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Fronto-orbital-ethmoid mucoceles

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Mucoceles are mucus filled cavities that most often occur in the frontal sinuses. In advanced stages, they can expand to large dimensions causing bone remodeling and erosion, and can extend into the intracranial cavity and orbits. In addition to symptoms associated with chronic rhinosinusitis, in advanced stages, symptoms may include headache and ophthalmologic problems such as proptosis and diplopia. Successful management requires involved sinus drainage, preferably endoscopically, or sinus cavity obliteration.

Mucoceles of the paranasal sinuses are mucous-filled cavities that result from obstruction of normal sinus outflow. Mucoceles are lined with pseudo-columnar respiratory mucosa that produces mucus in a physiological manner, which distinguishes mucoceles from mucus retention cysts.[1,2] Mucoceles can form in the context of anatomic variations, allergic reactions, trauma, chronic sinusitis, neoplasm, and postoperative complications.[2-6] Other variables such as the presence or absence of nasal polyps, history of asthma or nasal obstruction do not appear to predispose patients to fronto-orbital-ethmoid (FOE) mucocele formation (M. Herndon, K.C. McMains, S.E. Kountakis, unpublished data, September 2005). Mucoceles tend to occur between the fourth and seventh decades of life, and show no gender predilection.[7]

The most common site for developing a mucocele is within the frontal sinuses.[1] Pneumatization of the orbital plate of the ethmoid can extend lateral to the frontal sinus and into the frontal bone. This supraorbital ethmoid (SOE) region is another common site for mucocele formation. Common presenting symptoms in patients with frontal or SOE mucoceles include frontal headaches and ophthalmologic symptoms, such as diplopia and swelling of the upper eyelids.

When the mucocele expands such that the sinus volume is insufficient to house the mucocele, pressure within the cavity increases, eventually causing bony remodeling and erosion.[3] Pressure erosion can result in significant anatomic deformity, including facial asymmetry and ocular complaints, including "dynamic proptosis," acquired Brown syndrome, diplopia, and visual compromise.[4,8] Frontoethmoidal mucoceles eroding through the roof of the orbit force the globe inferiorly and laterally. Potential infectious complications include mucopyocele, meningitis, orbital cellulitis, and osteomyelitis. Classification of mucoceles is based on radiographic findings, and incorporate location and extent of bony erosion.[9] The treatment involves either the reestablishment of sinus drainage with open or endoscopic techniques, or obliteration of the affected sinus.

Surgical technique

Extensive FOE mucoceles can be successfully and safely treated with endoscopic and nonendoscopic methods. Surgical planning must include thorough investigation of the patient's overall health status and specific systemic diseases. In addition, preoperative intranasal endoscopic evaluation is important to identify anatomic structures that may limit surgical access and to treat concomitant intranasal disease, such as polyposis, fungal disease, or acute infection.

In large part, the choice of surgical approach depends on the anatomy of the frontal recess. Computerized tomography (CT) is the best initial study to conduct in the work-up

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of a suspected mucocele because it provides detailed resolution of bony structures. Evaluation of frontal sinus outflow in 3 dimensions is essential for surgical planning in this area. Magnetic resonance imaging is a useful adjunctive study in patients with bony erosion of the orbit or skull base. It provides better resolution between mucocele contents, and orbital and intracranial contents.

Before fiberoptic endoscopy was applied to the treatment of sinus mucoceles, external approaches with osteoplastic flaps were the mainstay of surgical treatment. The Lynch incision made in the superomedial aspect of the orbit allows access to the ethmoid and frontal sinuses, while providing good exposure for separation of mucoceles from periorbita. This approach can be used alone or in conjunction with an osteoplastic flap. Drawbacks of this method include visible scarring, tethering of the globe, and ocular webbing. Alternatively, a coronal incision with osteoplastic flap gives good exposure to lesions of the frontal sinuses and SOE cells. Treatment has traditionally involved complete mucosal stripping, and fat obliteration of the frontal sinus and SOE cell with plugging of the respective outflow tracts. Drawbacks include long scar, potential for alopecia along the incision line, hypesthesia posterior to the incision, damage to the frontal branch of the facial nerve, and mucocele recurrence within the frontal sinus or SOE cell.

Endoscopic techniques of marsupialization and the modified endoscopic Lothrop procedure (MELP) have been used successfully to decompress both complicated frontal mucoceles and mucoceles of other paranasal sinuses. For SOE cells with adequate opening into the nasal cavity, a complete ethmoidectomy may be sufficient for decompression. This process can be accomplished with straight and angled endoscopes, working in conjunction with manual instruments and/or powered instrumentation. For this technique to be successful, a sufficiently broad-based connection must exist between the nasal cavity and the SOE to allow for complete decompression with reasonable expectation of continued postoperative patency. If the tract is narrower, it is preferable to proceed to the MELP rather than risk damage to the orbital and intracranial contents through extensive manipulation. Image guidance can be helpful intraoperatively. However, after decompression, soft tissue shifts, rendering image guidance potentially imprecise. If marsupialization is not feasible, accessing disease via the frontal sinus outflow tract should be considered.

The ultimate choice of surgical procedure for extensive frontal mucoceles is determined after the sinus CT is reviewed, preferably on a workstation. Information is obtained, such as the anterior-posterior dimension of the frontal sinus, size of the frontal recess, number and location of the frontal cells within the frontal recess, and location of the skull base. The technique involves exposing the frontal sinus outflow via thorough anterior ethmoidectomy. Angled endoscopes can then be used to visualize frontal outflow. Intermittently balloting the eye provides verification of an intact lamina and can help decompress the mucocele once the sac is opened. If an agger nasi cell impinges on the frontal outflow, this must be removed. Similarly, to provide the widest possible exposure, type I and II frontal cells are removed. In cases of tortuous anatomy or extremely lateral disease, additional exposure may be necessary. The MELP is often useful in these cases. When there is bone erosion, the surgeon should be prepared for advanced frontal techniques, but, if an adequate frontal ostium without circumferential scarring is encountered, it may not be necessary to

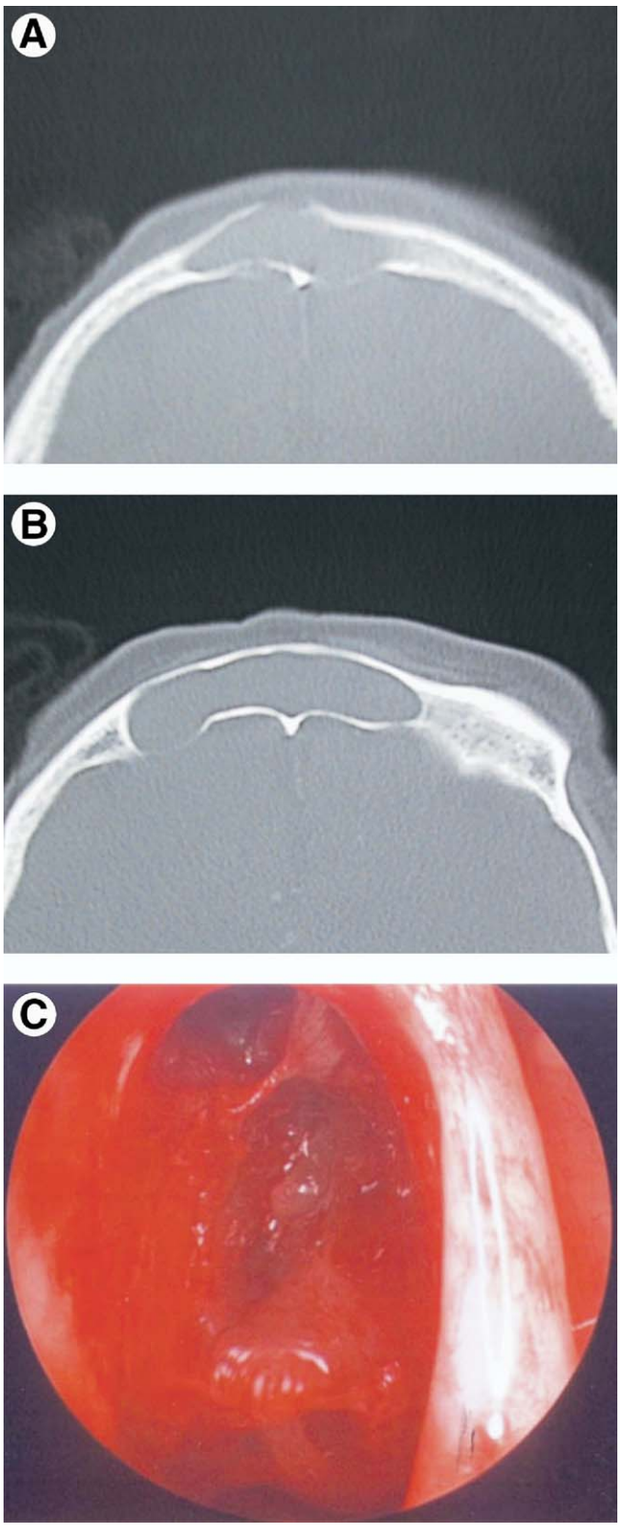

Figure 1 (A) Axial sinus CT showing a frontal mucocele with anterior and posterior frontal wall erosion. (B) Axial sinus CT illustrating a frontal mucocele with lateral posterior frontal wall erosion. (C) Endoscopic frontal recess surgery revealed a wide frontal ostium free of circumferential scar. (Color version of figure is available online.)