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Endoscopic approach for paranasal sinuses osteomas: Our experience and review of literature

A. Romano [a], G. Dell'Aversana Orabona [a], A. Pansini [a,*], V. Abbate [a], A. Cama [a], G. Iaconetta [b], L. Califano [c]

[a] University of Naples "Federico II", Department of Neurosciences, Reproductive and Odontostomatological Sciences, Maxillofacial Surgery unit, Naples, Italy
[b] University of Salerno, Neurosurgery Department, Salerno, Italy
[c] University of Naples "Federico II", Department of Neurosciences, Reproductive and Odontostomatological Sciences, Director and Chair, Maxillofacial Surgery unit, Naples, Italy

A B S T R A C T

Osteomas are common benign bone tumors of the skull and facial structures involving primarily the cranial vault, mandible, external auditory canal, paranasal sinuses, nasal cavity, and orbit.[1,2] These neoplasms are usually asymptomatic and account for 0.43% of tumor in population with an incidental finding on 1% of radiographs and on 3% of computed tomography (CT) scans. [1] These solid nodular sclerotic lesions usually arise from the outer table and are usually < 10 mm; lesions larger than 30 mm in diameter are considered giant tumors.[3,4,7] Most of patients with such a diagnosis have few or no symptoms, in general only 10% is symptomatic, in the second to fifth decades of life [5,6]. In literature, endoscopic endonasal approaches are mainly indicated for small ethmoidal osteomas without significant orbital or frontal extension[7], while large osteomas require Caldwell-Luc surgery[8] or other more aggressive approaches[25]. We report our experience about the treatment of paranasal sinuses osteomas treated endoscopically or by endoscope-assisted Caldwell-Luc approach, achieving total removal of the neoplasms with all the advantages deriving by endoscopic technique such as closer visualization of the anatomy, no damage to the surrounding structures, better cosmetic results, less morbidity and shorter hospitalization[17].

1. Introduction

Osteomas are benign, osteogenic, slow-growing tumors consisting mainly of mature compact or cancellous bone [9], with a predilection for the head and neck region which includes the facial bones, skull, and mandible. It is also the most common benign tumor of the sinonasal tract [14]. The mandible, particularly the angle, is the most common site, followed by the sinuses; in the literature, the frontal sinus is affected in 96%, the ethmoid in 2%, and the maxillary sinus in 2% of cases. The sphenoid sinus is rarely affected [9,10]. Osteomas may extend to surrounding structures, resulting in complications such as orbital involvement or intracranial invasion [11,12]. Majority of patients with such a diagnosis have few or no symptoms. Only 10% of patients have symptoms represented by headache, pneumocephalus, rhinorrhea, meningitis and abscess, given the neoplasm's size, blocking the sinuses drainage and generating sinusitis or paranasal sinus mucocele, mostly in the second to fifth decades of life [5,6]. Skull vault osteomas arising from the outer table are called exostotic while inner table are called enostotic; both types are usually asymptomatic [4].

These neoplasms can be incidentally discovered after radiographic evaluation for unrelated problems, such as minor head trauma [1–13]. Osteomas are subdivided in ivory and mature types depending on the proportions of dense and cancellous bone. Ivory osteomas are composed by dense, mature, lamellar bone with little fibrous stroma, and mature osteomas are composed by mature,

* Corresponding author.
E-mail address: a.pansini86@gmail.com (A. Pansini).

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lamellar bone with more abundant fibrous stroma. Tumors with both ivory and mature features are described as mixed type [2].

Another classification was reported by Haddad et al., dividing cranial osteomas into four types: intraparenchymal, dural, skull base and skull vault osteomas [4]. Intraparenchymal osteomas are the rarest type, with no connection to dura. Dural osteomas are asymptomatic and are often incidental findings on plain radiographs without bony attachment, arising mainly from the falx. Skull base osteomas are most common in the frontal sinus, but may also occur in the ethmoid air cells, maxillary and sphenoid sinuses, maxilla and mandible and occasionally arise in the temporal bone. Osteomas larger than 3 cm in diameter and weighing more than 110 g. are considered giant tumors [3,4,7].

2. Case series

Case 1: A 23-year-old female complained of intermittent localized pain over the left infraorbital area for the past nine months, not associated with fever or nasal discharge, and cacosmia. There was no history of trauma. The patient already underwent a partial left maxillary sinus osteoma resection in 2015 and, after developing a maxillary sinusitis poorly treated by antibiotic therapy, came to our attention on August 2017. On examination, foul odor coming from the nose, normal left cheek, normal nasal mucosa and no tenderness on palpation. MRI and CT scan of the paranasal sinuses showed a 50 × 30 × 30 mm bony mass in the left maxillary sinus arising from the lateral wall of the maxillary antrum, inflammatory tissue and previous intervention outcomes (Fig. 1).

The operation was performed with the patient under general anesthesia with the use of 0°, 30°,45° and 70° telescopes via endonasal endoscopic approach with navigator support. The bony neoplasms (one adherent to the maxillary floor, one adherent to the posterior wall, and one adherent to the maxillary roof and ethmoidal cells) were removed by using instruments such as drills to cavitate the neoplasms, osteotomes and hammer to dissect them, bone cutter to split them in smaller pieces, allowing the tumors' removal through a narrow space such as the nostril. Anyway, given the neoplasm's dimensions, an incision of the left nostril's vestibular base was performed (Fig. 3). The specimens were submitted for histological evaluation, and diagnosed as osteoma (Fig. 2). The patient underwent weekly endoscopic control and physical examination after surgery, showing progressive improvement with medication, performed endoscopically (consisting in nasal irrigation and crusts removal), and strict compliance to nasal irrigation for one month. The patient had complete relief of her symptoms with no complications and/or surgical sequelae. One month after surgery the patient practiced a CT scan that confirmed complete removal of the neoplasms. There was no residual tumor or recurrence at the 1 month (see Fig. 4) 6-months and 1 year follow-ups.

Case 2: A 55 years old male presented to our Maxillofacial Surgery Department with a complaint of left eye epiphora, started two years before, since 2016. The patient already underwent ophtalmologic, neurosurgical and ENT examinations and a CT scan. There was no history of trauma. On physical examination, left eye exophthalmos, no harmful palpation of the paranasal sinuses. No diplopia referred. The CT scan revealed a neoformation with an osteoma-like aspect of almost 25 mm involving the left ethmoid, maxillary sinus and nasal fossae, dislocating medially, through the lamina papyracea, the medial rectus muscle (Fig. 5).

The operation was performed with the patient under general anesthesia with the use of 0° 30° and 45° telescopes via endonasal endoscopic approach with navigator support. A bony spur was visualized. A left septoplasty, to improve visibility, was performed. The neoformation was removed by drill, osteotomes and hammer to dissect it, bone cutter to split it in smaller pieces that were removed, and submitted for histological evaluation and diagnosed as osteoma. After surgery, the patient underwent weekly visit and endoscopic control and medication (consisting in nasal irrigation and crusts removal), showing progressive improvement with such medication and strict compliance to nasal irrigation for one month. The patient had complete relief of his symptoms and no complications or surgical sequelae. One month after surgery the patient practiced a CT scan that confirmed complete removal of the neoplasm. There was no residual tumor or recurrence at the 6-months and 1 year follow-ups.

Case 3: A 42-year-old female presented with a complaint of rhinorrea. She already underwent ENT exam and underwent a CT scan and MRI. There was no history of trauma. On examination, no swelling of the paranasal area and no pain at palpation. MRI and CT scan of the paranasal sinuses showed a 17 × 14 mm bony mass involving the right orbital floor and associated with inflammatory tissue obliterating the right maxillary sinus and involving the ethmoidal cells. The patient also underwent a panoramic dental x-ray that showed a homogeneous opacity with regular, clear margins (Fig. 6). The operation was performed with the patient under general anesthesia with the use of 0° and 30° telescopes. A bony mass of the right maxillary sinus and a cyst were removed via endoscope assisted Caldwell-Luc procedure (Figs. 7 and 8). Then an apicectomy of upper right lateral incisor was performed. The endoscopic view of the lesion showed an osteo-mucosal lack of tissue in the nose floor region. An endoscopic right uncinectomy and right maxillary

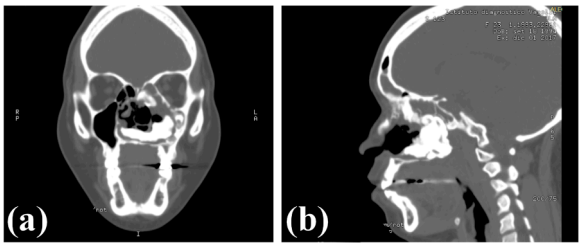

Fig. 1. a,b) Paranasal sinuses CT scan showing a 50 × 30 × 30 mm bony mass arising from the left maxillary sinus interesting maxillary floor, maxillary posterior wall, maxillary roof and ethmoidal cells.

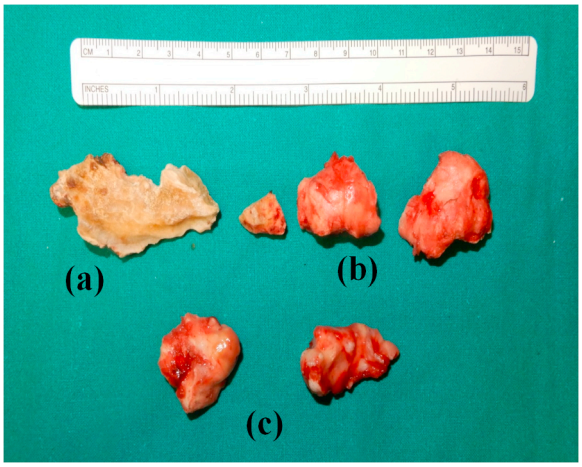

Fig. 2. Operative specimen: mixed tissue represented by lamellar bone and fibrous stroma. a) Inferior portion; b) Left maxillary sinus portion; c) Left ethmoidal portion.

Fig. 3. Incision of the left nostril vestibular's base resulted in a millimetric scar.

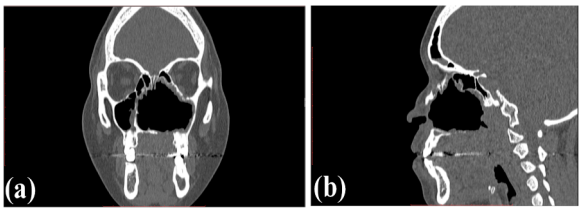

Fig. 4. a,b) Paranasal sinuses CT scan showing complete removal of the bony mass seen in Fig. 1, one month after surgery.

sinus antrostomy were performed and a platelet rich-fibrin (PRF) membrane was placed over the dental apexes in order to improve postoperative healing of the area. Closure of the surgical access was performed by absorbable sutures. The lesions were sent for histological evaluation that diagnosed an osteoma and an odontogenic cyst. After surgery, the patient underwent weekly visit and endoscopic control and medication (consisting in nasal irrigation and crusts removal), showing progressive improvement with such medication and strict compliance to nasal irrigation. The patient had complete relief of her symptoms with no complications and/or surgical sequelae. One month after surgery the patient practiced a CT scan that confirmed complete removal of the neoplasms. There was no residual tumor or recurrence at the 6-months and 1 year follow-ups.

3. Discussion

When symptomatic, surgical removal of osteomas is the treatment of choice. The adhesion of the surrounding brain tissue and vascular structures should be taken into consideration during the radical excision of large sized lesions [15]. The surgical goal is to

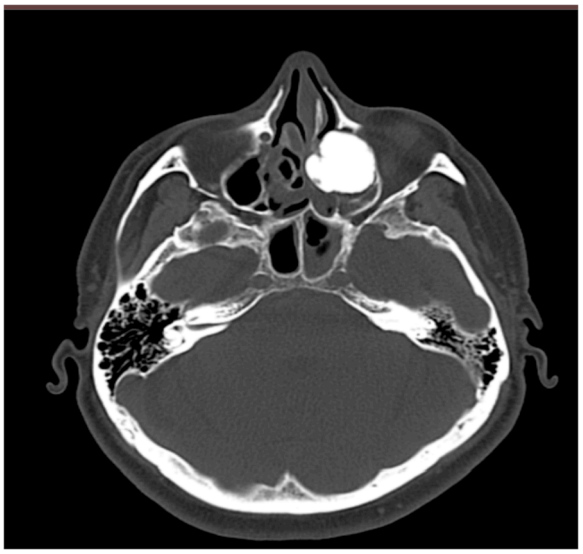

Fig. 5. Paranasal sinuses CT scan showing a 25mm bony mass interesting the left ethmoid, maxillary sinus and nasal fossae, dislocating medially, through the lamina papyracea, the medial rectus muscle.

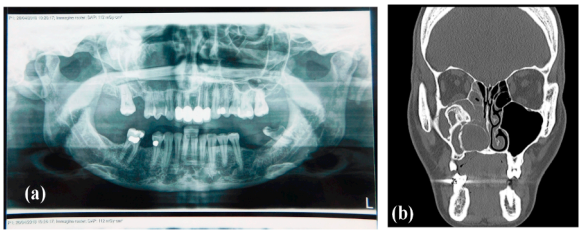

Fig. 6. a) Panoramic radiograph showing right maxillary cist and a homogeneous opacity with regular, clear margins. b) Paranasal sinuses CT scan showing a 17 × 14 mm bony mass involving the right orbital floor with inflammatory tissue obliterating the right maxillary sinus and involving the ethmoidal cells.

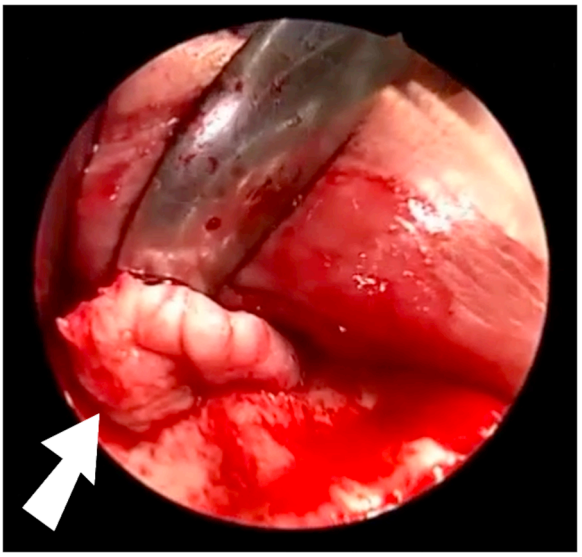

Fig. 7. Endoscopical view of the right maxillary cyst tissue during its asportation (arrow).

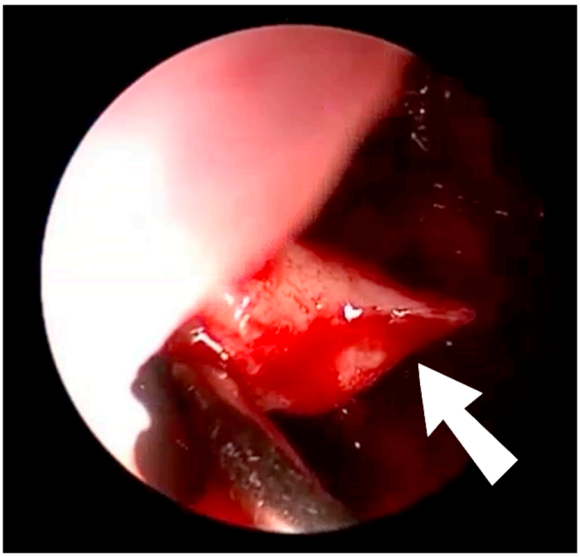

Fig. 8. Endoscopical asportation of the bony mass (arrow).

achieve complete surgical resection, to protect vital structures (cribriform plate, optic nerves, lacrimal apparatus, anterior and posterior ethmoidal arteries, and the trochlea), and to achieve favorable aesthetic outcomes. Complete surgical excision should be achieved by en-bloc resection of the osteoma whenever possible [22]. Surgery aims to lesion removal without damaging adjacent structures. The choice of a surgical approach depends on the location, the size and the extension of the osteoma and the surgeon's experience [23]. In literature, endoscopic endonasal approaches are mainly indicated for small ethmoidal osteomas without significant orbital or frontal extension [16]. On the other hand, the development of endoscopic sinonasal instrumentation and surgical navigation systems has emphasized endoscopic endonasal procedure indications in sinonasal osteoma management [17]. Some Authors consider small osteomas should be removed endoscopically, while large osteomas require Caldwell-Luc surgery [8] or other external surgical approaches (i.e., frontoethmoidectomy through a Lynch-Howarth incision, midfacial degloving, lateral rhinotomy and osteoplastic frontal sinusotomy via a coronal incision) that have all been extensively used in the past according to the site and size of osteomas [25]. On the other hand, recurrent frontal sinusitis, iatrogenic cranial nerve injury, visual disturbances, ptosis, cerebrospinal fluid (CSF) leakage, and postoperative hemorrhage have been reported in the literature with the open surgical techniques [23-25]. The experience reported by Strek et al., confirms that endoscopic sinus surgery offers a convenient, safe, and effective alternative to open procedures and can be successfully performed in well-selected cases of osteomas [20]. The endoscopic procedure can also constitute an important part of surgery undertaken for giant frontoethmoidal osteomas. The reduced morbidity, length of stay, and superior cosmetic results are distinct advantages of the technique of resection used also in our patients [21].

All three patients underwent MRI and CT scan, that are fundamental to examine the structures not reachable by endoscope, such as the extra-mucosal ones or those over the bony envelope of the nasal sinuses or the skull base [27]. What's more, the endoscopical approach's planning needs to verify the presence and, if so, graduate the dural invasion (lateral invasion and depth of *trans*-dural extension). Risk of orbital invasion, probable involvement of the anterior and/or lateral wall of the frontal sinus, of the lacrimal ways, of the maxillary sinus' walls (excluding the medial one) of the nasal bones and the erosion of the nasal fossa's floor need to be evaluated too. To respond to these needs, CT is inferior to MRI [28,29]. CT is inferior to MRI in discriminating neoplasm from the inflammatory tissue inside the nasal sinuses, too [30]. So, planning before treatment is based on information acquired from MRI, eventually integrated from the CT scans, that is more specific in analyzing thin bony structures. CT scans grant, anyway, a representation of the tissues' volume that can be acquired in few seconds. If obtained in arterial phase, the "virtual" volume contains the accurate three-dimensional anatomy of the most critical arteries, and when "fused" with patient's real anatomy landmarks, it minimizes intraoperative risks [31]. With this information acquired, an endoscopic approach could be designed for the three patients for different reasons: in the first case we preferred an endoscopic approach, even if in literature osteomas larger than 3 cm in diameter and weighing more than 110 g are considered giant tumors [3,4,7] requiring the aggressive approaches we already summarized. Such approach was preferred as main advantages of endoscopic approaches are closer visualization of the anatomy, less damage to the surrounding structures, better cosmetic results with less morbidity and shorter hospitalization [18]. However, this approach needs sophisticated instrumentation, such as navigator, and a long training in order to be able to manage possible complications such as massive bleeding or uncontrolled lesion margins [17]. In the second case, the patient was treated endoscopically and via neuronavigator support for the localization of the neoplasm, near the skull base. In the third case the surgeons were initially deceived by the aspect of the lesion, an osteoma associated with a cystic lesion, treated by an endoscopically assisted Caldwell-Luc approach to remove both the bony mass and the cystic lesion. In our experience [19,32–35], post-operative therapy and endoscopic controls are crucial to reduce or avoid surgical sequelae. Careful monitoring and good patient compliance to therapy after surgery and nasal irrigation are, in fact, fundamental to reduce events such as post-surgery sinusitis and adherent scars.

4. Conclusion

Complete surgical excision of osteoma is the treatment of choice, that should be achieved by en-bloc resection whenever possible [22]. Even if in literature a possibly partial removal, aiming at restoring interested sinus' drainage, is described [36], in our experience the removal must be radical, in order to avoid bacterial and mycotic superinfections. Furthermore, incomplete resection of the osteoma is associated with increased risk of recurrence (up to 10%) [4,26].

In our experience [19,32–35], the pure endoscopic and endoscope-assisted treatments described here, permitted, in every peculiar case, a good control of the pathology with no residual tumor or recurrence at the 6-months and 1 year follow-ups. What's more, endoscopy offers better visualization of the anatomy and so, a better approach for lesions involving the maxilla, like in the third case we described. As already described, endoscopic approach has, in literature [17] and in our experience, low morbility (such as stenosis or adherent scars) compared to recurrent frontal sinusitis, iatrogenic cranial nerve injury, visual disturbances, ptosis, CSF leakage, and postoperative hemorrhage reported in the literature by performing the open surgical techniques [23–25]; short hospitalization (3 days); and, mostly, lack of visible scars.

Conflicts of interest

The authors declare that they have no competing interest. None of the authors has a financial interest in any of the products or devices mentioned in this article.

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