



RESEARCH ARTICLE

INCIDENCE OF WORMIAN BONES IN NORTH INDIA – A STUDY ON ADULT CADAVERIC DRIED SKULL

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ABSTRACT

Aims & objective: The wormian bones are solitary, irregular bones that appear along with regular centres of ossification of cranium. The present study mainly aims at number, location of these wormian bones in the dried adult human skulls of north Indian population. The knowledge of sutural bones is essential for the radiologist and neurosurgeons in their clinical practice.

Material method: About 55 dried human skull were collected from the department of anatomy, SIMS Hapur. These skull were examined for the presence of wormian bones, in respect to their location and number. After collection of data it was tabulated and analysed.

Results: According to present study the incidence of wormian bone was 28 out of 55 adult skulls. The maximum number of wormian bone at lambdoid suture 14 (6 right, 8 left). The wormian bones were also seen at lambda 4, pterion 1, Asterion 3, parietotemporal 3, occipitomastoid suture 1, sagittal suture 1, bregma 1.

Conclusion: The present study proves the occurrence of wormian bones in the human skull is common at lambdoid suture, also may occur at different sites at different sutures.

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INTRODUCTION

Accidental or intercalated bones that made their existence along the sutures of skull called as wormian bones or sutural bones. These are found in neurocranium of human skulls having no regular relation to their normal ossific centers (Standing, 2008). Most often found in lambdoid suture. A wormian bone was first described by paracelsus (1460-1541). The term "wormian bones" is derived by Olaus Worm, a Danish anatomist who described them in a letter to thomas bartholin in 1643 (Parker, 1905). Wormian bones are separated parts of the primary ossification centers of adjacent flat bones of the skull. These are also found in normal healthy individuals, however a correlation was found between the higher incidence of wormian bones and congenital disorders like osteogenesis imperfecta, cleidocranial dysostosis, progeria, hypothyroidism etc (Bergman, 1988 and Shantharam, 2017). A study of Khan *et al.*, reported that incidence is variable, ranging from around 10% in Caucasian, 40% in Indians, to 80% in Chinese skulls (Khan, 2011).

According to Bergman *et al.*, nearly 40% of skull contains wormian bones in the vicinity of the lambdoid suture (Bergman, 1988), followed by the epipterical centre (pterion ossicles) close to the site of antero-lateral fontanelle (Khan, 2011 and Raja, 2016). These bones can also be seen in other sutures such as the coronal, sagittal and squamosal sutures but their presence are very rare. This study aims to contribute more knowledge about wormian bones, their incidence, with their relevance as far as clinical aspects are concerned. Knowledge of this variation is very useful for anthropologists, neurosurgeons, radiologists and orthopedic surgeons.

MATERIALS AND METHODS

The study was included total 55 adult human dried skulls, in which 30 skulls collected from cadavers dissected by 1st year MBBS students in the department of Anatomy and 25 skulls obtained from the Anatomy museum of Saraswathi Institute of Medical Sciences, Hapur, over a period of five 5 years. Dissected skulls were cleaned and dried properly and then all the skulls were examined for the presence or absence of the wormian bones. The number and the location of wormian bones were noted. The findings were tabulated and statistically analyzed.

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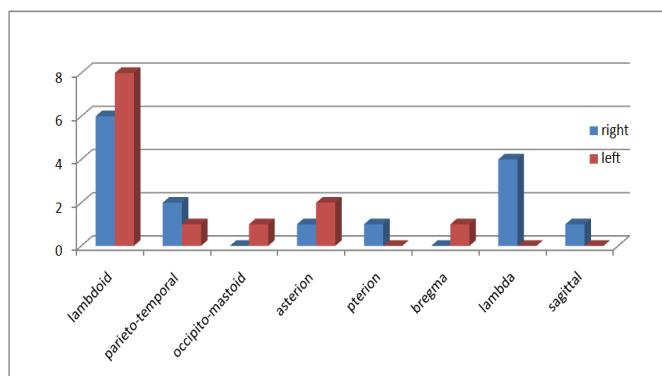
DOI: <https://doi.org/10.24941/ijcr.31882.08.2018>

RESULTS

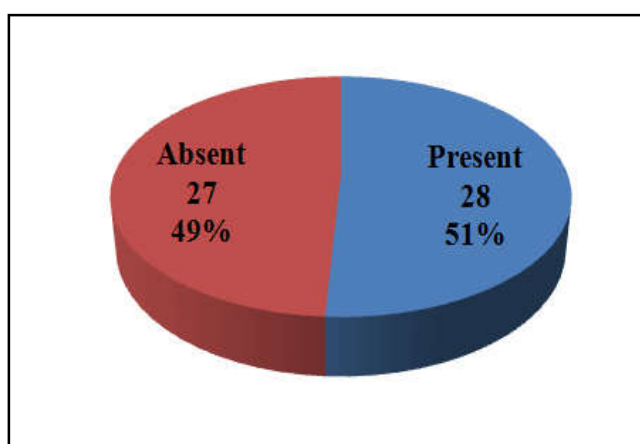
Graph 1 shows the incidence of Wormian bones. In this study wormian bones were present in 28 (51%) skulls out of total 55 (100%) skulls. About 27 skulls did not show any wormian bones. Table 1 shows the number and location of wormian bones at different regions of the adult human skulls. In this study we found that maximum numbers of wormian bones were occurred at lambdoid suture 14 (26%), 6 left side and 7 right side of the skull.

Table 1. Number and Location of Wormian Bones at Different Regions of Adult Human Skulls

Location of Wormian Bones	Right Side	Left Side	Total N (%)
Lambdoid suture	6	8	14 (26%)
Parieto temporal suture	2	1	3 (5%)
Occipito mastoid suture	0	1	1 (2%)
Asterion	1	2	3 (5%)
Pterion	1	0	1 (2%)
Bregma	0	1	1 (2%)
Lambda	4	0	4 (7%)
Sagittal suture	1	0	1 (2%)
coronal suture	0	0	Nil



Bar charts showing the number of wormian bone in right and left side at different suture



Graph 1. Incidence of Wormian Bones in the Present Study

At the Pareito-temporal suture 5% (2 right side and 1 left side), occipito-mastoid suture 2% (0 right side and 1 left side), Asterion 5% (1 right side and 2 left side), pterion was 2% (right 1 side, 0 left side), bregma 2% (0 right side and 1 left side), lambda 7% (4 right side and 0 left side), sagittal suture 2% (right 1 side, 0 left side). We not found wormian bone at coronal suture.

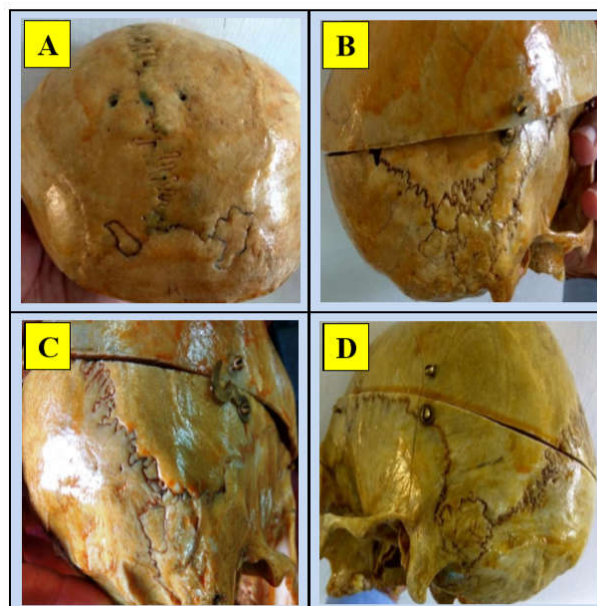


Fig. 1. Wormian Bones at the A. Lambdoid Suture B. Parieto-Temporal Suture C. Occipitomastoid Suture D. Asterion

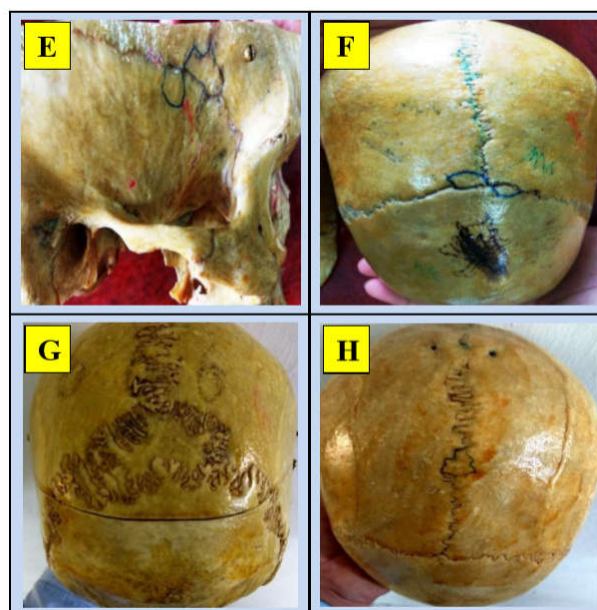


Fig. 2. Wormian Bones at the E. Pterion F. Bregma G. Lamda H. Sagittal suture

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, external forces such as stress condition as well as imbalance between cranial changes in size and shape during osteogenesis. Walulkar *et al.*, reported embryological reason for the formation of wormian bones are due to extra ossification centers close to the sutures (Walulkar, 2012). Wormian bones can be considered only as supplementary centers of ossification and have no contribution to the solidity of the cranium (Jean Cruveilhier, ?). According to Liu *et al.*, formation of wormian bones could be due to a gene called MSX2 which plays a role in fusion of sutures (Liu, 1999). It is also reported that they are inherited as autosomal dominant trait with incomplete penetrance (Tallapaneni, 2013). Another study reported that hydrocephalic skulls have a large number

of wormian bones which occur to compensate the additional cranial growth when the normal cranial capacity is not sufficient (Saxena, 1988). Some other authors also mention that some brain disorders lead to formation of wormian bones (Bergman, 1988 and Shantharam, 2017). But, Muralimanju *et al.*, states that wormian bones are formed in early membranous stage before formation of duramater and hence there is no correlation between brain disorders and wormian bones (Murlimanju, 2011). In the present study, 28 skulls had Wormian bones while 27 skulls had no wormian bones. The overall incidence of wormian bones was 51%, our findings are consistent with the study of Marti *et al.*, found 53% incidence of wormian bones (Marti, 2013), lower than that reported by Murlimanju *et al.*, 73.1% incidence (Murlimanju, 2011), Cirpan *et al.*, 59.3% incidence¹³ and higher than Bergman *et al.*, 40% incidence (Bergman, 1988), Khan *et al.*, 28% incidence (Khan, 2011) and Walulkar *et al.*, 34.22% incidence (Walulkar, 2012). We also found that higher incidence of wormian bones occurrence at the lambdoid suture (14 skulls out of the 55 skulls). Similar to our study, some other studies also reported that skulls had a higher number of wormian bones at the lambdoid suture (Bergman, 1988; Veeresh, 2016; Uchewa, 2018 and Showri, 2016). Saxena *et al.*, reported that 11.79% of Indian skulls and 5.06% Nigerians skulls had epipteric bone. It is still unclear why sutural bones are common in certain races (Saxena, 1988).

Conclusion

Wormian bones are actually more prevalent in the human skull. 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. The present study indicates that wormian bone may be present in the Parieto temporal suture, Occipito mastoid suture, and sagittal sutures in addition to the most common site at the lambdoid suture. Finally we would like to conclude that, presence of wormian bones should be kept in mind in case of any interventions or investigations on skull or cranial cavity.

Conflicts of interests: None.

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