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## Morphological Study of Wormian Bones in Dried Human Skulls

Shivaleela C<sup>1</sup>, Kumar GV<sup>2\*</sup>, Malipatil SB<sup>3</sup>, and Sandhya K<sup>3</sup>

<sup>1</sup>Assistant professor in Anatomy, Sri Siddhartha medical college, Tumkur, Karnataka, India.

<sup>2</sup>Assistant professor in Pediatrics, Sri Siddhartha medical college, Tumkur Karnataka, India.

<sup>3</sup>Professor in Anatomy, M R Medical College, Gulbarga, Karnataka, India.

### ABSTRACT

Wormian bones may be defined as those accidental or intercalated bones found in the cranium having no regular relation to their normal ossific centres. They are associated with cranial and central nervous system abnormalities. Knowledge of presence of wormian bones is of radiological importance and useful for the neurosurgeons, radiologists and anthropologists. The present study was carried out on 108 dried adult human skulls. The various sutures were examined systematically for the presence or absence of wormian bones. The findings were documented and the photographs of relevant wormian bones were taken using a digital camera. The incidence was 43.52 %. Many skulls had combination of wormian bones at different sites. 33.33% skulls had wormian bones at the lambdoid suture. 11.11% had at asterion and 1.85% at pterion. Wormian bone at lambda observed in 8.33% and 3.7% at temporoparietal suture. 2.78% skulls had wormian bones at coronal suture and 0.92% at sagittal suture. The present study indicates that wormian bones may be present in the coronal, sagittal sutures and at pterion, asterion in addition to the usual site in the lambdoid suture. It is important for neurosurgeons and radiologists to be aware of the presence of wormian bones in these sutures as they may be mistaken for fractures in cases of head injuries. Therefore, this report may be useful for neurosurgeons, radiologists, and anthropologists.

**Key words:** Wormian bones, asterion, pterion, inca bone.

*\*Corresponding author*



## INTRODUCTION

Wormian bones /supernumerary ossicles/sutural bones may be defined as those accidental or intercalated bones found in the cranium having no regular relation to their normal ossific centres. They are of frequent occurrence in man, and generally occupy the sutures and/or fill fontanelles of the neonatal skull [1, 2]. Wormian bones are found in both sexes in similar percentages as well as in both sides of the skull, being predominantly symmetrical [3]. The first specific description was by Olaus Worm, a Danish anatomist (1588-1654), who described them at some length in a letter to Thomas Bartholin. In turn Bartholin named them Ossa Wormiana, their present name [4]. They are studied and reported as ethnic variables, being of interest to human anatomy, physical anthropology, radiology, and forensic medicine [5]. They can have different irregular shapes (round, oval, oblong, triangular, quadrilateral and polygonal have all been reported) and can vary from under 1mm in diameter to 5x9cm or 1-2 inches in diameter. Wormian bones articulate with the surrounding bones by sutures with indentations more complex on the outer surface of the skull than on the inner aspect [6].

The mechanism of formation of sutural bones is not clear. According some authors the occurrence of wormian bones is controlled by genetic factors [7]. Since wormian bones belong to the neurocranium, they share its embryology. They appear as isolated ectopic islands of intermembranous ossifications. In the fetus the diploe is not formed yet, and thus wormian bones are composed of a single layer of compact bone on the dural side [8]. Studies have shown that the presence of sutural bones is associated with other cranial and central nervous system abnormalities [9]. Other associated anomalies included low-set ears, congenital tracheomalacia, single umbilical artery and congenital heart disease. Jeanty et al., have reported the presence of wormian bones in four fetuses. But in these cases there were no associated anomalies [10] Radiologist Dr. Frank Gaillard [11] and Dr. Amit Tripathi [12] have reported cases of wormian bones associated with rickets, hypothyroidism, down syndrome, osteogenesis imperfecta, pycnodysostosis and cleidocranial dysplasia. The wormian bones, in themselves, do not carry a negative prognosis, and thus the prognosis will depend on the type and severity of the associated diseases. Knowledge of presence of more than one sutural bone at pterion is of radiological importance. The sutural bones may be mistaken for fracture of skull in case of trauma of the pterion region. The presence of epipteric bones may lead to complications in making burr holes at the pterion [13].

## MATERIALS AND METHODS

The present study was carried out on 108 dried adult human skulls obtained from the Department of Anatomy, Mahadevappa Rampure Medical College, Gulbarga, Karnataka state, India. The various sutures were examined systematically for the presence or absence of wormian bones. The findings were documented and the photographs of relevant wormian bones were taken using a digital camera.

## RESULTS

Total 47 skulls out of 108 skulls studied were found to have wormian bones at single or multiple sites. The Incidence was 43.52 % (fig no 1). Multiple wormian bones were noted at lambdoid suture (LS) in many skulls. Many skulls had combination of wormian bones at different sites (fig no 2). 36 skulls had wormian bones at the lambdoid suture (33.33%) (fig no 3). 12 skulls (11.11%) had wormian bone at asterion (fig no 4). Wormian bones at pterion (fig no 5) was present in 2 skulls (1.85%). Wormian bone at lambda (inca bone, fig no 6) was present in 8 skulls (8.33%). 4 (3.7%) skulls had wormian bones at temporoparietal suture (TPS) (fig no 7) and 3 (2.78%) skulls had wormian bones at coronal suture (CS) (fig no 8). One (0.92%) skull had wormian bone at sagittal suture (SS) (fig no 9).

### Diagrams, Images and Tables

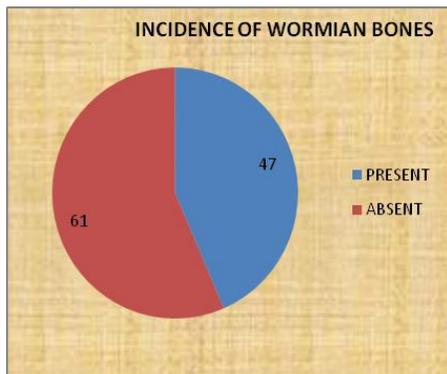


Fig no 1. Incidence of wormian bones.

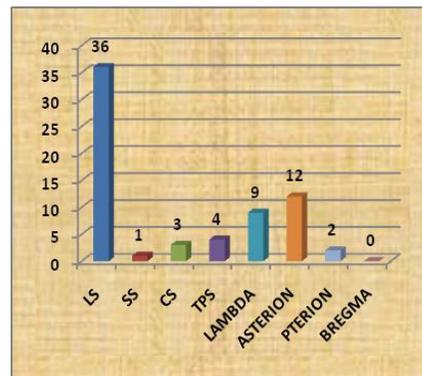


Fig no 2. Topographical distribution of Wormian bones at different sutures.

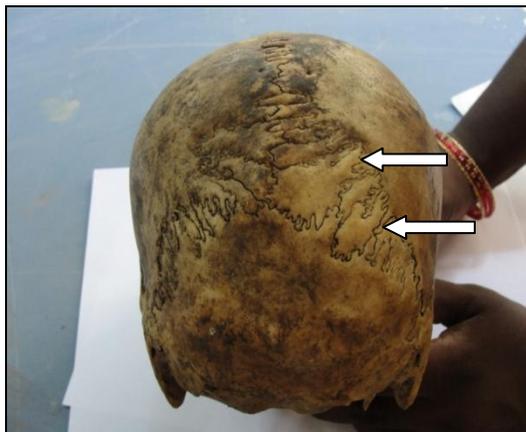


Fig no 3. Wormian bones at lambda.

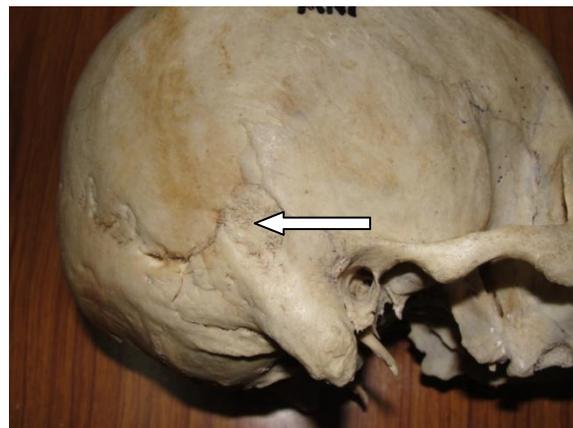


Fig no 4. Wormian bone at asterion

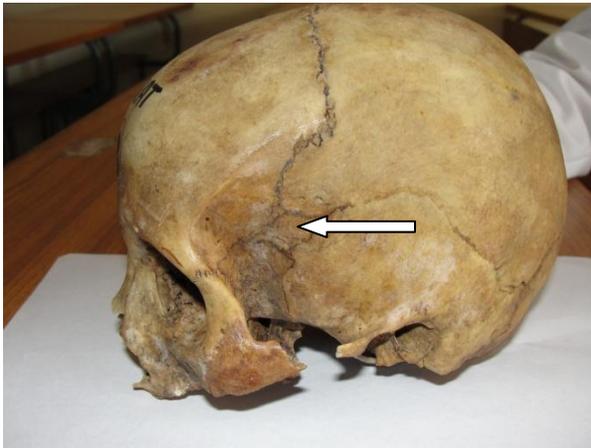


Fig no 5. Wormian bone at pterion.

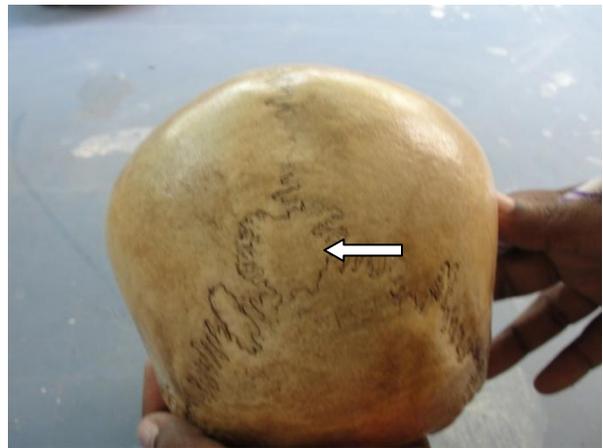


Fig no 6. Wormian bone at lambda.

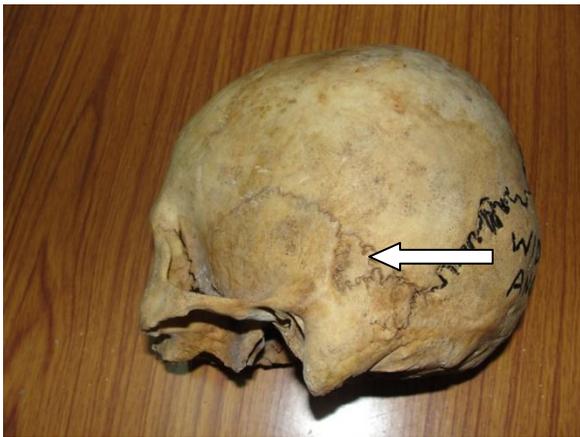


Fig 7. Wormian bone at temporo-parietal suture.

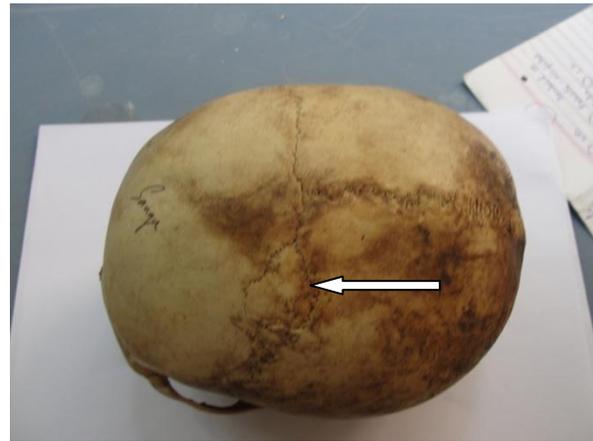


Fig 8. Wormian bone at coronal suture.

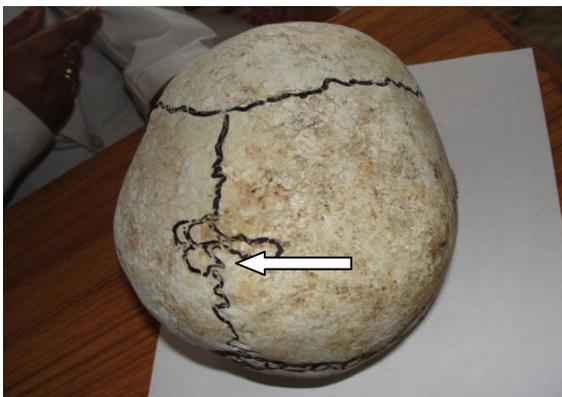


Fig no 9. wormian bone at sagittal suture.

## DISCUSSION

Wormian bones are a common occurrence in the human skull. Brothwell (1963) reported the prevalence of WBs among different populations and the data is represented in Table. Bergman et al. reported that nearly 40% of skulls have sutural bone in the lambdoid suture [14]. A study by Sanjay et al showed the incidence of wormian bones was 34.22% [15]. In the present study, incidence of wormian bones was found to be 43.52%. They occur most frequently in the lambdoid suture. In our study the most common site of occurrence of wormian bones was at the lambdoid suture which correlates with the other studies. The next most common site of wormian bone is the pterion ossicle, which has a high incidence among Indians. A study by Saxena et al. showed that 11.79% of Indian skulls and 5.06% Nigerians skulls had epipteric bone [16]. In the present study we observed wormian bones at pterion in 2 cases (1.85%) only. There can be another bone called the preinterparietal bone or inca bone at the lambda. The incidence of inca bones in our study (8.33%) is higher when compared to previous studies where the reported incidence varied from 0.8 to 6.6% by Zambare .B.R [17]. We also observed wormian bones at temporoparietal suture in 4 (3.7%) cases, at coronal suture in 3 (2.78%) cases which is not reported in the available literature. Wormian bones were noted at sagittal suture in 1 case (0.92%) case. Similar observations were made by Sanjay et al [15]. It was reported that the presence of wormian bones at the pterion may lead to complications in making burr holes at the pterion [18]. It is problematic if the fracture of skull is misinterpreted as a Wormian bone and the patient may lose the appropriate treatment at a right time. Hence the basic knowledge about these accessory bones is important for the doctors in day to day clinical practice.

**Table: Incidence of wormian bones in different populations according Brothwell (1963)**

Population	Incidence (%)
Chinese	80.32
German	75
Australian	72.58
Iron Age/Romano-British	71.03
Melanesian	64.15
Lachish	63.41
Anglo-Saxon	55.56
South Indian (present study)	43.52

## CONCLUSION

The present study indicates that wormian bones may be present in the coronal, sagittal sutures and at pterion, asterion in addition to the usual site in the lambdoid suture. It is important for neurosurgeons and radiologists to be aware of the presence of wormian bones in these sutures as they may be mistaken for fractures in cases of head injuries. Therefore, this report may be useful for neurosurgeons, radiologists, and anthropologists.



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