

Traumatic Diastasis of Metopic Suture in an Adult Skull Victim of a Gunshot Wound: a Case Report

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The metopic suture is a mid-sagittal plane variant of cranial syndesmosis, visualized from the nasion to the bregma. In most cases, the metopic suture closes during the first year of age; however, there are rare occurrences of persisting metopic suture in adults. Metopism is caused by incomplete fusion of the two embryological halves of the frontal bone. Usually, skull entry gunshot wounds are round or oval in shape and leave characteristic marks on the bone. Exit gunshot wounds to the skull are larger and more irregular. Herein we present a rare case of a human skull with a gunshot wound causing a traumatic diastasis of a complete, persisting metopic suture found during forensic examination. The gunshot wounds of the skull increase intracranial tension pressure and as a result an opening on the level of the nasion and nasofrontal suture was observed.

Key words: metopic suture, diastasis, gunshot wound

Introduction

The metopic suture is a vertical syndesmosis that connects the two halves of the frontal bone. This structure is a normal finding in the skulls of newborns, and between 3-9 months of age, it closes and allows complete fusion of the two halves of the frontal bone [14]. It is to be noted that the premature closure of the cranial sutures leads to the condition known as craniosynostosis [4]. There are two major variations of the metopic suture: complete – runs sagittal through the entire frontal bone; and incomplete that can be further subcategorized into upper – only present in the superior part of the frontal bone; middle – only present in the middle part of the frontal bone and it can be further subdivided into upper-middle and lower-middle; lower – present in the inferior part of the frontal bone [1]. The lower type shows variability in its course, and in accordance

with its shape, it can be further subdivided into linear; u-shaped; y-shaped; V-shaped; H-shaped; inverted Y-shaped; radiating types [1].

Gunshot wounds to the skull usually leave distinguishable marks and fractures to the adjacent bones. Entrance gunshot wounds to the skull vary in shape and diameter in accordance with the caliber of the projectile and the distance between the skull and the weapon. Typically, entrance wounds are round or oval in shape. Exit gunshot wounds to the skull are most commonly irregular in shape and with a wider diameter in comparison to the diameter of the entrance wound. Exit wounds normally exhibit an inward punch-out appearance [12].

Traumatic diastasis of cranial sutures is a pathological process of fracture of the suture consequently to a prior traumatic injury to the skull. This type of cranial fracture is more common in children due to the more flexible junctions at the sutures in comparison to the fully ossified adult skull [6].

Case report

During forensic examination in the Department of Forensic Medicine at the Medical University Sofia, of middle-aged human remains, it was determined that there was damage to the skull typical for a gunshot wound in the region of the head. To better assess the damage to the bones, the skull had undergone specific procedures for detachment of the remaining soft tissue. After the procedures, it was morphologically established that there were marks of gunshot damage on the skull, with an entrance wound, irregular ovoid in shape and around 9 mm in diameter, at the level of the left lateral supraorbital region. The exit wound is with irregular shape and larger in diameter than the entrance wound. Furthermore, a rare anatomical variation in the formation of the frontal bone was also present: – a continuous complete metopic suture. The atypical structure is situated in the sagittal plane, and it is a continuation of the sagittal suture, passes through the coronary suture, runs through the entirety of the frontal bone and ends inferiorly to the glabella below the level of the supraorbital margin, at the level of connection between the frontal bone and the nasal bone. As a result of the applied intracranial tension pressure, caused by the projectile, an opening of the distal part of the metopic suture, at the level of the nasion was observed. Traumatic diastases of the metopic suture and the frontonasal suture are illustrated on **Fig. 1**.

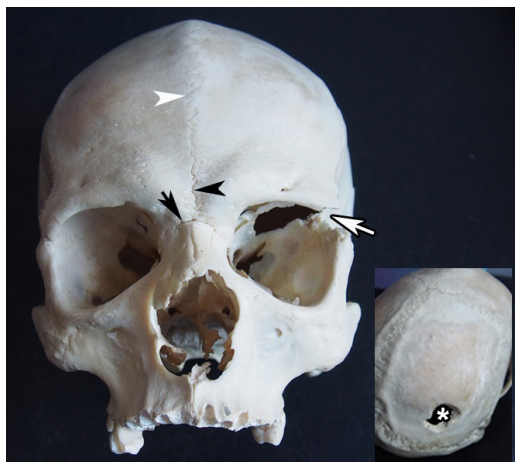


Fig.1. Photo of the skull of a gunshot wound victim with a persisting metopic suture. White arrow head – metopic suture; black arrow head – traumatic diastasis of metopic suture; white arrow – entrance gunshot wound; black arrow – traumatic diastasis of frontonasal suture, asterisk – exit gunshot wound.

A persisting metopic suture could be used to identify an individual by morphological criteria, if such peculiarity had been known and registered in the medical record of the given individual during his lifetime.

Discussion

Metopism, or the persistence of the frontal (metopic) suture in adults, is considered a rare anatomic variant [1; 3; 5; 13; 15]. The prevalence of this variation deviates throughout the literature. Furthermore, the incidence rate of metopism varies from race to race. According to Bergman [3], metopism has an incidence rate of 1-12%. According to Bryce [5], metopism is found in 8.7% of European skulls, 5.1% of Mongolian skulls, 1.2 of Negroid skulls and 1% of Australian skulls. According to Zdilla [15] the prevalence of metopism in European skulls is 8.06%; in 15.38% of Asian skulls; in 2.20% of Egypt skulls, 2.86% of Benga skulls. Moreover, metopism is more common in females (3.77%) than in males (1.79%) [15].

As anatomical variation, the persistent metopic suture has no immediate clinical significance. However, studies suggest link between the persistence of the metopic suture and the suppression of the development of the frontal sinus [4; 8-11]. According to the study of Guerram et al. [8], there was a statistical significance between metopism and hypoplasia of the frontal sinus: 50.8% of the skulls with persisting metopic suture were found to have bilateral hypoplasia of the frontal sinus, in comparison to the 9.4% of the normal skulls with this condition. According to Nikolova et al. [9], there was a statistically significant link between the persistence of the metopic suture and aplasia of the frontal sinus: 27,5% of the skulls with metopism had aplasia of the frontal sinus (20% unilateral and 7.5% bilateral) in comparison of 4.8% of the skulls in the control group exhibited aplasia of the frontal sinus. In another study, Nikolova et al. [10] found that 19.35% of the skulls with metopism exhibited aplasia of the frontal sinus (7.53% bilateral and 11.83% unilateral – 9.68% right and 2.15% left) in comparison to the 12.41% of the skulls in the control group with such condition. In 22,58% of the skulls with metopism exhibited hypoplasia of the frontal sinus (8.60% bilateral; 13.98 unilateral – 12.90% right and 1.08% left) in comparison to the 13.14% of the skulls from the control group with such condition. It is apparent that most commonly, the right frontal sinus is affected.

Gunshot wounds to the skull are associated with powerful pressure forces acting on the cranial bones. Initially the bullet causes inwards puncture pressure to entrance wound bone, which travels towards the adjacent bones and damages them. Afterwards the bullet causes intracranial tension pressure, when passing inside the skull. Lastly, the bullet causes outwards puncture pressure to the bone of the exit wound, which travels to the neighboring bones and damages them. The amount of pressure applied by the bullet depends on its mass, velocity, shape and trajectory [7]. As a result of the intracranial tension pressure caused by the bullet there might occur a traumatic diastasis of the coronary sutures.

Even though the persisting metopic suture is a rare anatomical variant without underlying pathology, it might be misinterpreted as a fracture of the frontal bone during

different radiological tests [2]. Therefore, knowledge of this ordinarily occurring deviation in the development of the frontal bone is paramount for radiologists, neurosurgeons and orthopedists.

Conclusion

The persisting metopic suture in adults – metopism is a standard anatomical variant with no primary underlying pathology. However, though, metopism might be the cause of suppressed development of the frontal sinus. Furthermore, the persisting metopic suture might mimic a frontal bone fracture and might be misinterpreted by inexperienced radiologists.

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Ethical Approval The article was performed in accordance with the ethical standards, approved by the Medico-Legal Office and Local Ethics Committee, Medical University of Sofia.

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