

Anatomical Variation of Asterion in Human Dry Skull – A Case Report

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Abstract

Sutural bones are usually small, irregularly shaped ossicles, often found in the sutures of the cranium, especially those in relation with the parietal bones. Their size, shape and number vary from skull to skull. The asterion corresponds to the site of the posterolateral (mastoid) fontanelle of the neonatal skull which closes at the end of the first year. The asterion is the junction of the parietal, temporal and occipital bones. During the routine osteology demonstration class for undergraduate students, five Wormian bones were noted at the asterion in an adult skull. The asterion is a surgical landmark to the transverse sinus location which is of great importance in the surgical approaches to the posterior cranial fossa. The study of asterion may be helpful to ENT and Neurosurgeons.

Key words: Wormian bone, sutural bone, asterion, lambdoid suture, lambda, Inca bones

Introduction

Wormian bones are accessory bones which occur within the cranial suture and fontanelles, especially those in relation with the parietal bones. Their size, shape and number vary from skull to skull. Wormian bones of the cranial vault are formations associated with insufficient rate of suture closure, and regarded as epigenetic and hypostatic traits. These bones rest along sutures and/or fill fontanelles of the neonatal skull. These bones might lead to confusions in reading the radiographs in the case of head injuries. The Wormian bones like this may be mistaken for multiple fractures. The asterion corresponds to the site of the posterolateral (mastoid) fontanelle of the neonatal skull which closes at the end of the first year. At the asterion the occipital, parietal and the temporal bones come into articulation. Sutural bones provide information as markers for various diseases, and can mislead in the diagnosis of fractures. Presence of these bones provides false impressions of fractures or the fractures may be interpreted for sutural bones especially in the region of asterion either radiologically or clinically which may lead to complications during burr-hole surgeries.

Case report

During the routine osteology demonstration classes for medical and dental undergraduate students, we found five Wormian bones at the asterion (Figure 1). These bones were found in an adult skull. They were quite large in size and were irregular in shape. In the same skull the lambdoid suture was very wavy. Few irregular Wormian bones were also found in the lambdoid suture of the same skull. There were no other notable abnormalities in the skull.

Discussion

The skull is most studied and documented part of vertebral skeleton. Wormian bones are an anatomical variation present in healthy individuals, also known as intrasutural bones. Sutural bones are small irregular bones found on the suture and they vary in size, shape and in number. These bones are commonly found in occipital bone. It is important to know about these bones because they can mislead in the diagnosis of fracture of skull bones. Formations of these bones are associated with insufficient closure of sutures. Sutural bones are most numerous in the lambdoid suture but rarely these bones may be seen on sagittal suture, coronal suture, pterion and bregma. As most of the previous studies observed that the sutural bones were more commonly found in the region of lambdoid suture while in present study these bones were found in coronal and sagittal suture, which were rarely seen (1).

Wormian bones or sutural bones are usually small irregular ossicles located within the cranial sutures. They are formed as a result of alterations in the normal formation of the flat bones of the skull and are usually regarded as normal variants. They are not named, because they vary in number and shape from skull to skull. They are studied and reported as ethnic variables, being of interest to human anatomy, physical anthropology, radiology, and forensic medicine. Our study indicates that Wormian bones may be present in the coronal, squamosal, and sagittal sutures 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 (2).

Asterion is the junction of the parietal, temporal and occipital bones. Occurrence of sutural bone at this craniometric point has been reported to vary among populations. Formation of sutural bone is due to the appearance of additional ossification centers which may occur in or near sutures. Another view expressed by some authors these bones may be result of pathological influences such as hydrocephalus. As per another opinion, there is a close association between developing duramater and calvarial bones. Other authors believe that sutural bones develop from normal processes and are genetically determined. The MSX2 gene, which encodes a home domain, transcription factor plays a crucial role in craniofacial morphogenesis by influencing fusion of sutures. The study can be of utmost importance when planning surgery to the cranium through this craniometrical point in Indian population and also when interpreting radiological images. Further, it can also be useful for identification of human male and female skulls in association with other parameters. Anthropologists and forensic experts may use this study to solve their problems (3).

The study conducted by Murlimanju BV et al. observed Wormian bones in 73.1% of the cases from Indian population. This incidence rate is slightly higher compared to other reports and may be due to racial variations. These variant bones were more frequently seen at the lambdoid suture and were rare at the coronal and sagittal sutures (4).

The wormian bone at bregma is certainly a rare occurrence. Study of skull showed a large number of sutural bones at the lambda and along the lambdoid suture. A wormian bone at pterion is called “pterion ossicle” or “epipteric bone” or Flower’s bone. Incidence of epipteric bone is high in Indians-11.79%. Presence of wormian bone at asterion is more in Indian males. The incidence of wormian bone is more among the female skulls (64.80%). Single wormian bone was seen in 26 (14.4%) skulls with equal distribution among male and female skulls (5).

The asterion is the junction of the parietal, temporal and occipital bones. The asterion is a surgical landmark to the transverse sinus location which is of great importance in the surgical approaches to the posterior cranial fossa. During surgical approaches asterion should be given consideration to the superficial anatomic reference points of the posterior cranial fossa that allow the topographic location of the intracranial structures to avoid causing injury or accessing them. Sutural morphology of the asterion in the Indian population does not differ much from that of other populations (6).

Surgical approach towards asterion has to be done with caution as many surgeons are unfamiliar with the anatomical variations. The asterion corresponds to the site of the posterolateral (mastoid) fontanelle of the neonatal skull which closes at the end of the first year. Inca bones provide information as markers for various diseases, and can mislead in the diagnosis of fractures. In the study conducted by Natekar PE et al, 12.6% of the Inca bones were seen at the asterion. The skull bone fractures in infancy and early childhood, which may be associated with large intersutural bones giving false appearance of fracture radiologically, and also during surgical interventions involving burr-hole surgeries as their extensions may lead to continuation of fracture lines (7).

Asterion are points of sutural confluence seen in the norma lateralis of the skull. Their patterns of formation exhibit population-based variations. Understanding of the sutural morphology of these points is important in surgical approaches to the cranial fossae. Sixty human skulls of unknown gender were examined on both sides. Sutural morphology at the asterion is classified into two types. Type I - when a sutural bone is present at its convergence, Type II - When sutural bone is absent. Sutural bones were found at the asterion in 9.1% of the cases (8).

As per the study conducted by Manjula Patil et al, the overall incidence of wormian bones was 52.22%. Incidence of wormian bones was more in female skulls (64.80%). Wormian bones occurred more frequently at lambdoid suture 56(60%) with incidence of 22(39.3%) in male skulls and 34 (60.7%) in female skulls. Wormian bones along the coronal suture and at bregma were seen only in male skulls, while intra-orbital ossicles were seen only in female skulls. Wormian bones along the sagittal suture showed sexual dimorphism (27.78%, $p=0.045$) while at lambda and lambdoid suture showed a good discriminating power of 17.65% ($p=0.087$) and 21.43% ($p=0.089$) respectively. Thus, there exists a moderate degree of sexual dimorphism among the wormian bones with respect to the overall incidence, number and location (9).

Conclusion

Along the course of life or during some medical emergencies we are in need to take the radiographs for analysis. During that period the x-ray may show some extra bones in the skull other than the normal bones. There are possibilities for the clinicians to misinterpret it as a fracture rather than sutural bones. Study of the wormian bones and their occurrence in different points and between male and female put some light on the radiographs to give a good interpretation in times of need. Understanding of the sutural morphology of these points is important in surgical approaches to the cranial fossae. The knowledge of Wormian bones is enlightening for the neuroanatomists, neurosurgeons, orthopedicians, radiologists, anthropologists and morphologists.

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Figure 1: Multiple sutural bones at the Asterion of left side

