anatomists. From the present study, it was concluded that the occurrence of wormian bones is low in Andhra Pradesh population compared to other regions of India. This may be considered as a pilot study, for a follow up study with more number of samples is planned.

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