# Fronto-ethmoidal osteoma.
## Open treatment

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INTRODUCTION: *Osteoma is a benign tumour, composed of mature compact or cancellous bone, which can arise in any facial bone. Among the paranasal sinuses, the frontal and ethmoid sinuses are most frequently involved. Osteoma grows very slowly and small lesions are often not symptomatic. On the other hand, sometimes patients present with symptoms such as sinusitis, headache or ophtalmologic manifestations. These findings are secondary to obstruction of the involved sinus cavity with secondary mucocele formation or occasionally an expansile lesion with distortion of the facial contour.*
MATERIALS AND METHODS: *From 2005 to 2010, twenty-one (21) patients affected with non-syndromic fronto-ethmoidalosteomas were evaluated in our Department. Collected data include patients' age at the time of disorders, gender, presenting signs and symptoms, primary diagnosis, type and characteristics of the treatment performed, radiological findings and post-treatment results.*
*All patients were investigated by CT scans in axial and coronal planes. The treatment and outcomes of this group were reviewed.*
RESULTS: *All patients of the study underwent surgery and had a follow-up of at least 5 years. Surgical excision of the tumour was undertaken. Postoperative CT scans in axial and coronal planes showed complete removal of the tumour in all cases. No complications or recurrences were observed.*
DISCUSSION: *Small, asymptomatic osteomas probably do not need to be treated but should be observed periodically. Surgical management remains the mainstay of treatment for these tumours. It requires total excision via an adequate approach, depending upon the site of presentation.*
CONCLUSION: *A purely endoscopic endonasal approach has the risk of incomplete excision. In our experience open technique provides a wide exposure and better control. Even frontal osteomas can be safely removed by careful open surgery*

KEY WORDS: Ethmoidal sinus, Frontal sinus, Open treatment, Osteoma, Paranasal sinuses

## Introduction

Osteoma is the most common primary skull neoplasm, comprising 20 to 30% of all such neoplasm. Although the majority of tumors remain occult, incidence in the general population has been shown to be from 0.014% to 0.43% [1-5]. The osteoma occurs at any age but it shows a predilection for the postpubertal period and most commonly in the second to fifth decades. The male to female ratio is of 1.5 to 3:1 [2].
Osteomas are generally solitary lesions; multiple localizations are associated with intestinal poliposis, fibromas, lipomas, neurofibromas, epidermoid cysts, abnormal teeth and pigmented skin lesions in Gardner's syndrome. They may consist of dense compact bone or lamellar bone with intratrabecular fibrous tissue and do not demonstrate osteoblastic activity. Patients with multiple osteomas of the facial skeleton should therefore be investigated for Gardner's syndrome in particular [3].

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This benign neoplasm are essentially restricted to the craniofacial skeleton and rarely are diagnosed in other bones. The most common locations are the body of the mandible or the condyle. Osteomas are the most common benign tumours of the paranasal sinuses. They are usually found in the frontal sinus (80%) and less often in the ethmoid, maxillary and sphenoid sinuses, in descending order of frequency.

The etiology of osteomas remains elusive. Three theories have been postulated. The developmental theory originally proposed by Cohnheim suggests that osteomas arise from residual embryological cell rests or embryologic cartilaginous cells of the junctional zone around the ethmoid labyrinth [4,5]. Gerber's traumatic theory holds that osteomas are sequelae of previous head injuries [4-7]. The infectious etiology theory argues that osteomas are generated from bone hypertrophy in areas of chronic infection. Although Rawlins presented data showing a 28% coexistence of infection and osteomas[6], there are no data to verify which entity is the cause and which is the effect [8,9].

A combination of the embryologic and traumatic theories is presently the most widely accepted theory. Embryological theory says that an osteoma would originate in the fronto-ethmoidal sutures where the membranous and cartilaginous tissues meet during embryonic life. This seems to be a more acceptable theory but the precipitating event may be recurrent infection or trauma [10].

There are two clinical types of osteoma: periosteal and endostealosteoma. The first pattern arise on the surface of the bone, as a polypoid or sessile slowly growing mass; some types may reach a large size, resulting in facial deformity. Instead, the endostealosteoma is located in the medullary bone; small endostealosteomas are asymptomatic, but large lesions cause a slowly progressive enlargement of the affected area.

Histologically, osteomas are composed of a composite of woven and lamellar bone that is frequently deposited in a cortical pattern with haversian like system. Some variants contain a component of trabecular bone in which the intertrabecular spaces are filled with hematopoietic marrow. Thus three types [7,11,12] of osteoma can be distinguished:

– eburnated, compact or ivory, with bony lamellae arranged in parallel layers, slow growing;

– spongy, areal-looking, with wide medullary spaces, without Haversian channels, of more rapid and more aggressive growth;

– mixed, in which two of the characteristics described above are present and representing the most common form (more than 50%).

Radiographic feature of the osteoma appears as circumscribed sclerotic mass. Periosteal osteomas may show a uniform sclerotic pattern or may demonstrate a sclerotic periphery with a central trabecular pattern. Smaller endostealosteomas are difficult to differentiate from foci of sclerotic bone representing the end stage of an inflammatory process (condensing osteitis, focal chronic sclerosing osteomyelitis) or from non-inflammatory foci of sclerotic bone (idiopathic osteosclerosis). The true nature of these osteomas can be confirmed only by documentation of continued growth.CT scan is the gold standard in the study of the lesions involving paranasal sinuses, including the frontal sinuses, because of its ability to demonstrate the intricate bony anatomy as well as the soft tissue component of the disease process. CT scan imaging of an osteoma shows a well-circumscribed, dense mass in the frontal sinus, varying in size. Osteomas may show a dense homogeneous or heterogeneous appearance depending on their composition [3].

MR imaging may show signal void on all pulse sequence, therefore these lesions may not be detected. Alternatively, osteomas with lamellar composition may reveal intermediate to slightly hyperintense signals on T1-weighted images. Differential diagnosis includes various types of bone tumours, epidermoid tumour, calcified meningioma, extra-axial developing gliomas and parasitic infection [13].

The osteoma is commonly asymptomatic, being an incidental finding in 1% of plain sinus radiographs and 3% of computed tomographic (CT) scans of the sinus [14]. The most frequent symptom is headache which is characteristically nocturnal and localized over the area of the osteoma. Others signs and symptoms are represented by facial pain or deformity, rhinorrea, anosmia, sinusitis secondary to obstruction of the involved sinus cavity possibly resulting in mucocele formation, ocular symptoms (e.g.: diplopia, proptosis) [15-25]. Because of the cramped nature of the ethmoid sinus, symptoms caused by an osteoma occur earlier than with osteomas of the frontal sinus [16,17]. Complications of fronto-ethmoidal osteomas are: obstruction of sinus ostium, extension into adjacent bones and the intracranial cavity, displacement of the anatomic structures, erosion through the posterior table of the frontal sinus may lead to neurologic complications such as intracranial mucocele, cerebro-spinal fluid (CSF) leak, subdural abscess, meningitis or intracranial pneumatocele [18-22].

Surgical treatment requires total excision via an appropriate surgical approach depending upon the site of presentation. The surgical approaches proposed for this surgery were: direct anterior surgical exposure, lateral rhinotomy, osteoplastic flap, emi-coronal flap, coronal flap and endoscopy.Surgical approach choice must consider several parameters such as neoplasm localization, extension, dimension, and frontal recess anatomic features[26]. When there is a concomitant lesion such as frontal mucocele, the surgical approach must necessarily be transcranial, since the dura is often lacerated [19]. It is essential to close dural and bone defects with pericranium, muscle grafts or autologous bone to prevent direct passage between the paranasal sinuses and the cranial cavity[3]. Osteomas are completely benign and patients do not experience malignant change or recurrences after complete excision.

## Materials and Methods

From 2005 to 2010, twenty-one (21) patients affected with fronto-ethmoidal osteomas underwent surgery at Department of Maxillo-Facial Surgery, Policlinico Umberto I, "Sapienza" University of Rome, Italy. Collected data include patients' age at the time of disorders, gender, presenting signs and symptoms, primary diagnosis, type and characteristics of the treatment performed, radiological findings and post-treatment results. Concerning the radiographic assessment, all the patients were evaluated by preoperative CT scans in axial and coronal planes integrated with three-dimensional (3D) images. All patients underwent open technique surgery under general anaesthesia. Patients were divided into four groups according to the localization of the osteoma: in group A were included 12 patients withfronto-ethmoidal localizations; in group B were included 5 patients with fronto-ethmoido-orbital localizations; in group C were included 2 patients with fronto-orbital localizations; in group D were included 2 patients with fronto-sphenoidal localizations.

## Results

*In the group A* were included 12 patients (54,1% of the sample) with fronto-ethmoidal localization: they was 8 males and 4 females with a ratio of 2:1. The mean age of the group was 40,92 years with a minimum of 16 years and a maximum of 63 years. At physical examination, clinical signs that have been detected was no obvious signs in 6 cases (50.1%), rhinorrea in 5 cases (41,6%) and local facial deformity in 1 case (8.3%). Symptoms that have been reported was headache in 7 cases (58,3%), anosmia in 5 cases (41,6%). In 1 cases (8.3%) was reported facial pain in association with headache.The surgical approach that has been performed was coronal flap in 9 cases (75%) and a direct anterior surgical exposure in 3 cases (25%). The average time of follow-up was 94.22 months (min 64-max 132 months).
*In the group B* were included 5 patients (23,9% of the sample) with fronto-orbital localization: they was 3 males and 2 females with a ratio of 3:2. The mean age of the group was 49,20 years with a minimum of 40 years and a maximum of 55 years. At physical examination, clinical signs that have been detected were facial deformity in 3 cases (60%), rhinorrea in 1 cases (20%) and proptosis in 1 cases (20%). Headache has been reported by all patients (100%). In association with this symptom have been reported anosmia in 2 cases (40%) and diplopia in 1 case (20%). The surgical approach that has been performed was coronal flap in all the cases (100%).The average time of follow-up was 108,33 months (min 81-max 124 months).
*In the group C* were included 2 patients (9.58% of the sample) with fronto-ethmoido-orbital localization: they was 2 males and 0 females with a ratio of 2:0. The mean age of the group was 39 years with a minimum of 31 years and a maximum of 47 years. At physical examination, clinical signs that have been detected were proptosis in all cases (100%). Headache has been reported by all patients (100%). In association with this symptom have been reported diplopia in 1 case (50%). The surgical approach that has been performed was coronal flap in all the cases (100%).The average time of follow-up was 72 months (min 63-max 81 months).
*In the group D* were included 2 patients (9.58% of the sample) with fronto-sphenoidal localization: they was 1 male and 1 female with a ratio of 1:1. The mean age of the group was 51 years with a minimum of 42 years and a maximum of 60 years. No clinical signs were detected at physical examination. Headache has been reported by all patients (100%). The surgical approach that has been performed was coronal flap in all the cases (100%). The average time of follow-up was 94 months (min 78-max 110 months). A summary of results is presented in Table I.



TABLE I

| Group | Average Age (min-max) | M/F Ratio | Localization | Signs | Symptoms | Approach (%) | Average Follow-up (months) |
|---|---|---|---|---|---|---|---|
| A | 40.92 (16-63) | 2:1 | Fronto-ethmoidal | Rhinorrea 41.6%<br>Facial deformity 8.3%<br>No signs 50,1% | Headache 58.3%<br>Anosmia 41.6%<br>Facial pain 8.3% | Coronal flap (75%)<br>Direct anterior surgical exposure (25%) | 94.22 (64-132)<br>108.33 (81-124) |
| B | 49.20 (40-55) | 3:2 | Fronto-orbital | Rhinorrea 20%<br>Proptosis 30%<br>Facial deformity 50% | Headache 100%<br>Anosmia 40%<br>Diplopia 20% | Coronal flap (100%) | 100.6 (69-126) |
| C | 39.00 (31-47) | 2:0 | Fronto-ethmoido-orbital | Proptosis 100% | Headache 100%<br>Diplopia 50% | Coronal flap (100%) | 72 (63-81) |
| D | 51.00 (42-60) | 1:1 | Fronto-sphenoidal | No signs | Headache 100% | Coronal flap (100%) | 94 (78-110) |

All patients had an uneventful recovery. In all clinical cases histological examination of the specimen confirmed the diagnosis of osteoma. CT scans, performed in the immediate postoperative period and during the follow-up at 12 and 24 months, showed complete removal of the tumour in 21 patients (100%). No recurrences were observed in 21 patients (100%). Each patient had at least a 5 years follow-up. In 2 patients (9.52% of the sample) affected with fronto-ethmoidal localizations, we observed headache persistence for about six months. This symptom spontaneously vanished after this term. In 1 patient (4.76% of the sample) affected with fronto-ethmoidal localization, we observed a clinical deficit of the frontal branch of the facial nerve. This deficit resolved after 6 months of physiotherapy.

## Discussion

Small, asymptomatic fronto-ethmoidalosteomas without intracranial or orbital extension or cosmetic deformity should be followed up with serial radiographs to determine any changes in size [15,20].

The radionuclide bone scanning has been described to assess the osteomas: surgery is reccomended in elevated uptake, whereas decreased uptake could be monitored[21]. Although fronto-ethmoidal osteomas are histologically benign tumours, they can be associated with potentially dangerous intracranial sequelae such as intracerebral abscess and mucocele.

Surgical intervention is curative, and several factors, including surgical accessibility, prevention of recurrent disease, and cosmesis, should be considered[27]. Surgery is required in symptomatic lesions, enlarging lesions, lesions with sinus involvement greater than 50%, lesions localized near natural ostium of the frontal sinus, lesions extending beyond the frontal and ethmoidal sinuses, lesions leading to a cosmetic deformity [28].

The surgical approach has to take in account the following factors: protection of the vital structures especially optic nerves and cribriform plate, complete resection, and minimal cosmetic deformity [4,15]. Selection of the appropriate surgical approach depends in general on location, volume, and side of osteoma, on the anatomical conditions as the anterior-posterior diameter of the frontal recess and on possible extrasinusal extensions [26]. For large osteomas of the fronto-ethmoidal region, surgical excision, including the osteoplastic flap technique, lateral rhinotomy, or direct anterior surgical exposure, were used whenever there was evidence of progressive growth and involvement of surrounding structures [15]. With ethmoidal or ethmoido-orbital surgery, caution should be exercised to avoid damage to the lacrimal apparatus, the trochlea of the superior oblique muscle, and the anterior and posterior ethmoidal arteries [14] . To date, open procedures for removal of fronto-ethmoidalosteomas have been the method of choice, but debate over optimal treatment continues. Endoscopic instruments offer an alternative approach in sinus surgery.

## Conclusion

Clinical presentation and complications are site and size specific. Even frontal osteomas can be safely removed by careful open surgery. A complete excision is curative. A purely endoscopic endonasal approach has the risk of incomplete excision. In our experience open technique provides a wide exposure and better control. It remains the mainstay for the surgical treatment of osteomas with intracranial extension or osteomas of the posterior and lateral wall of the frontal sinus or when remodeling of facial bone deformities is required. Open technique provides a direct repair of eventual CSF leaks and the management of complications such as pneumocephalus and mucocele with intracranial or intradural extensions.


### Riassunto

L'osteoma è un tumore benigno, composto da osso maturo compatto o spugnoso, che può insorgere in qualsiasi osso facciale. I seni paranasali, i seni frontali e l'etmoide sono le sedi più frequentemente coinvolte. L'osteoma cresce molto lentamente e le lesioni di piccole dimensioni spesso non sono sintomatiche. D'altra parte, a volte i pazienti presentano sintomi quali sinusite, mal di testa o manifestazioni oftalmiche. Questi risultati sono secondari all'ostruzione della cavità del seno coinvolto con la formazione secondaria di mucocele od occasionalmente di una lesione espansiva con una distorsione del contorno del viso.

Dal 2005 al 2010, sono stati valutati 21 pazienti affetti da osteoma non-sindromico fronto-etmoidale. I dati raccolti sono l'età del paziente al momento dei disordini, il sesso, la presenza o meno di segni e sintomi, la diagnosi primaria, il tipo e le caratteristiche del trattamento effettuato, i riscontri radiologici ed i risultati ottenuti dopo il trattamento.

Tutti i pazienti sono stati studiati con TC in proiezione assiale e coronale.

Tutti i pazienti dello studio sono stati sottoposti ad intervento chirurgico seguito da un follow-up di almeno 5 anni. Effettuata l'escissione chirurgica del tumore la TC post-operatoria ha mostrato la rimozione completa del tumore in tutti i casi. Non sono state osservate complicanze o recidive.

Gli osteomi di piccole dimensioni ed asintomatici probabilmente non hanno bisogno di essere trattati, ma occorre tenerli sotto controllo periodicamente. Il trattamento chirurgico rimane il cardine del trattamento per questi tumori mediante l'asportazione totale attraverso un approccio adeguato, a seconda del sito di presentazione. Un approccio puramente endoscopico endonasale ha il

rischio di un'escissione incompleta. Nella nostra esperienza, la chirurgia open offre una vasta esposizione ed un migliore controllo.

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