

CASE REPORT

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The Assymetrical Remodelling of Two Neurosurgical Burr Holes: A Case Study

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ABSTRACT: A human skull identified as that of a 16-year-old female who had been reported missing about 3 years before the discovery of the specimen displayed evidence for the assymetrical remodelling of bilateral neurosurgical burr holes. While one of the holes retained its original size and shape, gross evidence for the contralateral lesion had virtually disappeared. Initially, the open lesion was mistakenly suspected to be a recent bullet hole.

KEYWORDS: physical anthropology, musculoskeletal system

Anthropologists, odontologists, and forensic pathologists are all aware that individuals may be positively identified by comparing antemortem and postmortem X-rays. However, for a variety of reasons antemortem X-rays are often unavailable, and individualization may depend upon the ability to demonstrate, on a set of decomposed remains, evidence for skeletal anomalies, diseases, or certain life events such as injuries or medical treatments. For example, given a concordant biological profile, the mere presence of a partially healed rare fracture or an artificial joint may become the critical evidence for identification. However, bone is living tissue, and while the discovery of a known anomaly may confirm identification, the absence of such evidence may reflect remodelling and may not warrant exclusion. In the case that follows, skeletal evidence for neurosurgery illustrates that remodelling can obscure evidence for particular gross lesions and that rates of bone repair may be highly variable. It also illustrates a case in which a neurosurgical burr hole was mistakenly identified as a perimortem bullet injury.

Case Study

In 1976, the Michigan State Police presented us with an unidentified human skull (Fig. 1). The specimen was discovered by a hiker in a wooded area in Michigan's Upper Peninsula. The law enforcement officials requested assistance with identification and directed our attention to a small hole near the vertex which they thought might be a bullet hole or representative of some

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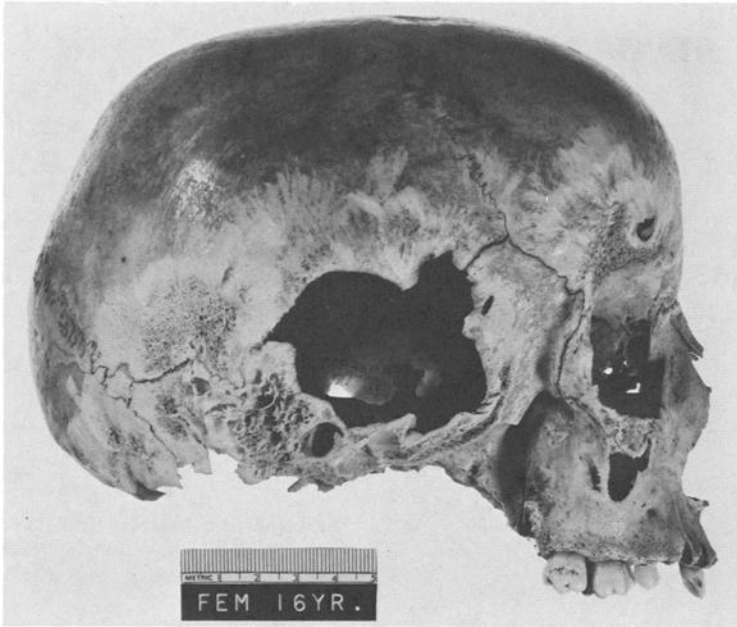


FIG. 1—*Right lateral view of skull. The opening in the temporal region and the erosion of bone around the eye orbit are a result of rodent activity.*

other injury associated with the person's death. The skull had been extensively damaged by rodents.

The specimen was identified by dental records and dental radiographs as that of a 16-year-old female who had disappeared about 3 years before the discovery of the remains. The opening near the vertex was neither the result of a bullet nor was it directly associated with the girl's death. It displayed none of the internal or external beveling or radiating fractures customarily associated with bullet injuries, and its borders had undergone obvious remodelling. The opening instead reflected cranial surgery.

The medical records of the decedent revealed that in 1967 bilateral burr holes were drilled into the top of her cranium. The holes were described as being 7 to 8 mm in diameter and positioned approximately 3 cm from midline. Although the reasons for the cranial surgery were not provided, the recorded position of the holes is identical to that described by Northfield as a procedure for the emergency relief of intracranial pressure. He states, "If there is no evidence for localizing the lesion a burr hole is made into each frontal region, approximately at the site of the coronal suture and 2 to 3 cm from the midline" [1]. Unfortunately, all of the radiographic records of the case described above were destroyed during a seven-year hospital records purge.

The opening on the skull that was initially pointed out by the police (Fig. 2) is identical in location and dimensions to the left burr hole described in the medical records (31 mm to the left of the axis of a patent metopic suture (midline) with a maximum diameter of 7 mm). Its posterior border incorporated the adjacent portion of the coronal suture. Although remodelling is evident around the periphery of the lesion, the general size and shape do not appear to have been significantly altered since the operation. In contrast, evidence for the contralateral burr hole, about 3 cm to the right of the metopic suture (Fig. 2), has been reduced on the ectocranial surface to a shallow depression and an interruption of the coronal suture. The endocranial surface beneath that point displays an abrupt depression or pit (Fig. 3).

Thus, the remodelling of two initially identical cranial burr holes, produced during the same

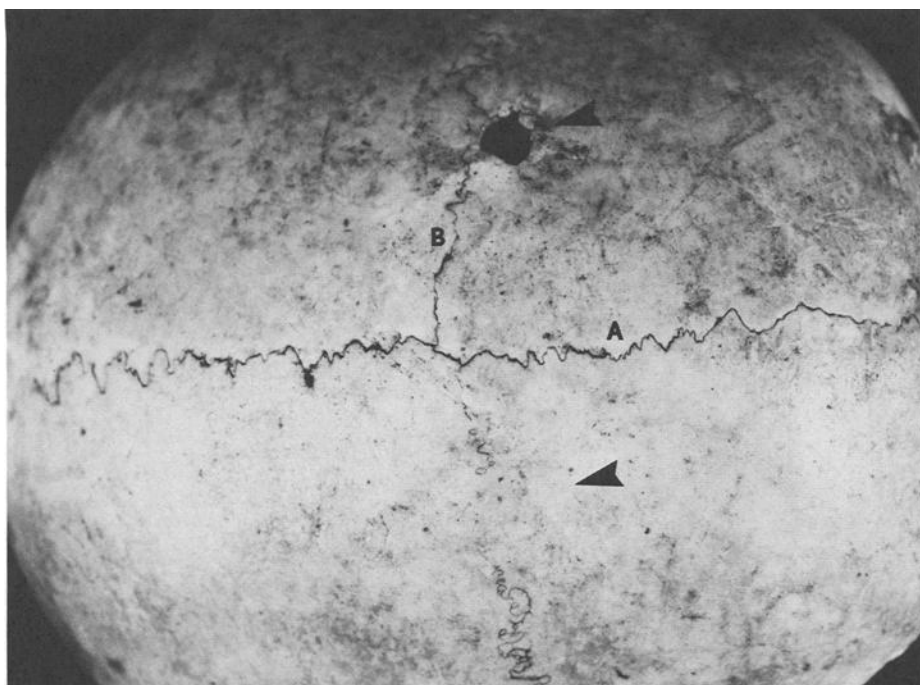


FIG. 2—Top view of skull with (a) the metopic suture to the right and (b) the coronal suture oriented vertically. The arrows indicate the left burr hole (upper) and the site of the right burr hole (lower).

neurosurgical procedure, took quite dissimilar courses. One maintained its initial dimensions and general form, while the other was nearly obliterated. Were it not for the presence of the more obvious juxtaposed lesion or the surgical report, the significance of the second modification may have gone unnoticed.

Discussion

When certain life events, such as bone fractures, diseases, and surgical procedures are recorded on both a person's skeleton and on their medical records they can become valuable tools for identification [2]. The value of such information, however, is mitigated by the fact that bone has the property to heal, remodel, and change its character, and that it may do so irregularly. In the case just described, even though the age, sex, and health status of the individual were constants and the anatomical positions and form were virtually identical, the remodelling of two bilateral individual bony lesions took dissimilar courses.

The specific use of neurosurgical burr holes for positive human identification has been reported [3,4], and their use in such cases is clear. Nonetheless, investigators should be aware of the variation that is possible in the nature of their repair and that the gross evidence for such surgery may disappear altogether.

A final note on the relevance of this case involves the diagnosis of the patent lesion as possibly reflecting a bullet injury. The law enforcement official involved, who had discussed the defect with a physician, even mentioned that the size and shape were consistent with a .22 caliber fired bullet. Evidently, some police personnel and medical examiners may be unaware of the nature and significance of skeletal remodelling and of the damage usually done by a bullet to the head.

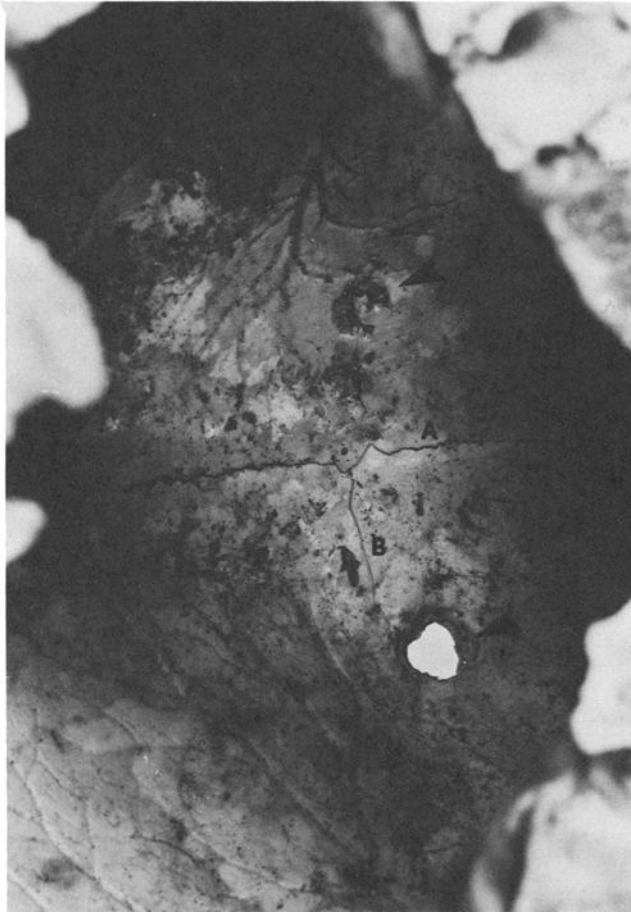


FIG. 3—View of the endocranial surface of the vault with (a) the metopic suture to the right, and (b) the coronal suture oriented vertically. The arrows indicate the site of the right burr hole (upper) and the left burr hole (lower).

A better understanding of and communication about the character of fresh and old lesions and of the effects of certain types of injuries to the skull may warrant our attention.

Acknowledgments

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