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Sino-orbital osteochondroma with malignant transformation to osteosarcoma

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A B S T R A C T

Purpose: Osteosarcoma is an aggressive malignant osteogenic tumor that commonly arises in long bones of pediatric populations. Primary osteosarcomas of the head and neck are rare, comprising less than 0.5% of malignancies in this region, usually affecting the mandible or maxilla. Here we present an extraordinary case of a rare benign osteochondroma of the ethmoid sinus and bilateral orbits evolving to an intermediate grade osteosarcoma.

Observations: An 80-year-old woman with a history of right orbital tumor resection 20 years ago presented to our clinic with right eye proptosis and palpable bony prominence of the right orbit and nasal bridge. Partial resection demonstrated sino-orbital osteochondroma. Relapse a year later prompted repeat partial resection with unchanged histology. The patient was followed clinically until an abrupt relapse four years after initial presentation. Imaging demonstrated a large bony mass involving the right orbit, ethmoid and frontal sinuses, and anterior cranial fossa. Repeat debulking confirmed transformation to intermediate grade osteosarcoma.

Conclusions: Osteochondroma is an extremely rare tumor in the orbit with only three cases previously reported. This patient is the first known case of benign osteochondroma of the orbit undergoing malignant transformation to osteosarcoma. Rapid progression of orbital osteochondroma should raise the suspicion of malignant transformation to osteosarcoma and prompt biopsy. Our patient subsequently underwent palliative radiation treatment and is stable with no gross progression.

Osteosarcoma is an aggressive malignant osteogenic tumor that commonly arises in long bones of pediatric populations. It has a bimodal age distribution of incidence with another peak of cases occurring in adults over the age of 65. Primary osteosarcomas of the head and neck are rare, comprising less than 0.5% of malignancies in this region,[1] usually affecting the mandible or maxilla. Orbital osteosarcoma has been reported, especially in association with Paget's disease[2] and orbital radiation therapy.[3] Here we present an extraordinary case of a rare benign osteochondroma of the ethmoid sinus and bilateral orbits evolving to an intermediate grade osteosarcoma. Three other cases of orbital osteochondroma have been documented[4–6] and this is the first reported case of malignant transformation to osteosarcoma occurring within the orbits. Consent was obtained to publish identifying patient information and pictures. This study was conducted in accordance with The Declaration of Helsinki and Health Insurance Portability and Accountability Act of 1996.

1. Case report

An 80-year-old female with remote history of central facial fracture after traumatic nasal injury as a child presented to the oculofacial plastic surgery clinic in May 2014 with progressive right eye bulging and epiphora. By history, a right orbital/nasal bridge/sinus bony tumor was partially resected in 1999 and again in 2010 due to obstruction of the tear duct system. Histopathology was not available to review from the initial procedure, but serial sectioning of the 1.7 × 1.2 × 0.8 cm rubbery red-pink-tan lesion in 2010 demonstrated, by report, dense hyalinized and myxoid fibrous tissue associated with cartilage and bone, consistent with fibroma of the cortex of the orbital bone, and was not suspicious of malignancy.

Examination on presentation in 2014 showed 3 mm right axial globe proptosis, 2 mm right hypoglobus, complete right nasolacrimal duct obstruction, and a palpable bony prominence extending from right medial orbit over the nasal root to the left anterior medial orbit (Fig. 1). Visual acuity was 20/25 bilaterally with right lagophthalmos,

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hypertropia and exotropia; intraocular pressure was 21 mm Hg on the right and 22 mm Hg on the left. Computed tomography (CT) imaging confirmed a 20 × 36 mm lobular ossified mass extending from the right ethmoid sinus and medial orbital wall to the left nasal bone (Fig. 2a). Uncomplicated partial resection in October 2014 restored the natural bony configuration of the right medial orbit and nasal bridge and corrected proptosis and diplopia. Histology showed cartilage with endochondral ossification with mature trabeculae of bone and osteoid without mitotic activity. This was consistent with a diagnosis of benign sino-orbital osteochondroma.

In June 2015, the patient returned with tumor progression causing diplopia and difficulty wearing spectacles. After thoroughly considering wide resection, the patient elected repeat debulking due to significant medical comorbidities. Histology again demonstrated benign osteochondroma. She was followed biannually and remained asymptomatic without clinical progression until she returned in May 2018 with diplopia. Vision was 20/40 bilaterally at this time, and she remained orthophoric with full motility. Repeat imaging demonstrated a 42 × 39 × 25 mm bony lesion involving the right orbit, ethmoid sinus, frontal sinus, and floor of the anterior cranial fossa (Fig. 2b). In contrast to previous debulking procedures, the current lesion contained multiple gross gelatinous spaces intermixed within chondromatous blocks intraoperatively.

Histopathology demonstrated a neoplastic lesion with a mature-appearing cartilaginous component and an osteoid component (Fig. 3a), as well as irregular deposits of immature lace-like osteoid with surrounding multi-nucleated osteoclasts and atypical mononuclear osteoblast-like cells (Fig. 3b). Higher magnification highlighted atypical nuclear features of the mononuclear cells including nuclear contour and chromatin irregularities and distinct eosinophilic nucleoli (Fig. 3c). These findings were consistent with an intermediate grade osteosarcoma.

At 86 years old, the patient again declined wide resection and ultimately elected to pursue palliative radiation treatment with 60 Gy intensity-modulated radiation therapy (IMRT) in 30 fractions over six weeks. She did not elect to complete a metastatic workup. She is eighteen months status post radiotherapy with stable diplopia (corrected with prism spectacles) and no gross tumor progression. She developed exudative age-related macular degeneration and maintains vision at 20/80 in the right eye and 20/25 in the left eye with regular intravitreal anti-VEGF treatments. Follow-up MRI of the orbits and brain in Jan 2021 demonstrated no significant change of the mass and no evidence of frank dural invasion or other intracranial progression.

2. Discussion

To our knowledge, this is the first reported case of malignant transformation of orbital osteochondroma to osteosarcoma. The potential for malignant transformation in the orbit poses unique challenges to the patient and oculofacial surgeon. Rapid and debilitating diplopia and proptosis with impending vision loss and intracranial extension require fast action. A care team including oculofacial surgery, oncology, radiation oncology, otolaryngology, and neurosurgery must work together with the patient to establish goals and expectations. Malignant disease in this location could require interventions ranging from globe-sparing tumor debulking to wide resection with complex skull-base and sino-orbital reconstruction with chemotherapy and radiotherapy.

Osteochondroma constitutes 10% of all bone tumors, and most frequently occurs in the appendicular skeleton.[7] Osteochondroma of the orbit is an extremely rare benign tumor; only three previous cases were identified in the literature.[4–6] The differential diagnosis for orbital osteochondroma includes osteoma, chondrosarcoma, and most concerning, osteosarcoma. Radiologically, these tumors are difficult to distinguish and the diagnosis must be made histologically. Osteosarcomas may have thicker cartilaginous caps on CT, whereas osteochondromas may have T2 hyperintense cartilaginous caps on MRI.[8] Suspected osteochondroma should only be excised if symptomatic, or if changes to the thickness of the cartilaginous cap or overall tumor size are noted. During excision, care should be taken to prevent leakage of myxomatous tissue, as it can provide nidus for recurrence or progression.[8]

Although osteochondroma can undergo malignant transformation to chondrosarcoma in 1–2% of cases,[8] transformation to osteosarcoma is extremely rare with very few cases reported in the literature.[8,9] This distinction is important, especially for orbital disease, because osteosarcomas generally respond more favorably to chemotherapy than chondrosarcomas.[1,10] This may open up options for globe-sparing treatment in select cases. MRI may be useful for detecting malignant transformation in osteochondroma, with a cartilaginous cap exceeding 2 cm in adults raising suspicion for malignant transformation; gadolinium-based contrast can detect neovascularization which is suggestive of osteosarcoma.[8]

Osteosarcoma can have a rapid clinical progression, with one series of craniofacial osteosarcomas having a 5-year survival of 10%.[11] Craniofacial osteosarcoma has been noted to carry a comparatively high local recurrence risk to other osteosarcomas.[12] Treatment typically involves neoadjuvant as well as adjuvant chemotherapy along with radical

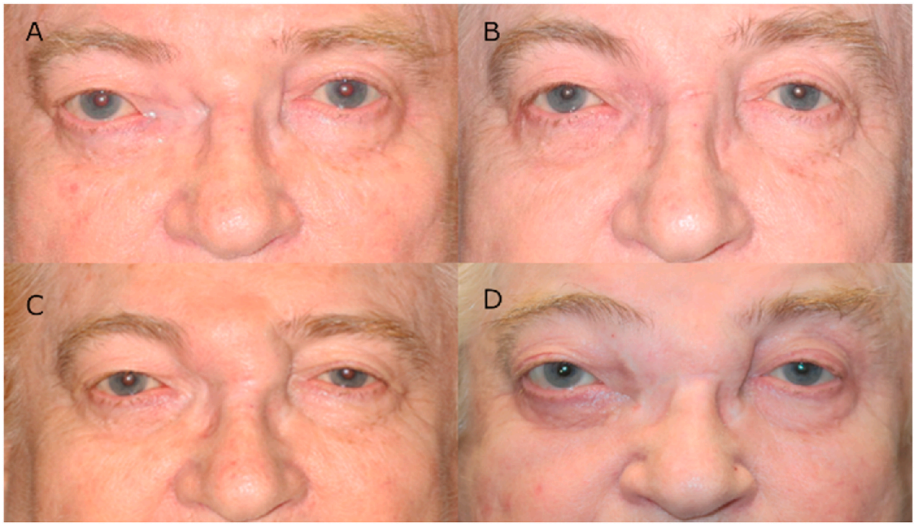

Fig. 1. Clinical images of bony tumor of medial canthus. A: Initial presentation, 2014. B: 1-month status post partial resection, 2014. C: Relapse, 2015, D: Relapse with malignant transformation 2019.

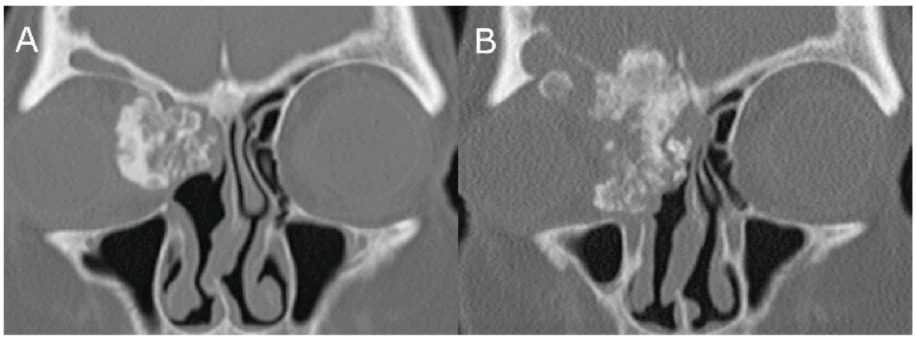

Fig. 2. Non-contrast coronal computed tomography imaging of lesion. A: Well-circumscribed bony mass occupying right ethmoid sinus and medial orbit, 2014. B: Expanded bony mass extending through frontal sinus and into anterior cranial fossa, 2018.

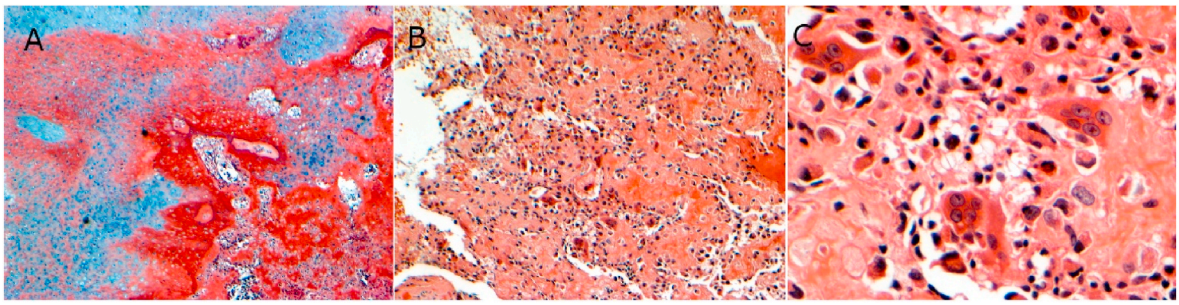

Fig. 3. Excision biopsy of bony tumor, 2018, H&E stain. A: Osseocartilaginous proliferation (40x). B: Irregular deposits of lace-like osteoid (100x). C: Nuclear atypia of mononuclear cells (400x).

resection of the tumor. The chemotherapy regimen has changed little over 30 years and utilizes high dose methotrexate, doxorubicin, cisplatin, and ifosfamide.[12] When total resection of the tumor is not possible or further surgery and/or chemotherapy are declined, radiotherapy may palliate symptoms, as in this case.[13,14] It has been suggested that local radiation with 70 Gy or higher can achieve a local control rate of 72% after 5 years.[12] Chest CT should be considered while evaluating for metastasis in those willing to undergo systemic therapy, as osteosarcoma has a propensity to metastasize to the lungs.[12]

Our patient highlights the importance of maintaining a wide differential when presented with a progressive primary bony lesion of the orbit. This case also demonstrates the importance of maintaining a close working relationship with oncology, radiation oncology, otolaryngology, and neurosurgery to recruit quickly for patient-centered decision-making and planning. Close long-term follow-up of orbital osteochondroma is necessary, we recommend every 6 months or sooner as needed for any changes noted by the patient. Rapid progression of orbital osteochondroma should raise the suspicion of malignant transformation to osteosarcoma and prompt biopsy. Patient-centered management options of osteosarcoma include resection, chemotherapy, and potentially palliative radiotherapy.

Patient consent

Consent to publish this case report has been obtained from the patient in writing.

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Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Declaration of competing interest

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