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Case Report

Osteoblastoma in the occipital bone: A case report of a rare tumor in the calvarium

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ABSTRACT

Osteoblastomas infrequently occur in the calvarium, displaying a preference for temporal and frontal bones when it does. We present an unusual case of a large, expansile osteoblastoma in the occipital bone of a 23-year-old man who presented with a nontender lump at the back of his head. Initial computed tomography scan showed a large occipital bone mass, and after additional imaging, a gross total resection was performed. Histopathological examination revealed an osteoblastoma. Although these tumors are benign, overlapping imaging characteristics of lesions affecting the calvarium often present a diagnostic dilemma. This case emphasizes the importance of imaging in the management and work-up of these patients to decrease the risk of complications and assists surgeons in their preoperative planning.

Introduction

Osteoblastomas are rare, benign osteoid forming tumors with the majority presenting in young adults between their second and third decades of life. This tumor predominantly affects the vertebral column and long tubular bones [1]. Skull involvement is markedly less frequent, and particularly occipital bone involvement is extremely rare. The following case report describes, to the best of our knowledge, the 13th reported case in the literature of an osteoblastoma in the occipital bone. Multiple imaging modalities were used for lesion characterization and completion of preoperative work-up. While challenging, interpreting and describing bone lesions is an essential skill for a radiologist to help establish the correct diagnosis and avoid unnecessary tests.

Case report

A 23-year-old male noticed a bump at the back of his head for 1 month after he had his hair shaved off. The lump was not painful. He denied any further symptoms associated with the bump and his medical history was unremarkable. On physical examination, note was made of a fixed bony mass in the occipital region, which caused his neck to be somewhat stiff.

Imaging work-up initially included a noncontrast computed tomography (CT) of the head, which demonstrated an

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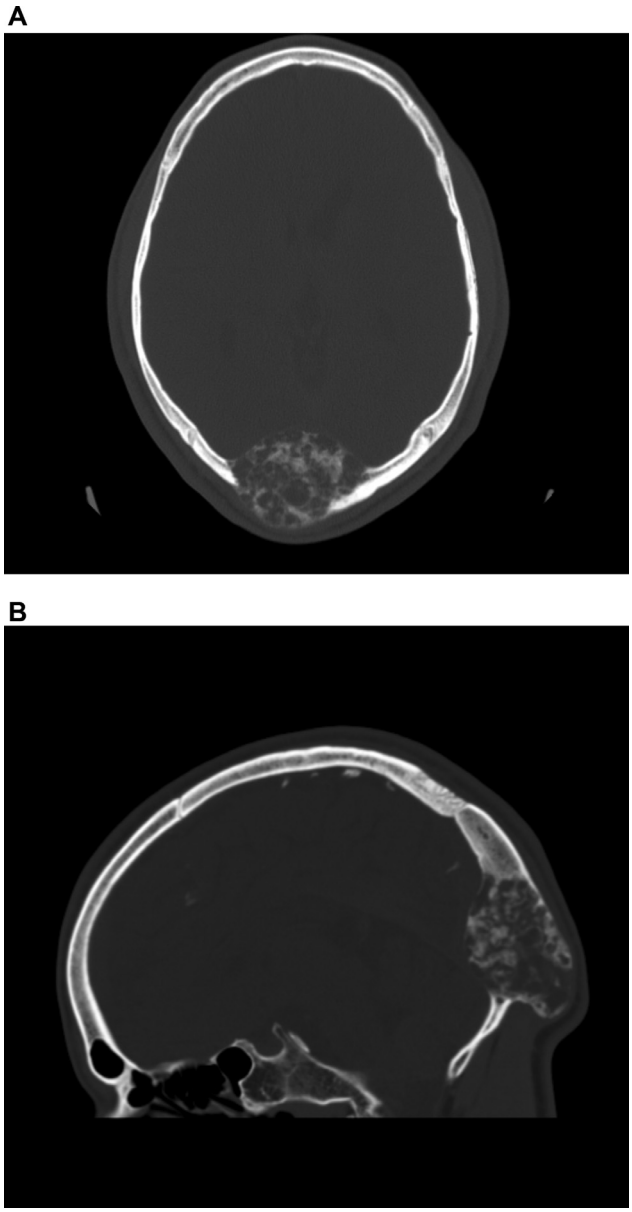

Fig. 1 – Axial and sagittal head CT in bone window shows an expansile, mixed lytic and sclerotic mass, in the midline occipital bone measuring up to 5.7 cm.

expansile, mixed lucent and sclerotic mass in the midline occipital bone with a suggestion of osteoid matrix calcifications (Fig. 1). In its largest extent, the craniocaudal dimension, the mass measured up to 5.7 cm.

Contrast-enhanced magnetic resonance imaging (MRI) showed a lobular, predominantly T2/fluid-attenuated inversion recovery (FLAIR) hyperintense, heterogeneously enhancing mass (Fig. 2). The lesion did not lose signal on out-of-phase images, suggesting no significant intracellular fat. There was mass effect on the adjacent torcular herophili, which was pushed anteriorly (Fig. 2, arrows); however, no invasive component or adjacent edema was present.

Furthermore, a 3D time-of-flight magnetic resonance angiography (MRA) was obtained, which revealed prominent occipital vessels with multiple arteries posterior to the mass, of which at least 1 entered the mass. Additional, prominent arteries along the anterior surface of the mass intracranially were also noted (Fig. 2, circle).

The patient underwent surgical resection with complete removal of the occipital mass (Fig. 3). Repair of the skull was accomplished with a titanium mesh cranioplasty. Histopathological microscopic examination detailed osteoid and woven bone, rimmed by osteoblasts, consistent with osteoblastoma (Fig. 4). Postoperative MRI demonstrated complete resection without residual tumor enhancement (Fig. 5). There was no evidence of recurrence during a 5-month follow-up, and the patient was doing well.

Discussion

Jaffe and Mayer first described in 1932 “an osteoblastic osteoid tissue-forming tumor” before it was further characterized separately by Jaffe and Lichtenstein 1956, which coined the final terminology benign osteoblastoma [2]. Approximately 3.5% of all benign primary bone tumors and 1% of all bone neoplasms represent osteoblastomas [3]. Osteoblastomas show mostly intramedullary growth and 60% to 70% of the cases arise in the vertebral column and long tubular bones, with the posterior elements in the spine being involved most frequently [1,4]. The calvarium is affected much less common (2%-4%), and involvement of the occipital bone is exceptionally rare [3]. Osteoblastomas occur more in males with a male to female ratio of approximately 2:1 [5].

The presentation of an osteoblastoma can vary dependent upon the size and location of the mass, ranging from pain/tenderness to palpation through to gait disturbances related to compression of the cerebellum [3]. However, often they are asymptomatic and simply recognized due to their size. On imaging, osteoblastomas have a variable appearance making radiologic diagnosis challenging, especially in the rare location of the calvarium. Radiographic and CT findings overlap, with CT in bone window serving as the mainstay for defining geographic definition and osseous characteristics [4]. Typically, osteoblastomas present as mixed lytic and sclerotic lesions with expanded thinned cortices [3]. Although many osteoblastomas express these features, different stages of the mineralized matrix can lead to entirely lytic/sclerotic appearances [5].

Signal intensity on MRI ranges from low to intermediate signal intensity on T1 and high signal intensity on T2 sequences, to low signal intensity on both T1 and T2 sequences. Likewise, after gadolinium administration, enhancement patterns vary significantly with reports of no enhancement to strong enhancement [4,5]. Our case demonstrated intermediate signal intensity on T1-weighted images and high-signal intensity on T2-weighted/FLAIR images with strong, heterogeneous enhancement on postcontrast images. No diffusion restriction was present on diffusion weighted imaging. These features are nonspecific and are linked to other bone tumors as well, such as chondroid tumors [6]. The main advantage of MRI over CT is the ability to identify the intracranial extension of the tumor as well as to delineate the surrounding brain

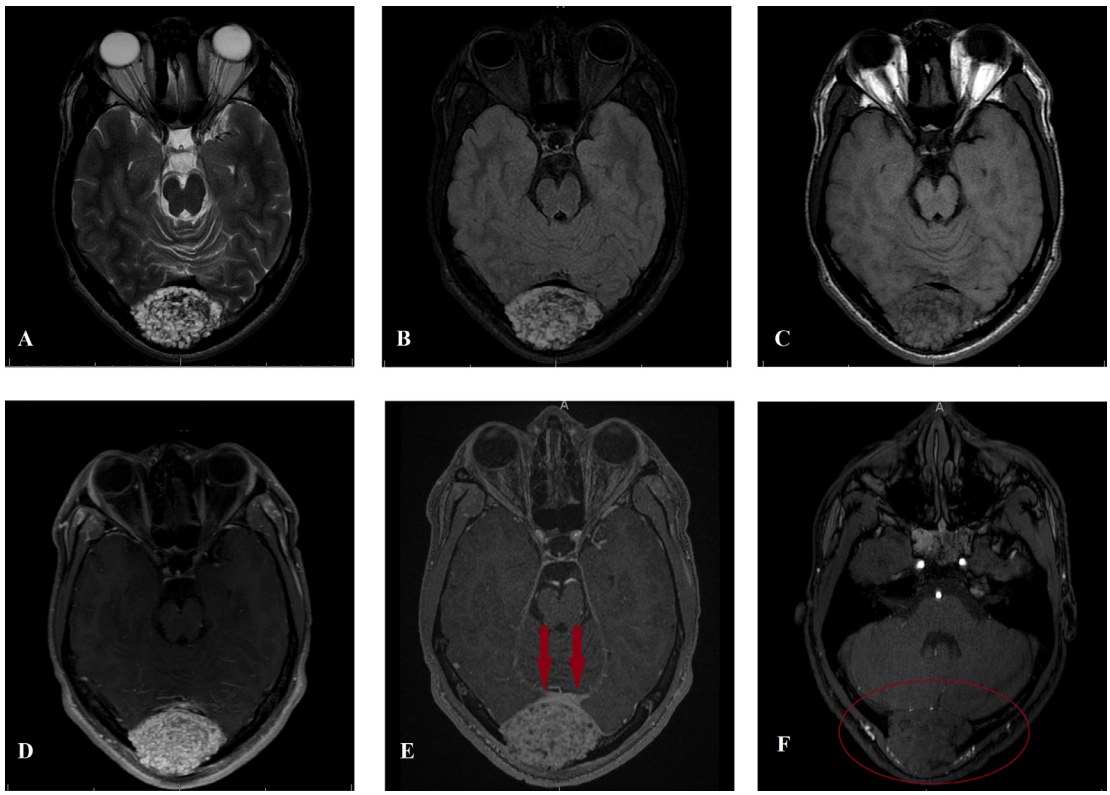

Fig. 2 – Preoperative work-up. (A) Axial T2-weighted and (B) FLAIR images show a lobular, predominantly hyperintense mass. Axial T1-weighted images (C) before and (D) after IV gadolinium administration show avid enhancement of the mass. (E) Postcontrast axial T1-weighted thin slice image shows mass effect on the adjacent torcular herophili, which is pushed anteriorly (arrows). However, no invasive component or adjacent edema is present. (F) 3D time-of-flight MRA image shows prominent occipital arteries with multiple vessels posterior to the mass. Additional prominent arteries along the anterior surface of the mass intracranially are also noted (circle).

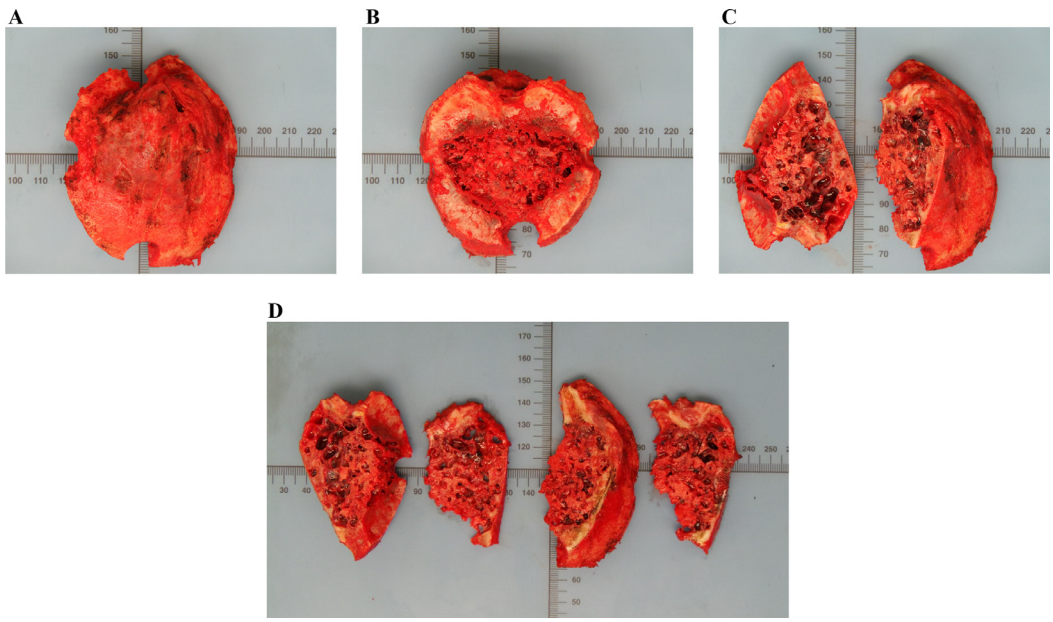

Fig. 3 – The gross specimen demonstrates a fragment of occipital bone with adhesed scattered thick tumor. The exterior surface of the specimen is shaggy. The interior surface of the specimen contains tan-brown to tan-pink speculated bony tumor in the center, measuring 5.7 x 5.2 x 4.3 cm.

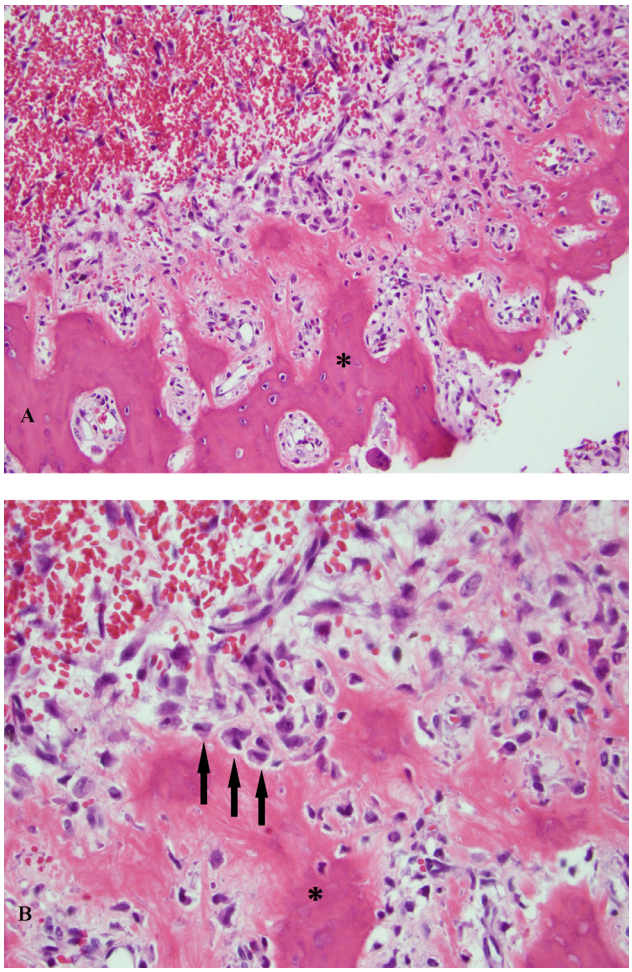

Fig. 4 – Microscopic evaluation of hematoxylin-eosin stained tissue of the tumor in original magnification (A) ×20 and (B) ×40 shows anastomosing trabeculae of osteoid and woven bone (asterisk). The woven bone is focally rimmed by osteoblasts (arrows).

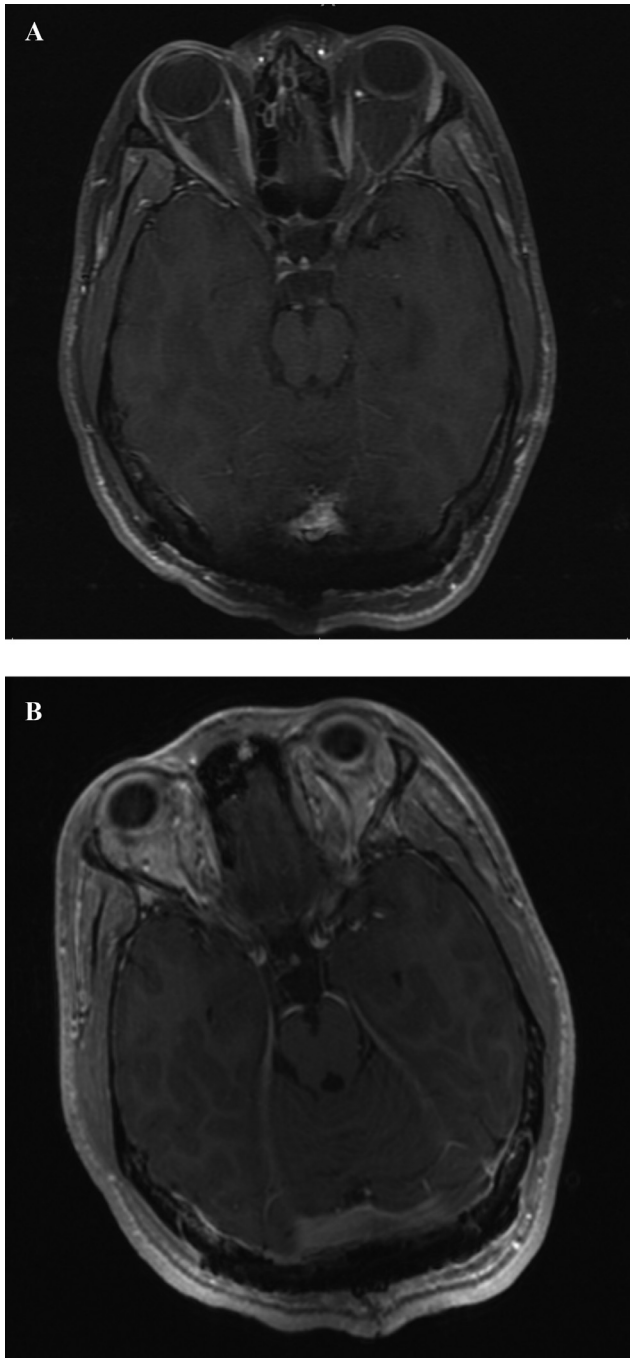

Fig. 5 – Postoperative MRI. Axial T1-weighted images after IV gadolinium administration (A) thick slice and (B) thin slice images show complete resection of the mass without residual enhancement at the surgical site.

parenchyma/soft tissues [4,5]. Additionally, since the majority of osteoblastomas are highly vascular, CT or MR angiography are essential studies to be obtained preoperatively [3]. Our case showed multiple prominent vessels around the lesion, of which at least 1 entered the mass, thus helping the surgeon to plan the surgical approach.

On histopathological examination, osteoblastomas have a classic appearance, but close histologic resemblance to other tumors, especially osteoid osteomas, can make distinction of these very challenging or simply impossible [5].

Besides the aforementioned chondroid tumors such as low-grade chondrosarcoma or chondroblastoma, osteoid osteoma is a main differential diagnosis. Clinically, osteoid osteomas produce pain, which exacerbates at night and is receptive to nonsteroidal anti-inflammatory drugs. Distinction is usually made by size: osteoid osteomas are rarely larger than 1.5 cm, while osteoblastomas continue to grow and are often larger than 1.5 cm [5,7]. In addition, osteoid osteomas are usually cortically based rather than in the medulla and express a central nidus. In addition, characterization of the type of matrix calcification is important. In this case, the central calcifications had a trabecular ossification pattern more typical of an osteoid tumor such as osteoblastoma or osteosarcoma. Chondroid calcifications are typically described as rings and arcs or a focal stippled pattern, which would be seen in lesions such as chondrosarcoma. Considering this, a crucial distinction to make is to differentiate osteoblastomas from osteosarcomas.

Osteosarcomas usually have a more aggressive pattern with significant permeative osseous destruction, pronounced periosteal reaction as well as greater involvement of the adjacent soft tissues. Further differential diagnosis to consider include meningioma, giant cell tumor, fibrous dysplasia, eosinophilic granuloma, and metastasis [3,5].

Despite the fact osteoblastomas are benign lesions, treatment of choice, whenever possible, is complete surgical excision. Osteoblastomas constitute a predisposition for pathological fractures, and continued growth of the tumor may lead to functional impairments. Moreover, cases with malignant transformation into osteosarcoma have been described even though a transformation of a calvarial osteoblastoma into osteosarcoma is so rare that the initial diagnosis should be questioned whenever such a case is detected [8,9]. It is highly recommended for hypervascular osteoblastomas to undergo preoperative embolization since there are various case reports where surgery was impaired due to excessive bleeding [3]. Radiation- or chemotherapy plays currently no role in treatment except possibly in selected patients with recurrent or surgically unresectable osteoblastomas [10]. Local recurrence after incomplete resection is not uncommon, with a recurrence rate reported in different studies between 14% and 23%, which underlines the importance of complete resection [2,8,11].

Conclusions

Occipital bone osteoblastomas are exceedingly rare, which can mimic a variety of other benign as well as malignant lesions. While radiologic interpretation is often difficult and a definitive diagnosis based on imaging alone is not possible, differentiating benign from malignant calvarial tumors is crucial and a thorough preoperative work-up using advanced cross-sectional imaging techniques, such as CT and MRI/MRA, helps the surgeon to plan the operative approach and decreases the risk of complications. Whenever possible, the preferred treatment is complete surgical resection. Postoperative follow-up imaging should be obtained to ensure complete resection without residual tumor.

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