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A Rare Case of Giant Dumbbell-Shaped Frontoethmoidal Osteoma with Medial Orbital Wall Involvement: Surgical Excision and Reconstruction

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ABSTRACT

Introduction: Frontoethmoidal osteomas are rare benign tumors that may cause functional and cosmetic morbidity when large. Surgical excision is indicated for symptomatic or giant osteomas, particularly those involving the orbit or frontal recess. We present a rare case of a giant dumbbell-shaped frontoethmoidal osteoma with medial orbital wall involvement, managed with external excision and autologous rib graft reconstruction.

Case Report: A 17-year-old female presented with progressive forehead swelling and frontal headache for 4 months. Clinical examination revealed a firm supraorbital swelling, and CT imaging showed a homogenous, ossified, dumbbell-shaped lesion involving the left frontal and ethmoid sinuses, with thinning of the medial orbital wall and indentation of the medial rectus. The patient underwent complete excision through a Lynch-Howarth approach. Due to orbital wall loss, medial wall reconstruction was performed using a novel "papyrus graft" fashioned from autologous rib, shaped into thin plates and sutured to periosteum. Postoperative recovery was uneventful with no ocular morbidity, and graft survival was confirmed on CT at 3 weeks.

Conclusion: Giant frontoethmoidal osteomas are rare and may demand complex reconstruction after excision. External approach combined with autologous rib grafting provides effective tumor clearance and durable orbital wall reconstruction with excellent functional and cosmetic outcomes.

Keywords: Frontoethmoidal osteoma, paranasal sinus tumor, orbital wall reconstruction, rib graft, Lynch-Howarth incision, papyrus graft.

INTRODUCTION

The fibro-osseous lesions of the paranasal sinuses are benign bony abnormalities and are classified into three types- Fibrous dysplasia, Ossifying Fibroma, Osteoma (in the order of increasing bone content) [(1)]. Osteomas are osteogenic tumors composed of organised mature bone and are the most

common benign tumors of the paranasal sinuses, frequently arising in the frontal sinus. While often asymptomatic, large osteomas may cause mass effect, necessitating surgical removal. Complex frontoethmoidal osteomas near the orbit and skull base pose significant reconstructive challenges post-excision [(2)(3)].

CASE PRESENTATION

A 17-year-old female presented with a 4-month history of insidious onset frontal headache and a gradually enlarging swelling over the left supraorbital region. There were no associated symptoms of nasal obstruction, epistaxis, anosmia, or visual disturbances.

Examination Findings:

A 3x1 cm hard, non-tender swelling could be palpated superomedial to the left medial canthus with no signs of inflammation. The patient had bilateral inferior turbinate hypertrophy. There were no associated cranial nerve deficits or ocular findings. (Figure 1)

Figure 1: 17-year-old female with a 4-month history of insidious onset frontal headache and a gradually enlarging swelling over the left supraorbital region

Imaging:

CT PNS revealed a homogenous, densely ossified, well circumscribed lesion involving the left frontal and ethmoid sinuses, with indentation of the medial rectus muscle, compression of the lacrimal sac and nasolacrimal duct. There was associated thinning of the medial orbital wall.

No intracranial extension of the tumor was identified. All the findings were suggestive of a frontal-ethmoidal sinus osteoma (Figure 2).

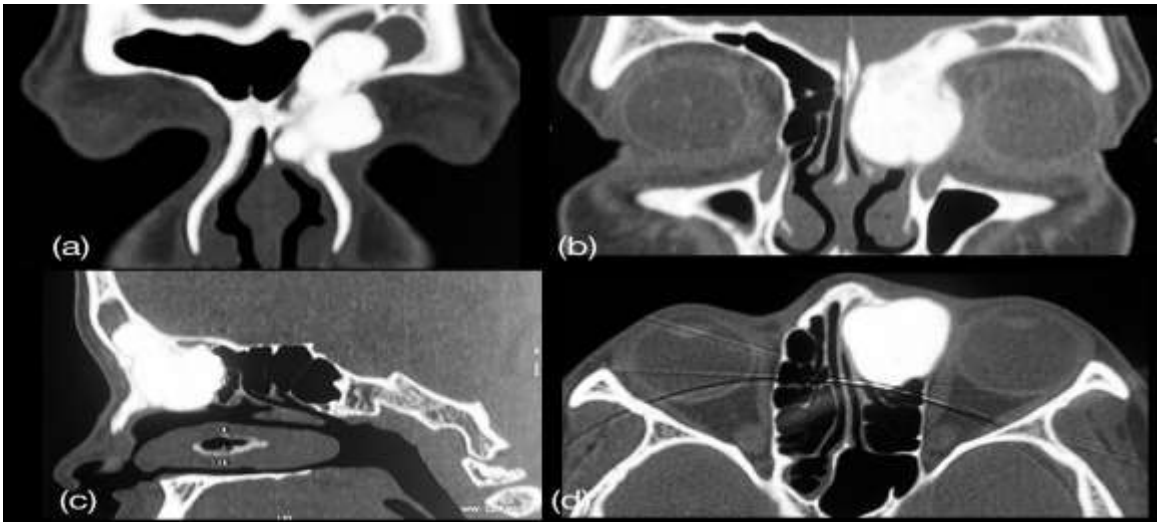

Figure 2: CT PNS revealed a homogenous, densely ossified, well circumscribed lesion involving the left frontal and ethmoid sinuses seen in the coronal section (a) (b), Sagittal section(c) and axial section (d), Compression of the lacrimal sac and nasolacrimal duct and thinning of the medial orbital wall identified in the coronal section(b);Indentation of the medial rectus muscle seen in the axial section (d).

Surgical Management:

The patient was planned for left frontoethmoidal osteoma excision via external Lynch-Howarth approach with medial orbital wall reconstruction using autologous rib graft. A dumbbell-shaped osteoma extending from the superomedial part of the orbit to frontal sinus was delineated. After delineation, significant medial orbital wall thinning with loss of clear separation from the osteoma was present. Complete excision of external and internal components of the osteoma using powered drill was done to first free the osteoma from its attachments and then finally the ostema was rocked and delivered in 2 pieces (Figure 3).

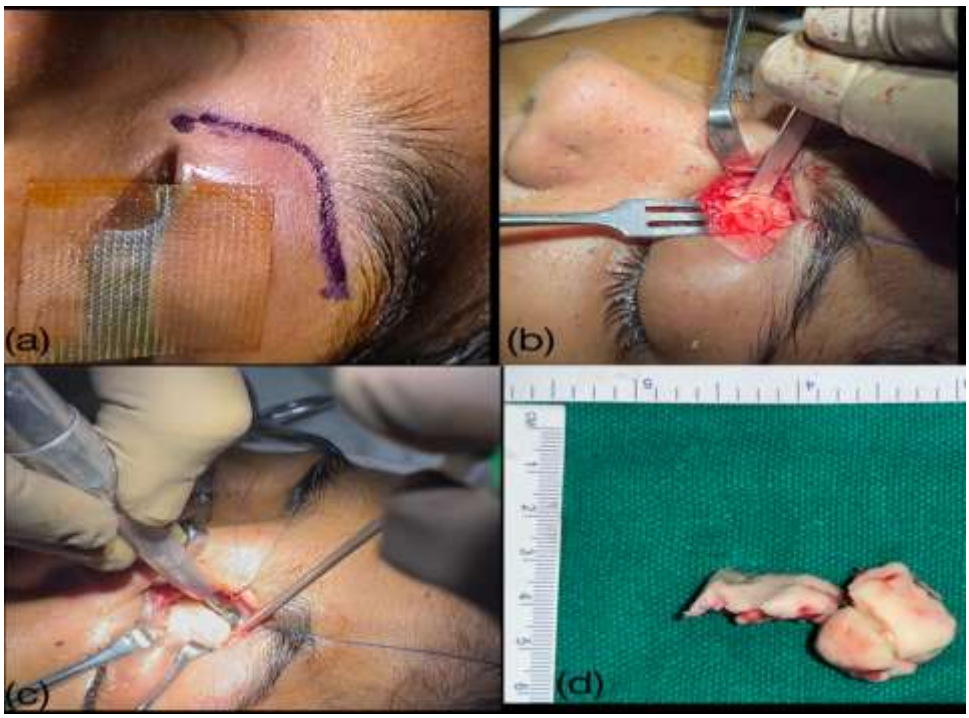

Figure 3: Intraoperative steps: Lynch-Howarth incision taken (a); Osteoma identified and delineated using powered micro-drill (b) & (c); final histopathological specimen (d).

After removal of the tumor, the medial orbital wall needed reconstruction. Autologous rib was harvested and shaped into two thin plate using powered drill and multiple holes created to allow better uptake and tissue ingrowth. Reconstruction of the medial orbital wall was done using the the two thin plates of rib graft sutured to periosteum referred to as the "Papyrus Graft" (Figure 4). The survival of the graft was confirmed by a CT scan at 3 weeks postoperatively.

Figure 4: Reconstruction of the defect after removal of the specimen viz.absence of medial orbital wall (a). Shaping of the costal rib cartilage into the papyrus graft (b). The thin papyrus graft secured to the periosteum(c). Survival of the papyrus graft uptake confirmed by a CT scan after 3 weeks post operatively (d).

Postoperative Course:

The patient was given an eye dressing for a period of 5 days. There were no immediate ophthalmic complications. The patient was kept on intravenous amoxicillin-clavulanic acid and Metronidazole antibiotics for a period of 5 days postoperatively.

Eye sutures were removed on postoperative day 7. Chest sutures were removed on postoperative day 14.

Written informed consent was obtained from the patient for publication of this case report and the accompanying images.

DISCUSSION

With a prevalence of approximately 3% worldwide, osteomas are the most common benign tumor of the paranasal sinuses. The osteomas are most often found in the ethmoid sinuses followed closely by the presence in frontal sinuses. Ethmoid osteomas generally present early in terms of size of the tumor as compared to the frontal osteomas due to the presence of larger space in the frontal sinus as compared to the ethmoid. In our case, the lesion was identified occupying the left ethmoid and frontal sinus [(1)(4)].

There are varied theories regarding the etiology of this entity. According to the Developmental theory, there can be re-activation of embryonic stem cells after puberty that can lead to uncontrolled bone formation. Inflammatory processes due to any preceding trauma or infection can then act as an inciting factor [(4)].

In the gross aspect, these are well circumscribed, yellowish-white, hard, oval to round lesions. Histologically, they can be classified as - Ivory/ Compact, Mature/ Cancellous, Mixed.

Clinically, these patients are often asymptomatic with osteoma being identified as an incidental finding on the radiology. However, due to progressive growth, osteomas can produce a dull pressure like symptom or headache. Depending upon their location, the patients may even present with a visible growth on the face [(5)]. Our patient had visible growth below the medial aspect of the left eyebrow along with frontal headache.

Since these are benign lesions, a conservative approach can be adopted for asymptomatic cases.

Surgical intervention is needed in symptomatic patients when the osteoma is causing obstruction and leading to chronic rhinosinusitis, mucocele, facial deformity, orbital or neurological complications. Radiological evidence of a tumor occupying more than 50% of frontal sinus, progression of tumor on serial CT scans, tumor obstructing the frontal recess or tumors extending out with the paranasal sinuses are all situations that warrant surgical exploration [(6)(7)]. In our case, not just the symptoms but the radiological characters of the tumor- extension into the frontal recess and frontal sinus, growth into the medial part of the orbit- were considered before planning a surgical intervention.

The frontal osteomas are graded based upon their site and relation to the lamina papyracea and frontal recess [(8)]. Our patient's osteoma lesion extended lateral to the virtual sagittal plane through the lamina papyracea as well as the base of attachment was superior within the frontal sinus thus, making it classically a Grade III tumor. Therefore, an external approach was taken up for better access and control.

Paranasal sinus osteomas can vary in size from 2 to 30 mm. A diameter of more than 30 mm or weight more than 110 g is characterized as a "large" or "giant" osteoma which is a rare entity [(9)]. The specimen of our case measured 40mm×25mm×20mm thus being classified as a Giant Osteoma. In the literature review done by Cheng et al., 41 articles were identified with a total of 45 patients with giant osteomas [(7)].

CONCLUSION

Timely diagnosis and external surgical management of large frontoethmoidal osteomas are crucial to prevent ocular or neurological complications. Reconstruction using autologous rib graft is a feasible and

effective technique for restoring orbital wall integrity.

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