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Giant cell tumor of the sphenoid bone

Abstract

Background: Giant cell tumor is a benign but locally aggressive bone neoplasm which uncommonly involves the skull. Giant cell tumor (GCT) of the sphenoid bone is relatively rare. In this report, we describe a tumor of the greater wing of left sphenoid bone.

Case presentation: A 31-year-old female was presented with headache, proptosis and diplopia of her left eye. Cranial magnetic resonance imaging and CT scan showed an enhancing tumor at the junction of the orbital apex, ethmoidal and sphenoid sinuses. The tumor was removed and pathological examination confirmed a giant cell tumor.

Conclusion: This is the second report to describe the appearance of a GCT of the part of sphenoid bone which caused proptosis of the unilateral orbit. Radical excision of tumor was achieved which may be curative.

Key words: Giant cell tumor, Bone, Sphenoid.

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Giant cell tumor (GCT) of bone is an uncommon primary bone neoplasm that usually occurs in the long bones. It is rarely encountered in the skull where it is preferentially seen to involve the sphenoid and the temporal bones. Primary sphenoid GCT is a relatively rare entity within the spectrum of giant cell tumor of others, composing less than 1% of all cases of GCT. GCT of the sphenoid bone typically presents with symptoms related to palsies of the adjacent cranial nerves, particularly diplopia or sensory symptoms attributable to the facial nerve such as pain or numbness (1,2). It is a benign neoplasm but can be locally aggressive. The usual age range is 20-40 years. Benign tumors predominate in female patients in a proportion of 3:2. The malignant tumors show a predilection for the male patient in a ratio of 3:1. A tendency towards local recurrence and late malignant change with metastases especially to the lung has been reported (3,4). Imaging findings consistent with erosion of the sphenoid bone may be seen, along with contrast enhancement (2). Radical surgical removal is the preferred modality of treatment. We present a GCT of the sphenoid bone in a 31 year old female which was treated with radical surgery with a good outcome.

Case presentation

A 31 year old female was admitted due to proptosis and diplopia of the left eye, headache which was gradually progressive for the last one year. Her general physical examination was normal. Neurological examination revealed eighth cranial nerve dysfunction. A diffuse swelling was seen in the left eye. CT scan of the brain showed a large well defined hyperdense contrast enhancing lesion which was a large soft-tissue osteolytic mass in the left anterior skull base. This tumor involved the greater wing of the left sphenoid bone as well as extension into the sphenoid sinus to the left of midline (fig 1,2).

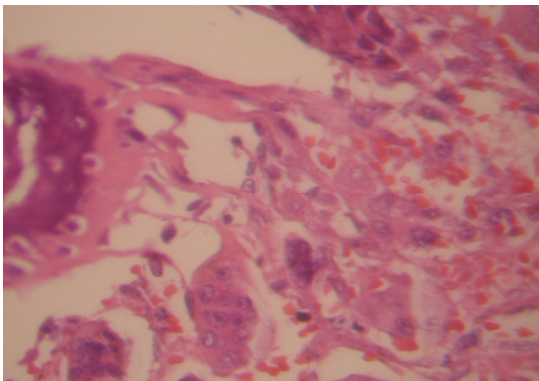


Fig 1; A neoplasm composed of numerous osteoclast like giant cells amidst a background of mononuclear plump spindle cells

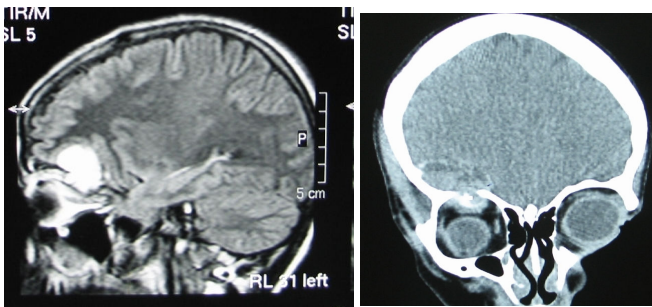


Fig 2,3; A CTscan of brain shows the infiltration of tumor in left cavernous sinus

Preoperative axial CT scan which shows a large hyperdense tumor arising from the left of sphenoid bone with intracranial extension.

Fig 3. These findings were confirmed on the subsequent brain MRI imaging.

The patient was taken up for surgery with an intention of radical removal. Through the infratemporal fossa, the tumor was resected. The tumor was firm, reddish brown and vascular. It had destroyed the ramus of left sphenoid bone. Biopsy was taken from main tumor and surrounding bone.

Histopathological examination revealed a neoplasm composed of numerous osteoclast like giant cells amidst a background of mononuclear plump spindle cells suggestive of a GCT. The histopathological examination of the other areas of bone did not reveal any tumor infiltration. Postoperative CT scan confirmed a total excision of the tumor. Since a radical excision of the tumor had been achieved it was decided to defer radiotherapy. The sphenoid tumor was subsequently resected. It was feasible to remove

the lesion in its entirety. Local radiation therapy was performed. The patient subsequently began a regimen of chemotherapy (doxorubicin and Ifosfamide) within 3 months following the sphenoid surgery.

Discussion

Neoplasia of the skull bones are uncommon accounting for only 2.4% – 2.6% of all primary bone tumors (3). The majority of giant cell tumors occur in the long bones usually the distal femur, proximal tibia and fibula, distal radius and ulna (5). The skull is a rare location for GCT. In the cranium, the sphenoid bone is the commonest site followed by the temporal bone (3,5,6). This can be explained by the fact that the tumor genesis occurs in the endochondral bone instead of intramembranous bone (5,7,8).

GCT is commonly seen in the 30–50 years age group with only 16% of patients below 20 years of age (9,10). A mild female preponderance is seen, but this is more pronounced in the younger age group (10). Typically, the tumor presents an enlarging mass associated with local pain over a period of few weeks to years (10). GCT of the sphenoid may present with headache, visual field defects, blindness, diplopia, second through eighth cranial nerve dysfunction, endocrinopathy and change of mental status (11). Plain radiography shows radiolucent lesion of the skull and cannot be generally differentiated from other radiolucent lesions. On CT, it is seen as a lytic lesion expanding the bony cortex (12). Generally these tumors are contrast enhancing due to their vascular nature as seen in our patient.

These tumors generally tend to expand and attenuate the bony cortex rather than erode it (12).

Grossly, these tumors are grey to yellow-brown, soft or firm and friable. Small cystic areas and grey-white necrotic foci may be seen. Microscopically, GCT consists of plump spindle shaped or ovoid cells with admixed multinucleated, cytologically benign giant cells. Various numbers of benign multinucleated cells are seen amidst sheets of benign mononuclear spindle shaped cells with similar nuclear features. The nuclei are generally hypochromatic with inconspicuous nucleoli and mitotic figures are uncommon (11). Histological differentiation of GCT may be challenging. The differential diagnoses consist of central giant cell granuloma (CGCG), aneurysmal bone cyst, chondroblastoma, hyperparathyroidism and fibrous dysplasia (6). CGCG is a reactive bone lesion that occurs mainly in the

jaws (13). CGCG and GCT are histologically very similar and the main significant difference is the greater number of nuclei in the giant cells of the GCT (14,15). CGCGs are distinguished from true GCTs by their fibrogenic, relatively acellular stroma, extensive osseous metaplasia and the clustering of giant cells around areas of hemorrhage or necrosis (7).

A key point in the differential diagnosis is that in GCT the stromal cells and giant cells resemble each other particularly with regard to their nuclei, whereas in giant cell reparative granuloma, the osteoclasts and the stromal cells of the fibroblastic type are distinctly different (16). Jaffe has subclassified GCT into three grades but such a grading has not been found to correlate with subsequent tumor behaviour or sarcomatous transformation (3,7).

The precise ontogeny of GCT is unresolved. GCT and CGCG are histologically and pathogenetically similar (17). Cell cycle associated proteins like MDM2, Ki-67 and PCNA have been seen to be widely expressed in CGCG and GCT. The percentage of Ki-67 and PCNA positive cells are higher in CGCG (11). This means that CGCGs show a higher proliferative activity than GCTs. GCT cells are also seen to produce both MMP-9 and tumor necrosis factor-alpha (TNF-alpha) (18).

Studies suggest that TNF-alpha secreted by the multinucleated giant cells up-regulates MMP-9 expression in GCT stromal cells by the induction of certain transcription factors, which in turn enhanced the rate of transcription of MMP-9 gene. An essential cell-cell interaction in the regulation of MMP-9 expression exists in GCT (18). Although it is the giant cell which is the most prominent feature of these lesions, it is the mononuclear spindle cell which is the proliferating cell. Several pathways to induce osteoclast like giant cell formation from monocytes have been reported. The spindle cell recruits monocytes and induces them to differentiate into osteoclastic giant cells through release of cytokines (17,19).

Receptor activator of nuclear factor kappa B (RANK) ligand is also reported to play a crucial role in osteoclastic cell genesis (19-21). It is possible that the soluble RANKL is released from the tumor derived cells and the soluble factor interacts with RANK expressed in monocytes resulting in osteoclast-like cell formation in cooperation with macrophage colony stimulating factor secreted from the cells (19). The treatment of choice is complete surgical excision which if achieved can be curative (3,7,10).

The role of adjuvant radiotherapy in eliminating residual tumor tissue is controversial. Some authors claim that GCT is not radiosensitive and radiation may provoke a sarcomatous transformation in the residual tumor tissue (5,7). However, other authors recommend a single course of moderate dose super voltage radiation in achieving a high success rate and at the same time lowering the likelihood of malignant transformation (6,9,11). Radiotherapy remains the only option for unresectable tumors. In our patient, radiotherapy was deferred for the present as radical surgical excision was achieved with no residual tumor.

Osteoclasts express calcitonin receptors and can be inhibited by calcitonin. In GCT and CGCG, tumor giant cells and their precursors also express calcitonin receptors. Clinical studies on treatment of CGCG with calcitonin have shown positive results probably due to control of osteoclastogenesis (17).

GCT can recur especially where only a curettage is employed (8,9). Prosser et al. recommend primary curettage for intraosseous giant-cell tumors without adjuvant treatment or filling agents, but tumors with soft tissue extension or with local recurrence require more aggressive treatment (22). Metastases occur only in 2% cases and usually spread to the lungs but rare areas like lymph nodes, mediastinum, skin, scalp and pelvis have been reported [4,10]. Our patient is on regular clinical follow up every 3 months and with a 6-month CT scan. She is recurrence free at the end of 12 months.

In conclusion, giant cell tumor involving the greater wing of the sphenoid bone is rare. A radical excision if possible is the optimal treatment. Adjuvant radiotherapy is controversial and should be reserved for residual tumor and unresectable tumors. Never modalities like calcitonin is being investigated.

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