

ORIGINAL ARTICLE

Medicine Science 2021;10(1):101-5

Paranasal sinus mucocoele; clinical presentations and surgical management** Ozer Erdem Gur,  Nevreste Didem Sonbay Yilmaz***Antalya Training and Research Hospital, Department of Otolaryngology, Antalya, Turkey*Received 04 August 2020; Accepted 13 September 2020
Available online 17.01.2021 with doi: 10.5455/medscience.2020.08.154Copyright@Author(s) - Available online at www.medicinescience.org

Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

**Abstract**

Mucocoeles of the paranasal sinus are benign expandable lesions that primarily occur between the fourth and seventh decades of life. In this study, the cases diagnosed with paranasal sinus mucocoele who were operated by a single surgeon between 2002 and 2019 were evaluated in terms of symptoms, surgical technique, complications, and recurrence and discussed in the light of the literature. In this study, we retrospectively analyzed 75 patients, 76 mucocoeles who underwent operations due to paranasal sinus mucocoeles between January 2002 and December 2019. In the patients diagnosed with a mucocoele, the mucocoele was removed surgically. Of the 75 patients, 36 were female and 40 were male. All the patients were between the ages of 21 and 85, with an average age of 56.9 years old. Mucocoele formation occurred in the frontal sinus in 46 (61%) patients, the maxillary sinus in 16 (21%) patients the ethmoid sinus in 11 (14%) patients, and the sphenoid sinus in 3 (4%). 1 patient had both frontal and maxillary sinus mucocoele. 15 underwent surgery using external approach. All patients were followed-up with endoscopic examinations for 13 months to 4 years. 4 of 76 mucocoeles (5,3%) experienced recurrence Treatment of paranasal sinus mucocoeles is surgical and usually simple drainage and marsupialization of mucocoeles is sufficient. The endoscopic approach in the treatment of sphenoid, maxillary and ethmoid mucocoeles is the surgical method of choice without question. However, in frontal sinus mucocoele surgery, external surgery is still valid as much as endoscopic sinus surgery.

Keywords: Mucocoele, endoscopic sinus surgery, external approach**Introduction**

Mucocoeles of the paranasal sinus are benign expandable lesions that primarily occur between the fourth and seventh decades of life [1]. Sinus mucocoeles may develop due to obstruction of the sinus outflow resulting from anatomical obstruction, mucosal hyperplasia, mass lesion or other mechanical factors. Previous operation and trauma, chronic sinusitis, tumor, nasal polyps, and RT are the main etiological factors [1,2].

The frontal sinus is the most common site of mucocoele formation, followed by the ethmoidal, maxillary, and sphenoid sinuses [3-6].

Mucocoeles are slow-growing mucosa-filled cysts lined with pseudo-columnar epithelium [3,5]. Although they grow slowly, they may extrude from the sinus from which they originate

because of the bone erosion caused by the pressure they exert on the sinus wall and the cytokines they secrete. If the mucocoele advances into the nasal passage, it causes nasal symptoms such as nasal congestion.

If it advances towards the orbital wall it causes orbital symptoms, such as proptosis, diplopia, epiphora, visual loss, and orbital cellulitis [1,4]. Frontal sinus mucocoeles can cause intracranial symptoms, such as brain abscess, subdural abscess, and meningitis or they can cause cosmetic complaints because of swelling in the cheek or front and facial asymmetry due to expansion into the skin anteriorly [2,5]. Additionally, mucocoeles may sometimes become infected and transform into a mucopyocoele, causing symptoms such as osteomyelitis, orbital cellulitis and meningitis [1,7]. Therefore, when a mucocoele that affects the sinus is detected, it must certainly be treated to prevent irreversible complications.

Diagnosis is made on imaging [8]. Computed tomography may illustrate an expansile remodeling-thinning and often sufficient for diagnosis. Magnetic resonance imaging (MRI) delineate the relationship among the mucocoele, brain tissue, the orbit, and other soft tissues [1,8].

*Corresponding Author: Nevreste Didem Sonbay, Antalya Training and Research Hospital, Department of Otolaryngology, Antalya, Turkey
E-mail: didem_ece@yahoo.com

The treatment method of mucocoeles is surgery [1,3,9,10]. Endoscopic sinus surgery is the gold standard in paranasal sinus mucocoele treatment [9]. Nowadays, only endoscopic sinus surgery is preferred for maxillary, ethmoid and sphenoid sinus mucocoeles. However, although endoscopic sinus surgery is the first choice in frontal sinus mucocoele, open technique surgery can still be used today when there is frontal sinus anterior wall defect, intracranial or intraorbital extension.

In this study, cases diagnosed with paranasal sinus mucocoele who were operated by a single surgeon between 2002 and 2019 were evaluated in terms of symptoms, surgical technique, complications, and recurrence and discussed in the light of the literature.

Materials and Methods

In this study, we retrospectively analyzed 75 patients, 76 mucocoeles who underwent operations due to paranasal sinus mucocoeles between January 2002 and December 2019. Approval for the study was granted by the Local Ethics Committee of Antalya Training and Research Hospital (30/05/2019-14/12). Age, sex, sinonasal symptoms, facial deformity and visual changes were noted. All the patients were assessed with endoscopic inspection followed by a paranasal sinus computed tomography (PNS CT) scan. In cases of cranial or orbital extension, magnetic resonance imaging (MRI) was performed for additional evaluation. In the patients diagnosed with a mucocoele, it was removed surgically. All the patients underwent surgery by the same team. The patients with a postoperative pathological diagnosis of a mucocoele were included in the study.

Results

Of the 75 patients, 35 were female and 40 were male. All these patients were between the ages of 21 and 85, with an average age of 56.9. Mucocoele formation occurred in the frontal sinus in 46 (61%) patients, the maxillary sinus in 16 (21%) patients the ethmoid sinus in 11 (14%) patients, and the sphenoid sinus in 3 (4%). 1 patient had both frontal and maxillary sinus mucocoele (Figure 1).

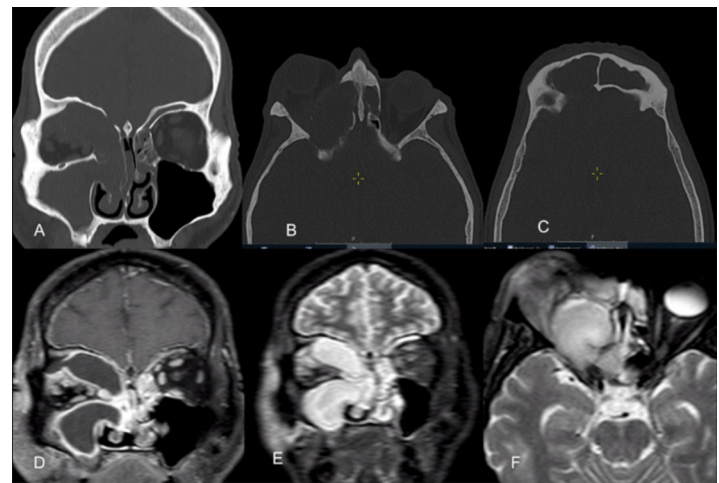


Figure 1. Ethmoid and frontal sinus mucocoele (Preoperative PNS CT A. Coronal Plane B. Axial Plane C. Involvement of the right orbit. Preoperative MRI D. Coronal Plane T2 Hyperintens Image E. Coronal Plane T1 Hypointens Image. F. Axial Image)

Of the 75 patients, 76 paranasal sinus mucocoeles, 19 (25%) had a history of FESC or nasal surgery and 18 (24%) had a history of chronic sinusitis, 11 (15%) had a history of allergy, 5 (7%) had a history of trauma, 4 (5%) patients had both frontal mucocoeles and nasal polyposis. In 19 (25%) patients, no etiological factor was determined.

The most common symptom was nasal obstruction, which was exhibited by all patients with maxillary sinus mucocoeles. Proptosis was the second most common symptom; total vision loss was present only in 1 patient with a frontal mucocoele. In the preoperative assessment, a mucocoele that invaded the superior orbital wall in the right frontal region and a 2/10 vision loss in the right eye was found. Vision in the left eye was 10/10. The patient was treated with the endoscopic approach, and in the postoperative assessment, the vision in the right eye was 10/10. Swelling was most frequently observed in the frontal sinus mucocoele patients, and visual symptoms were exhibited by the sphenoid and ethmoid sinus mucocoele patients. Headache was present in 38% of the patients. CSF fistula, meningitis and brain abscess are rare but serious complications due to frontal pyocoele. The distribution of the sinus symptoms is provided in (Table 1).

Table 1. Distribution of the sinus symptoms

		Frontal (46 /61%)	Ethmoid (11/14%)	Maxillary (16/21%)	Sphenoid (3/4%)	Total
Nasal Symptoms	Nasal Obstructions	11(24%)	7(63%)	16(100%)	0	34(45%)
	Nasal Congestion	4(8.6%)	2(18.1%)	4(25%)	0	10 (21%)
Orbital Symptoms	Proptosis	25(54,3%)	4(36%)	0	0	29(38%)
	Visual Symptoms	5(10%)	4(36%)	0	1(50%)	10 (21%)
	Orbital Wall Defects	16(34%)	2(18%)	0	0	18 (23%)
Cranial Symptoms	Headache	14(30%)	3(27%)	2(12%)	1(33%)	20 (26%)
	CSF Fistula	2 (4%)	0	0	0	2 (2.6%)
	Menengitis	2(4%)	0	0	0	2 (2.6%)
	Apscess	1 (2%)				1 (1%)
Cosmetic Symptoms	Facial Asymmetry	6(13%)	0	1(6%)	0	7 (%9)
	Bone Defect	4(8%)	0	0	0	4 (5%)

Maxillary, ethmoid, sphenoid sinus mucocoeles were all treated with the endoscopic approach (Figure 2). Of the 46 patients with frontal sinus mucocoeles, 31 underwent surgery underwent ESC (Figure 3). 15 underwent surgery using external approach (Figure 4). We performed osteoplastic frontal sinus surgery in 14 of these patients, and trephination was performed in the 1 remaining patient. The characteristics of the patients who underwent external approach and had frontal sinus mucocoele are shown in (Table 2).

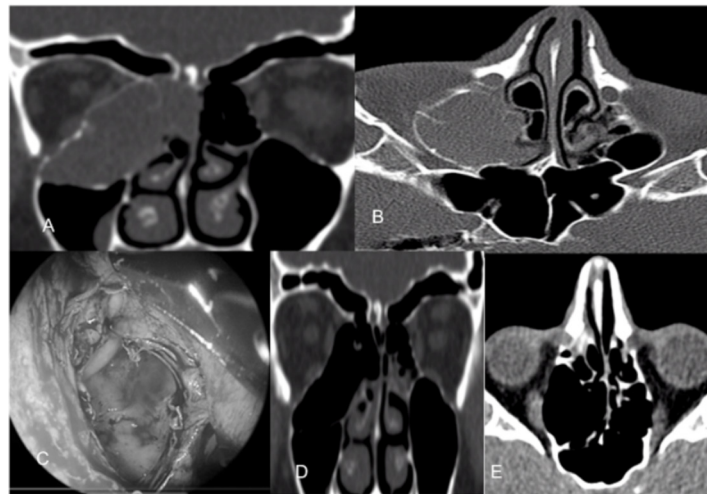


Figure 2. Ethmoid sinus mucocoele is involvement of the right orbit (Preoperative PNS CT A. Coronal Plane B. Axial Plane, C. Intraoperative Imaging Postoperative PNS CT D. Coronal Plane E. Axial Plane)

All patients were followed-up with endoscopic examinations for 13 months to 4 years. 4 of 76 mucocoeles (5,3%) experienced recurrence. The recurrent patients were those who had previously been operated for chronic sinusitis (3 patients with polyps, 1 patient with chronic sinusitis without polyps).

Table 2. Causes of External Surgery Preference in Patients Diagnosed with Frontal Sinus Mucocoele

Anterior Wall Defect	5
Frontal Lobe Abscess	1
Dura Defect	2
Intracranial Expansion	2
Orbital Oomplications	5
Not Being Able to Get General Anesthesia	1

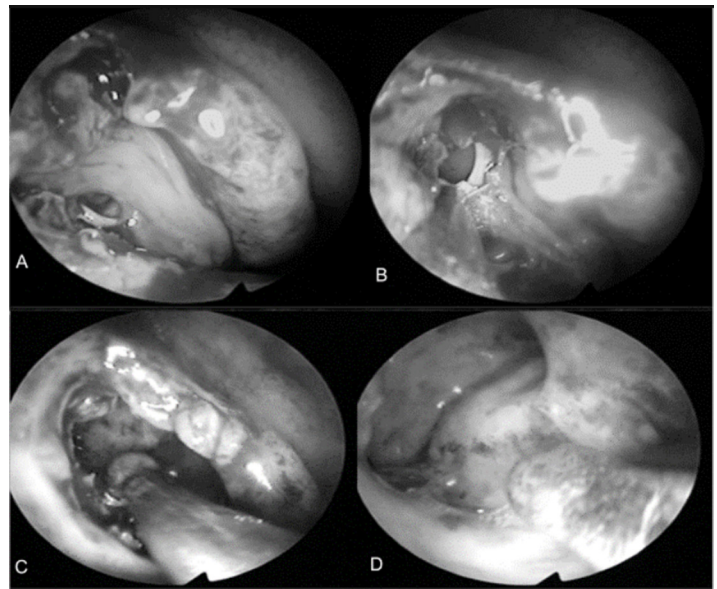


Figure 3. Frontal sinus mucocoele intraoperative image. A. Drainage of the mucocoele. B. After marsupialization of frontal mucocoele, C-D: Frontal sinus

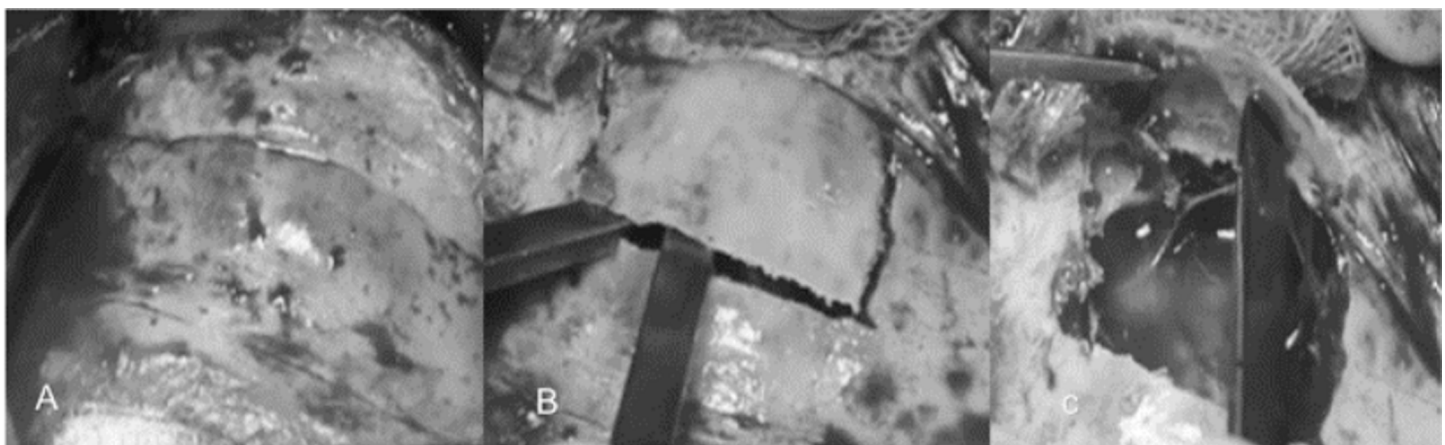


Figure 4. External Approach. A. Expansion of the frontal sinus mucocoele on the anterior wall. B. Osteoplastic flap elevation. C. Frontal sinus mucocoele

Discussion

Mucocoeles are cystic, benign expansile masses [3,8]. Mucocoeles may give different symptoms depending on the area they affect. Depending on the size of the lesion, bone resorption and remodeling may be seen [2,4]. Visual disturbances due to orbital displacement or optic nerve compression may also lead to facial deformities due

to bone expansion or defect. When mucocoeles become infected and form pyomucocoele formation, orbital cellulitis, orbital abscess, and intracranial spread may cause complications such as meningitis and brain abscess that require urgent intervention [9,10].

In our study, the 3 most common symptoms in paranasal sinus mucocoeles were nasal obstruction (45%), proptosis (38%), and

Headage (20%). Plainter et al (78) reported that the most common symptom was pain before surgery. Fhu et al [1], on the other hand, reported the most common symptom in patients with primary and secondary mucocoele as nasal obstruction. Proptosis is the 2 most common symptoms and was more common in frontal sinus mucocoeles (54%) and ethmoid sinus mucocoeles (36%), which are closely related to the orbit.

The treatment of paranasal sinus mucocoeles is surgical and simple drainage and marsupialization of mucocoeles is usually sufficient [8,9]. The endoscopic approach in the treatment of sphenoid, maxillary and ethmoid mucocoeles is the surgical method of choice without question. Especially in ethmoid and sphenoid sinus mucocoeles, endoscopy provides the same field of vision as in the external approach, and the morbidity rate is much lower [11].

In frontal sinus surgery, as a result of the magnificent development of endoscopic sinus surgery, the area of use of the external approach is gradually narrowing. However, it still has a place in some pathologies of the frontal sinus. In the literature, there are many authors who support the use of external approach in frontal sinus anterior wall effects, pathologies with excessive lateral localization, presence of pathology in type 3 frontal cells, and lesions with intracranial extension leading to the dura effect [2,11,12]. However, there are also publications treated with endoscopic approaches in many similar pathologies [3,6,10]. In our series, 16 of 46 patients with frontal sinus mucocoele were treated using an external approach. Since 1 patient could not receive general anesthesia, trephination with LAA was performed, and 2 patients underwent craniotomy for frontal lobe abscess. Endoscopic surgery was unlikely to be performed in these cases. An external approach was applied to 5 patients with anterior wall defect in order to perform reconstruction. In these cases, the external approach is required for reconstruction (bone cement, titanium rapier). External approach was applied to 2 patients due to dura defect. There are patients treated with both methods in the literature. In these cases, the surgeon's facilities and experience are the most important factors in decision-making. A meta-analysis evaluating the development and use of endoscopic sinus surgery and techniques applied according to the surgeon's experience was conducted by Courson et al [13]. The studies examined in this meta-analysis are divided into 2 groups. The surgeries performed between 2002-2012 were collected in the first group, and the studies performed between 1975-2001 in the second group. It is seen that the rate of endoscopic surgery has increased in the second group. Again, in the same meta-analysis, in the comparison between the senior surgeons and others, it is seen that the senior surgeons solved the problems endoscopically at a much higher rate. In our study, 15 of 46 frontal sinus mucocoeles and 31 external ones were treated by endoscopic approach. When we evaluate the development of our own surgical experience, we think that 5 cases that cause orbital complications can be performed endoscopically.

If the external approach is applied in the frontal sinus surgery, another discussion point is the obliteration of the frontal sinus. Some authors claim that the obliteration of the sinus after the complete removal of the frontal mucocoele decreases the rate of recurrence [5,9]. Others defend the position that the sinus must be left open because obliteration damages the physiology of the frontal sinus [1,3]. Although we support the view that unless there

is an underlying pathology, marsupialization of the mucocoele is sufficient to protect the drainage and physiology of the frontal sinus, we also claim that for the patients who have dura defects, there is a need for obliteration to support the fascia that we use to repair the defect.

Another topic of discussion in the treatment of frontal mucocoeles is whether to place a stent in the frontal ostium. Har-El G et al [10] placed stents in the cavity when they endoscopically performed small unilateral marsupialization and removed the stents after 8-12 weeks; they observed no recurrence in the follow-ups. On the other hand, we did not place stents in any of our patients. In the only patient who had recurrence, the real reason for the recurrence was that a nasal polyp obliterated the frontal recess; however, the recurrence occurred on postoperative month 41. As a result, we maintain that even a 12-week stent would not have been able to prevent recurrence in this patient. Even though the treatment for sinus mucocoeles is surgery, it must be kept in mind that past surgical operations are also important in the etiology of mucocoeles. The formation of a scar that blocks the sinus ostium after the surgery speeds up the formation of mucocoeles [1,3]. Recurrence in the surgery operations due to nasal polyps or chronic rhinosinusitis may be caused because the ostium was not enlarged enough, and blockage of the ostium due to the recurrence of the primary pathology or excessive deformation of the nasal physiology during the surgery. The recurrence after the mucocoele surgery occurs due to the same reasons. Especially in the frontal mucocoeles, more frequent obliteration due to the anatomy of the frontal recess increases the recurrence rate [14]. However, in the surveys on mucocoele surgery in the literature, it was observed that recurrence rates were very low (0-13%). In our study, the recurrence rate was 5%. However, we maintain that these recurrence rates do not reflect the reality because the follow-up periods did not exceed 10 years in any of these studies. However, mucocoeles are cysts that grow very slowly. Meetze et al [15] retrospectively surveyed the frontal sinus complications in patients who underwent frontal craniotomy and found that frontoethmoidal mucocoeles developed 14.8 years (1-39 years) after the operation on average. If recurrence can develop 39 years after a previous operation, we believe it is also possible for it to develop many years after mucocoele surgery due to the trauma caused by the operation. We maintain that with longer-running studies, the recurrence rates may increase even more.

Conclusion

Paranasal sinus mucocoeles can lead to serious complications such as orbital cellulitis, brain abscess and meningitis, especially when they are infected, that is, when they form a pyomucocoele formation.

Endoscopic sinus surgery has emerged as the preferred surgical method for ethmoid, maxillary and sphenoid mucocoeles. It is also the best treatment approach for frontal sinus mucocoeles. In frontal sinus mucocoeles, the limits of endoscopic sinus surgery are determined by the experience of the surgeon and the characteristics of the mucocoele. Mucocoeles that cause anterior wall defect and cause intracranial complications are the most important candidates for open surgery.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

All authors declare no financial support.

Ethical approval

Local Ethics Committee of Antalya Training and Research Hospital (30/05/2019-14/12).

References

1. Fu CH, Chang KP, Lee TJ. The difference in anatomical and invasive characteristics between primary and secondary paranasal sinus mucocoeles. *Otolaryngol Head Neck Surg.* 2007;136:621-5.
2. Bockhmul U. Osteoplastic frontal sinusotomy and reconstruction of frontal defects. In: Kountakis S, Senior B, Draf W (eds) *The frontal sinus.* Springer, Berlin, 2005;281-9.
3. Har-El G. Endoscopic management of 108 sinus mucocoeles. *Laryngoscope* 2001;111:2131-4.
4. Stienberg CM, Bailey BJ, Calhoun KH, et al. Management of invasive frontoetmoidal sinus mucocoeles. *Am J Otolaryngol.* 2007;28:145-7.
5. Soon SR, Lim CM, Singh H et al. Sphenoid sinus mucocoele: 10 cases and literature review. *J Laryngol Otol.* 2010;124:44-7.
6. Herndon M, McMains KC, Kountakis SE. Presentation and management of extensive fronto-orbital-ethmoid mucocoeles. *Am J Otolaryngol.* 2007;28:145-7.
7. Zukin LM, Hink EM, Liao S, et al. Endoscopic Management of Paranasal Sinus Mucocoeles: Meta-analysis of Visual Outcomes. *Otolaryngol Head Neck Surg.* 2017;157:760-6.
8. Plantier DB, Neto DB, Pinna FR, et al. Mucocoele: Clinical Characteristics and Outcomes in 46 Operated Patients. *Int Arch Otorhinolaryngol.* 2019;23:88-91.
9. Khong JJ, Malhotra R, Wormald PJ et al. Endoscopic sinus surgery for paranasal sinus mucocoele with orbital involvement. *Eye* 2004;18:877-81.
10. Har-El G. Transnasal endoscopic management of frontal mucocoeles. *Otolaryngol Clin North Am.* 2001;34:243-51.
11. Haug GA, Dortzbach RK, Brandenburg J. Treatment of frontal sinus mucocoeles with the osteoplastic flap technique. *Ophthalmic Surg.* 1978;9:40-66.
12. Park CM, Stoffella E, Gile J, et al. Osteoplasty Flap Technique for Repair of Latent (30-Year) Post-Traumatic Frontal Sinus Mucocoele: Case Report and Review of the Literature *J Oral Maxillofac Surg.* 2012;70:2092-6.
13. Courson AM, Stankiewicz JA, Lal D Contemporary Management of Frontal Sinus Mucocoeles: A Meta-Analysis. *Laryngoscope.* 2014;124:378-86.
14. Serrano E, Klossek JM, Percodani J, et al. Surgical management of paranasal sinus mucocoeles: a long term study of 60 cases. *Otolaryngol Head Neck Surg.* 2004;131:133-40.
15. Meetze K, Palmer JN, Schlosser RJ. Frontal sinus complications after frontal craniotomy. *Laryngoscope.* 2004;114:945-8.