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Bilateral Occipitomastoid Wormian Bones In An Adult Human Skull: A Morphological And Computed Tomography Case Report

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Abstract:
Background: *The aim of this study was to describe a rare case of bilateral Wormian bones located in both occipitomastoid sutures of an adult male human skull.*
Materials and Methods: *The material of the study was an adult male skull from the craniological collection of the Museum of the Department of Human Anatomy and Medical Terminology, Azerbaijan Medical University. Cranial measurements were performed, including determination of the length and width of the Wormian bones located in the occipitomastoid sutures. The skull was additionally examined using computed tomography.*
Results: *The anteroposterior dimension of the right occipitomastoid sutural bone was 23.85 mm, and its width was 8.38 mm. The anteroposterior dimension of the left occipitomastoid sutural bone was 13.92 mm, and its width was 7.77 mm. The mastoid foramen was located within the right occipitomastoid sutural bone, whereas on the left side it was situated within the temporal bone.*
Conclusion: *This case represents a rare bilateral occurrence of Wormian bones in the occipitomastoid sutures and contributes additional anatomical data regarding this uncommon cranial variation.*
Key Word: *occipitomastoid suture; Wormian bones; Sutural bones; Skull; Anatomical variation.*

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I. Introduction

Wormian bones represent the most common type of supernumerary bones of the human skull. These accessory sutural bones are located within the cranial sutures and demonstrate considerable variation in size, shape, and number [1–2]. They are thought to originate from additional ossification centers developing within or adjacent to the cranial sutures during skull formation [3–5]. Wormian bones are most frequently observed along the lambdoid suture, where they may occasionally form large accessory bones, including interparietal bones. Their development may involve genetic factors; however, the increased occurrence of Wormian bones in conditions associated with cranial deformation, such as hydrocephalus, suggests that mechanical stress during skull growth may also contribute to their formation [6]. Wormian bones can be found in healthy individuals but are also considered a characteristic feature associated with osteogenesis imperfecta (OI) and several other pathological conditions [5]. Knowledge of Wormian bones is also important for radiologists, forensic physicians, and pathologists, as these accessory sutural bones may mimic cranial fractures on imaging or during skeletal examination. Accurate identification of Wormian bones helps to distinguish normal anatomical variations from pathological findings, including traumatic lesions associated with physical abuse or bone fragility disorders [7]. The development of Wormian bones appears to vary depending on their anatomical location. O'Loughlin [8] suggested that posteriorly located Wormian bones may be more influenced by environmental factors, whereas those occurring in anterior cranial sutures appear to be under stronger genetic control.

Studies of Wormian bones have addressed several aspects of their significance, including anthropological variation in their frequency among different populations [2,7,9–11], their association with cranial deformities and other developmental conditions [8,12–14], and the application of imaging techniques, such as computed tomography and ultrasonography, for their detection and evaluation [3,4,15–16]. Wormian bones are most frequently observed in the lambdoid suture, as supported by previous studies [2,7,9–10]. The frequency, morphology, size, sex-related differences, and associations between Wormian bones and cranial indices have been mainly investigated in sutures adjacent to the parietal bone, including the lambdoid, coronal, sagittal, and squamous sutures [3,7,9–11]. However, cranial sutures extending to the skull base, such as the occipitomastoid suture, have received considerably less attention regarding the occurrence of Wormian bones and have often been evaluated only as part of broader studies of cranial sutural variations [9–11]. The close relationship between the occipitomastoid suture and the mastoid foramen, which may occasionally be located directly on the suture line [17–19], highlights the importance of detailed anatomical investigation of this region and the identification of possible sutural bones.

We examined an adult male human skull demonstrating bilateral Wormian bones located along both occipitomastoid sutures. According to Bennett [20], Wormian bones are generally considered to show a predominantly unilateral distribution, although bilateral occurrences have been reported in the literature [9,11]. However, the morphological characteristics and anatomical significance of bilateral occipitomastoid sutural bones remain insufficiently described.

II. Materials And Methods

The material of this study was an adult male skull from the craniological collection of the Museum of the Department of Human Anatomy and Medical Terminology, Azerbaijan Medical University. Cranial measurements were performed according to the methods described in [21]. The anteroposterior dimensions (length) and transverse dimensions (width) of the Wormian bones located in the occipitomastoid sutures were measured using an electronic caliper. The skull was additionally examined using computed tomography.

To obtain maximum accuracy of morphometric data and to evaluate the anatomical and topographic characteristics of the skull, computed tomography (CT) was performed using a 64-row, 128-slice Aquilion CXL scanner (Toshiba, Japan). The CT examination of the male cranial specimen was carried out at the Radiology Department of the Educational-Surgical Clinic of Azerbaijan Medical University (Baku, Azerbaijan Republic).

Prior to scanning, the skull was positioned on the CT table and secured using fixation devices to minimize movement. Computed tomography was performed according to a standard scanning protocol without the need for repeated acquisitions. The scanning parameters were as follows: detector configuration, 64 × 0.5 mm; effective slice thickness, 0.5 mm (128-slice reconstruction); rotation time, 0.4 s; tube voltage, 120 kV; and tube current, 200–350 mA. Two CT-based reconstructions of the skull were obtained.

III. Results

The results of the cranial measurements are presented in Table 1.

The anteroposterior dimension of the right occipitomastoid sutural bone was 23.85 mm, and its width was 8.38 mm. The anteroposterior dimension of the left occipitomastoid sutural bone was 13.92 mm, and its width was 7.77 mm.

Additional Wormian bones were also identified in the examined skull, including one apical bone, one bone located in the right lambdoid suture, and four bones located in the left lambdoid suture. The dimensions of these bones are summarized in Table 2.

On the right side, the mastoid foramen was located within the occipitomastoid sutural bone, whereas on the left side it was situated within the temporal bone (Fig. 1, Fig. 1A, and Fig. 1B). Computed tomography of the examined skull was also performed to further evaluate the anatomical features of the region (Fig. 2A, Fig. 2B, Fig. 3A, and Fig. 3B).

Table 1. Dimensions of the studied skull, (in mm).

Maximum cranial length (g-op)	180.4	Orbital breadth (d-ec), L	36.43
Naso-occipital length (n-op)	170.6	Orbital breadth (d-ec), R	37.62
Maximum cranial breadth (eu-eu)	135.7	Orbital height, L	30.29
Bizygomatic breadth (zy-zy)	129.2	Orbital height, R	28.83
Basion-bregma height (ba-b)	134.1	Biorbital breadth (ec-ec)	94.07
Cranial base length (ba-n)	105.3	Interorbital breadth (d-d)	23.86
Basion-prosthion length (ba-pr)	99.13	Frontal chord (n-b)	108.45
Maxillo-alveolar breadth (ecm-ecm)	58.1	Parietal chord (b-l)	110.25
Maxillo-alveolar length (pr-alv)	49.74	Occipital chord (l-o)	94.19
Biauricular breadth (ra-ra)	117.89	Foramen magnum length	38.32
Nasion-prosthion height (n-pr)	62.75	Foramen magnum breadth	31.78
Minimum frontal breadth (ft-ft)	96.1	Mastoid height (po-ms)	28.14
Upper facial breadth (fmt-fmt)	100.74	Biasterionic breadth	107.88
Nasal height	49.47	Bimaxillary breadth (zma-zma)	92
Nasal breadth	21.99	Zygomaticoorbitale breadth	52.56

Table 2. Dimensions of the Wormian bones of the studied skull, (in mm).

	Length	Width
Apical bone	3.30	3.58
Right lambdoid suture bone	10.96	5.19
Left lambdoid suture bone (1)	17.50	7.61
Left lambdoid suture bone (2)	14.04	2.10
Left lambdoid suture bone (3)	8.91	2.24
Left lambdoid suture bone (4)	8.21	1.46

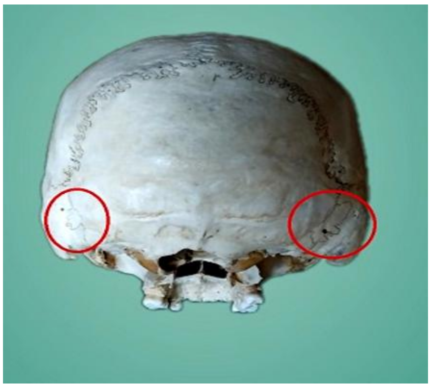
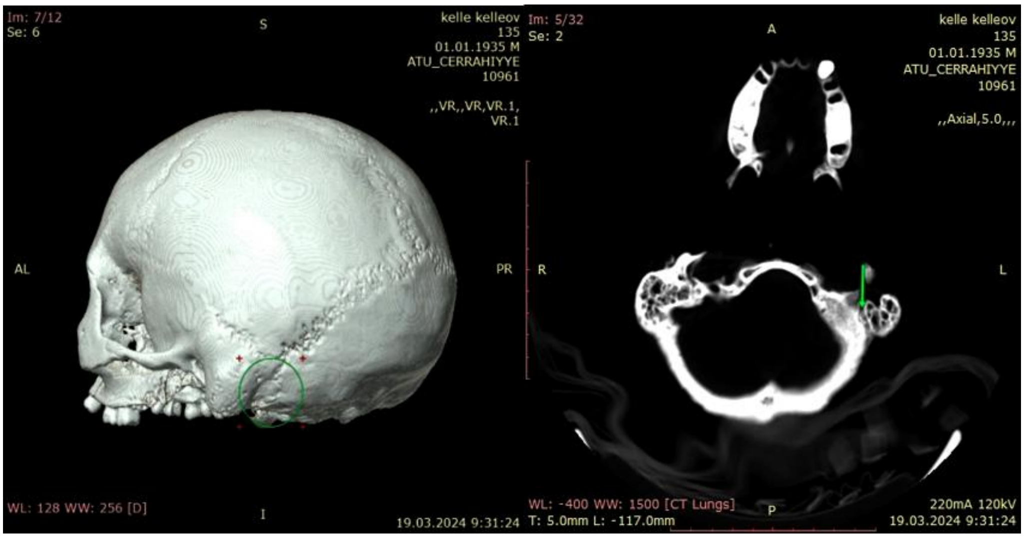


Fig. 1. The Wormian bones of both occipitomastoid sutures are indicated by red circles.

1A **1B**

Fig. 1A. The left occipitomastoid suture bone is indicated by the white circle; the four left lambdoid suture bones and apical bones are indicated by points and red circles.

Fig. 1B. The right occipitomastoid bone is indicated by the white circle, and the right lambdoid suture bone is indicated by the red symbol.



2A **2B**

Figs. 2A and 2B. On CT reconstruction, the left occipitomastoid suture bone is indicated by a green circle (A) and a green arrow (axial projection).

3A **3B**

Figs. 3A and 3B. On CT reconstruction, the right occipitomastoid suture bone is indicated by a green circle (A) and a green arrow (axial projection).

IV. Discussion

Marti B. et al. [16] described Wormian bones as small accessory bones commonly found within cranial sutures and fontanelles. Although they are generally regarded as normal anatomical variants, their increased occurrence has been reported in association with several skeletal disorders, including cleidocranial dysostosis, pycnodysostosis, congenital hypothyroidism, and rickets. Among these conditions, osteogenesis imperfecta is of particular importance because of its relevance in the differential evaluation of skeletal findings in forensic and clinical practice. Cirpan S. et al. [10] investigated 150 crania of West Anatolian individuals of unknown age and sex. Wormian bones were observed in 89 skulls (59.3%). According to the authors, the highest frequency was recorded in the left lambdoid suture (40.7%; 61/150), whereas the lowest frequency was observed in the right occipitomastoid suture (1.3%; 2/150). Occipitomastoid sutural bones were identified on the right side in 2 skulls (1.3%) and on the left side in 4 skulls (2.7%). Bilateral occurrence of occipitomastoid sutural bones was not reported in this study.

Natsis K. et al. [11] examined 166 Greek dry human skulls (92 males and 74 females) of known age and identified Wormian bones in 124 specimens (74.7%). The highest frequency of Wormian bones was observed in the lambdoid suture (44.6%). Although no sex-related differences were found in the overall incidence of Wormian bones, a male predominance was reported for their occurrence in the lambdoid and occipitomastoid sutures. Regarding occipitomastoid sutural bones, they were identified in 11 right-sided (8.9%) and 8 left-sided (6.5%) sutures, with a total of 16 skulls demonstrating this type of variation.

Kiliç Safak N. et al. [22] examined 28 dry human skulls of unknown age and sex. Wormian bones were identified in 12 skulls (42.86%). Their occurrence in the occipitomastoid suture was observed in 3 cases (9.37%), including two right-sided and one left-sided occipitomastoid sutural bone.

Basnet L.M. et al. [9] examined 98 adult human dry skulls of unknown sex with intact calvaria and erupted third molars. After excluding 28 skulls due to suture obliteration, 70 skulls were included in the analysis. Occipitomastoid sutural bones were identified in 19 skulls (27.14%). Unilateral occurrence was observed in 16 cases (9 on the right side and 7 on the left side), whereas bilateral occurrence was found in 3 cases ($p = 0.039$).

Narayan R.K. [23] examined 30 complete dry adult human skulls and reported occipitomastoid sutural bones in 5.88% of cases, including two right-sided and three left-sided unilateral occurrences. Bilateral localization was not observed in that study.

Besson C. et al. [24] described the occipitomastoid suture as an anatomical region considered in osteopathic practice. Although the clinical relevance of occipitomastoid sutural bones in such procedures remains unclear, awareness of anatomical variations in this region may be important for clinicians working with cranial structures.

V. Conclusion

This case report describes a rare bilateral occurrence of Wormian bones within the occipitomastoid sutures of an adult human skull. Although Wormian bones have been extensively studied in various cranial sutures, detailed descriptions of their occurrence in the occipitomastoid region remain limited. The presented findings contribute additional anatomical data on this uncommon variation and may serve as a reference for future morphological and clinical studies of the occipitomastoid suture.

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