

Hyperostosis Frontalis Interna: Irregular Skull Ossification in Cadaveric Dissection

Sara Eliseo, Zhi Quan Kuat, Yeva Nayflish, Anthony Sciuva, Leslie Pryor McIntosh, PhD
Department of Biomedical Sciences, Philadelphia College of Osteopathic Medicine, Moultrie, Ga

ABSTRACT

Hyperostosis Frontalis Interna (HFI) is an unusual condition characterized by the thickening of the frontal bone of the skull. Although HFI may extend to parietal bones, it often ends at the coronal sutures. HFI has been found most often in post-menopausal women, with incidence rates surpassing men by nearly nine times. This abnormal thickening of the skull may compress the cerebrum leading to atrophy, frequent headaches, and cognitive impairment. Our case report surrounds an 88 year-old Caucasian female cadaver with an extensive presentation of HFI. A distinct irregular ossification of the internal surface of the frontal bone was noted bilaterally with visibly demarcated borders. Furthermore, it is of interest to note that HFI may be linked to conditions of kidney disease and this cadaver also displayed another unusual anatomical defect, commonly referred to as a “horse-shoe” kidney. Despite being labeled as a benign entity with no clinical significance, the etiopathology of HFI is not well established. Our group aims to investigate these relationships further with the hopes of providing insight into a condition that may affect as many as 12 percent of the female population.

INTRODUCTION

Hyperostosis Frontalis Interna (HFI) is an unusual condition characterized by abnormal thickening of the frontal bone of the skull. The degree of excess ossification ranges from minor to unambiguously severe and can be classified macroscopically using a 4-scale grading system [4]. There is much that remains unknown about this condition, such as the underlying etiology, clinical manifestations, and implications it has on the health of millions globally. Previous research has implicated possible causes of HFI to include hormonal imbalances (especially estrogen), diabetes, thyroid disorders, lifestyle habits, kidney dysfunction, obesity, and virilism, among many others [6]. Greater awareness of HFI is called for, as this elusive condition does not clinically present with distinct symptoms that need immediate medical correction. Our case report aims to document another incidence of HFI, found in an 88 year-old Caucasian female cadaver with extreme presentation, and to explore the research community to take focused interest in investigating this important medical condition, for which there is currently no treatment.

METHODS

Cadaver dissection was performed during the gross anatomy laboratory at PCOM South Georgia. Grant's Dissector was used for the removal of the calvaria [1]. The first cut was made by reflecting the scalp inferiorly with the specimen in the supine position. The temporalis muscle was then reflected inferiorly before chiseling the calvarial bones. A saw was employed to cut along the circumference of the calvaria without completely cutting through the bone. After a complete circumferential cut was made, a chisel was placed into the saw cut and struck with a mallet to break the inner lamina of the calvaria. Following the removal of the brain, a distinct irregular ossification of the internal surface of the frontal bone was noted bilaterally with visibly demarcated borders. HFI was diagnosed according to macroscopic morphological characteristics proposed by Herschkovitz et al [4]. Cranial thickness, length, and width were recorded.

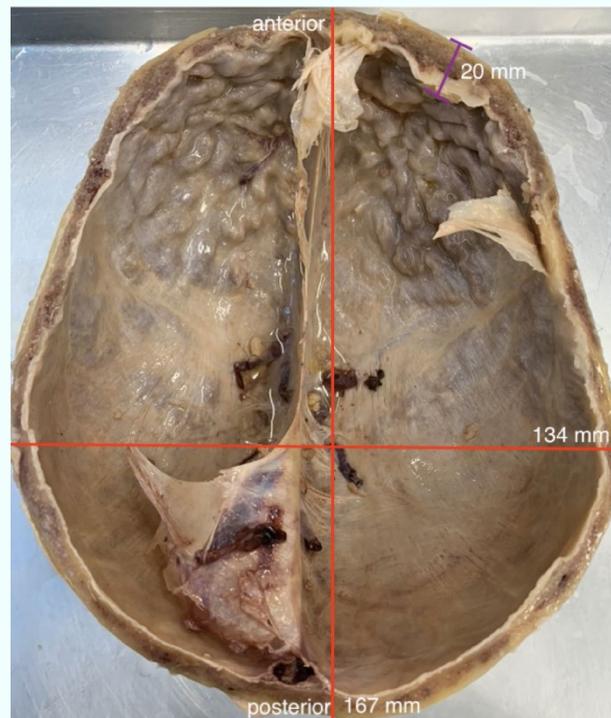


Figure 1. Photograph of cadaveric skull showing HFI.



Figure 2. Photograph showing hyperostotic surface of the frontal bone.



Figure 3. Photograph showing thickest nodule of the skull.

RESULTS

- Cadaveric dissection of an obese 88-year-old female showed diffuse hyperostosis frontalis interna with dural fusion to the calvarium involving the frontal and parietal bones bilaterally. Cause of death was reported as left lung carcinoma. Significant conditions contributing to death, but not related to cause was noted to be acute metabolic encephalopathy and hypercalcemia. Other notable findings include a horseshoe kidney and presence of calcific atherosclerotic plaques in major blood vessels, including but not limited to the abdominal aorta and common iliac arteries.
- The skull was of average size, measuring 167 mm in length and 134 mm in width at its widest points. External appearance was otherwise normal. Examination of the interior surface of the cranium revealed significant and continuous ossification of more than 50% of the endocranial surface in the form of irregular bony nodules. The hyperostotic area was present on the frontal bones and extended posteriorly to the parietal bones with slight predominance on the left side. These bony lesions were not present on the occipital bone. The skull measured 20 mm thick at its most prominent nodule on the frontal bone, which is markedly greater than the average thickness of the remainder of the cadaver's skull, which was measured to be 5 mm.
- Excessive vascularization of the cerebrum was indicated by prominent cerebral arteries on the brain and in the dural sinuses lining the surface of the cranium. The dura mater of the hyperostotic region was thin, tightly adhered, and in some places fused to the surface of the skull.

DISCUSSION & CONCLUSION

- The presentation of HFI within our cadaveric specimen was classified as the most severe type of overgrowth. The proliferation of the bone indicates osteogenic remodeling and shows a consistent pattern of vascularization throughout the remainder of the calvaria. The vascular networks created within the calvaria is indicative of continuous skeletal growth and could be related to a hormonal imbalance or a potential metabolic disorder[3].
- Our cadaver at 88 years old additionally showed signs of hypercalcemia which shows breakdown of bone and raises a potential for deposition elsewhere within the body as well as contributions to other chronic diseases such as osteoporosis.
- A recent study found an increase in HFI prevalence to 2.5 times greater in today's population compared to 100 years ago [5]. This could be potentially linked to greater lifespans, greater dietary compliments of estrogen, or even delays in childbearing [6]. The causes of HFI remain uncertain. However, hormonal influence on bone growth in the skull has been postulated. The majority of the patients appear asymptomatic but metabolic disorders, such as diabetes and acromegaly have been highlighted [2].

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