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CASE REPORT

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PATHOLOGY/BIOLOGY

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ABSTRACT: Wormian bones (WB) are irregular small cranial ossicles found along suture lines and fontanels. In Brazil, gunshot wounds to the skull are quite common in young individuals. Nevertheless, as far as we know, this is the first report of a WB giving an erroneous aspect of gunshot entrance due to its displacement position. The present manuscript describes the case of a Brazilian young man who died due to ballistic trauma, where a gaping bony defect on the right side of the skull was thought to be the exit wound of an injury related to the destruction found on the left side, highly suggestive of firearm injury. Thus, this case study has brought to light similarities between a traumatic lesion and an orifice of a WB, with emphasis on differential diagnosis during routine anthropological examinations.

KEYWORDS: forensic science, forensic anthropology, Wormian bones, skull fractures, wounds and injuries, firearms

Wormian bones (WB) are supernumerary ossicles resulting from the abnormal ossification centers that create islands of small isolated bones, found in different locations inside the skull (1). The mechanism of WB origin is not fully ascertained, although genetic and environmental factors have been claimed as etiological factors (2). WB arise along the cranial sutures and/or fontanels during the neonatal period in normal or pathologic conditions, with clinical significance to the diagnostic process of many genetic disorders, such as craniosynostosis (1,3).

Cranial lesions resulting from gunshot wounds (GSW) are traditionally described in forensic medical articles by different morphological characteristics, depending on the bullet speed and on several mechanisms that constitute the harmful action (4–8). The classic description is a small entrance wound with an internal beveling in the direction of the projectile, and a larger exit wound with external beveling (8,9). The impact of the bullet can

cause disruption of bone tissue greater than the bullet defect (6). This occurs due to a radial effect of high air pressure generated by high-speed bullets, associated with hydrodynamic shock against the spongy layer of the flat cranium (6,7). It is well known that several factors influence defect morphology, including the biomechanical properties of anatomical tissues affected. A suture affects the way the energy is dissipated in a skull, and thus, the defect morphology of a wound in the sutures may be different from the typical ones (10). Coronal, squamosal, and sagittal sutures are uncommon locations for WB and can lead to confusion in the diagnosis of skull injuries (11). When a bullet enters through a suture, there is an eccentric pattern of delamination on the edges (10).

These findings prompted us to report a singular case of WB mimicking a firearm projectile hole. This is, to our concern, the first report of such an occurrence in the English literature.

Case Description

Skeletal remains were received by Afrânio Peixoto Legal Medicine Institute of Rio de Janeiro, Brazil, in September 12, 2011 for anthropological examination. The anthropological examination followed by subsequent DNA (deoxyribonucleic acid) analysis confirmed the identification of a Caucasian male, between 20 and 25 years of age (12). The initial skull observation revealed a round-shape hole of 9 mm at its smallest diameter, measured from the outer cranial cortical near point asterion, on the left lambdoid suture region (Fig. 1). Orifice analysis from the endocranium denoted an apparent beveling with increasing diameter toward the inner surface. These set of characteristics are commonly observed in entrance wounds caused by firearm bullets. On the other side of the skull, opposite to this orifice, an

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FIG. 1—Round orifice with punched-out appearance located in the left squamosal suture suggestive of entrance of projectile firearm.



FIG. 2—Extensive irregular fracture with loss of substance in the right temporal-parietal region suggestive of exit hole of projectile firearm.

extensive loss of substance of irregular shape, measuring about 106×73 mm and involving the right parietal and temporal bones, was observed. Moreover, the presence of edges showed an exterior beveling of some regions (Fig. 2). A detailed analysis revealed that the beveled surface of the round hole did not display the characteristic medullary portion of the trabecular dipole bone, but a smooth and shiny surface, similar to the outer cortex of the same skull, although more porous. On the opposite side, an extensive loss of substance with a few fragments adhered to the skull, indicating they had been internally displaced, highlighting the sense (direction) of scattering energy. Furthermore, this bone bending suggested a blunt force trauma. Interestingly, after maceration, some small bone fragments were separated and mounted in similar anatomical position. One of these fragments was a WB which fit perfectly the spherical hole, showing that the supposed orifice was actually the region from which the WB had been dislocated, corroborating with the cortical aspect observed, and elucidating any doubts about a possible inlet caused by a firearm projectile (Figs 3 and 4). These findings ruled out the possibility of a GSW. In addition, a more detailed analysis of the skull injury leads to conclude that a forceful action, namely a blunt trauma to the right temporal-parietal region, was the cause of extensive loss of bone substance and consequently, the likely cause of death of the individual.

Discussion

Wormian bones (WB) are accessory bones, documented to be present in the area of skull sutures in 8–15% of the population. They predominantly (50%) involve the lambdoid sutures (1,11,13). We report herein a case where a displaced WB in the area of the left lambdoid suture, artifactually suggested the presence of an entry gunshot wound of the skull. However, analysis of the entire submitted specimen uncovered the missing bone. In addition, examination of the right side of the skull, where there was a gaping bony defect, was more consistent with blunt force trauma than an exit gunshot wound.

Specific features commonly allow for the recognition of entrance wounds in bones (14,15). A typical round or ovoid sharp-edged hole with punched-out appearance, slight flaking at the edge, smaller and more regular than the exit wounds is usually found in firearm cranial entrance injuries and quite well described in the forensic literature (14,15). However, the displacement of WB can generate an orifice quite similar to a



FIG. 3—Wormian bone being placed in position at right squamosal suture.



FIG. 4—Wormian bone totally positioned in the left squamosal suture. Note the perfect fitting in the supposed entrance orifice caused by firearm. The small Wormian bone can be observed at right edge of the figure.

gunshot entrance wound and mislead the anthropological study, especially if the WB is not in position during the initial analysis of the cranium, as seen in the case described above.

The anthropological and forensic literature concerning firearm wounds is not scarce; nevertheless, no manuscript was found that discussed abnormal ossicles such as WB mimicking the aspect of a gunshot entrance hole, and only one study related a

confusing impression between WB and a cranial fracture (16). The absence of insights on this subject and the inexistence of similar related cases can hamper the examiners during an investigation.

Therefore, this case report revealed important unexpected findings about WB and the possibility of this bone giving an erroneous impression of a traumatic lesion during an anthropologic study, if dislocated from its position. In conclusion, an orifice originated from WB displacement might be included as a differential diagnosis in the circumstances of suspicion of firearm wound to the skull.

References

- Bellary SS, Steinberg A, Mirzayan N, Shirak M, Tubbs RS, Cohen-Gadol AA, et al. Wormian bones: a review. *Clin Anat* 2013;26:922–7.
- Barberini F, Bruner E, Cartolari R, Franchitto G, Heyn R, Ricci F, et al. An unusually-wide human bregmatic Wormian bone: anatomy, tomographic description, and possible significance. *Surg Radiol Anat* 2008;30:683–7.
- Kaplan SB, Kemp SS, Oh KS. Radiographic manifestations of congenital anomalies of the skull. *Radiol Clin North Am* 1991;29:195–218.
- Hauser G, Stefano GF. Epigenetic variants of the human skull. Stuttgart, Germany: E. Schweizerbart'sche Verlagsbuchhandlung, 1989.
- Hanihara T, Ishida H. Frequency variations of discrete cranial traits in major human populations. I. Supernumerary ossicle variations. *J Anat* 2001;198:689–706.
- Dubrovin IA, Dubrovina IA, Pigolkin IuI. Morphological features of gunshot injuries of the cranial bones. *Sud Med Ekspert* 2005;48:9–11.
- Dubrovin IA. Forensic-medical significance of the characteristics of gunshot perforating fractures of the skull bones. *Sud Med Ekspert* 2006;49:3–5.
- Delannoy Y, Colard T, Becart A, Tournel G, Gosset D, Hedouin V. Typical external skull beveling wound unlinked with a gunshot. *Forensic Sci Int* 2013;226:e4–8.
- Işcan MY, Quatrehomme G. *Medicolegal anthropology in France*. *Forensic Sci Int* 1999;100:17–35.
- Kimmerle EH, Baraybar JP. *Skeletal trauma. Identification of injuries resulting from human rights abuse and armed conflict*. Boca Raton, FL: CRC Press, 2008.
- Khan AA, Asari MA, Hassan A. Unusual presence of Wormian (sutural) bones in human skulls. *Folia Morphol (Warsz)* 2011;70:291–4.
- Buikstra JE, Ubelaker DH, editors. *Standards for data collection from human skeletal remains*. Arkansas Archaeological Survey Research Series: Fayetteville, AR, 1994.
- Sanchez-Lara PA, Graham JM Jr, Hing AV, Lee J, Cunningham M. The morphogenesis of wormian bones: a study of craniosynostosis and purposeful cranial deformation. *Am J Med Genet A* 2007;143A:3243–51.
- Quatrehomme G, Işcan MY. Analysis of beveling in gunshot entrance wounds. *Forensic Sci Int* 1998;93:45–60.
- Quatrehomme G, Işcan MY. Characteristics of gunshot wounds in the skull. *J Forensic Sci* 1999;44:568–76.
- Mishra KK, Lala JK. Wormian bone giving erroneous impression of valvut-fracture. *J Indian Med Assoc* 1969;52:178–9.

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