Rhinology, 46, 70-74, 2008

Frontal sinus obliteration - a successful treatment option in patients with endoscopically inaccessible frontal mucoceles*

J. Kristin, C.S. Betz, K. Stelter, A. Berghaus, A. Leunig

Department of Otorhinolaryngology, Head and Neck Surgery, University of Munich, Klinikum Grosshadern, Munich, Germany

SUMMARY

Objective: *This study evaluates non-standardized subjective patient satisfaction- and clinical outcome variables following frontal sinus obliteration with abdominal fat in endoscopically inaccessible mucoceles.*

Methods: *In a retrospective chart review, all patients who underwent frontal sinus obliteration for endoscopically inaccessible mucoceles at the Ludwig Maximilian University in Munich between 1996 and 2006 were identified and the postoperative outcomes were evaluated by a non-standardized patient questionnaire rating the degree of symptoms before and after surgery. Additionally, the postoperative clinical status and MRI-scans were analysed in a subgroup of patients.*

Results: *Nine out of 10 patients were generally satisfied with the obliteration. Most had a significant improvement in their main symptoms and reported a decrease in annual days of missed work and a reduced use of disease-specific drugs. The sense of smell and the intensity of postnasal dripping remained subjectively unchanged. Seventy percent of patients complained about temporary pain at the abdominal donor side.*

Conclusions: *Based on these results, osteoplastic frontal sinus obliteration using abdominal fat seems to be a successful treatment option in patients in whom mucoceles of the frontal sinus are not endoscopically accessible.*

Key words: frontal sinus, mucocele, obliteration

INTRODUCTION

Since the advance of endoscopic techniques in the 1980's, the interest in minimally invasive techniques as a way to treat patients with frontal sinus pathologies has risen considerably [1-3]. In complicated cases, however, open approaches remain a useful treatment option. Following prior trauma, extensive surgery or radiation therapy as well as in cases with a narrow anterior-posterior diameter of the frontal recess, a highly compartmentalized frontal sinus, a large, septated frontal sinus or with mucoceles that are situated within the lateral aspect of the frontal sinus, open frontal sinus surgery in combination with an obliterative procedure is appropriate. Although there are an increasing number of materials that have been described for obliteration, autologous fat remains the gold standard. Rohrich and Mickel [4] noted that there are several essential principles to be followed for success: careful removal of all visible frontal sinus mucosa (causing possible relapse), removal of the inner cortex of the sinus wall and permanent occlusion of the frontal recess. In addition, damage to the supraorbital nerve should be avoided to reduce postoperative morbidity. Several authors have evaluated the patients' satisfaction following frontal sinus obliteration using subjective and objective outcome variables for common diagnoses such as chronic sinusitis [5-8], but none of these have specifically focussed their investigations on patients with frontal sinus mucoceles. In this study, we present our current experiences (mostly from a patients' perspective) in cases of frontal sinus obliterations that were performed to treat endoscopically inaccessible frontal sinus mucoceles. The patient-rated outcome is presented and discussed in order to evaluate the efficacy and benefit of this procedure in clinical reality.

MATERIAL AND METHODS

Patients and procedures

For the time period between January 1996 and August 2006, patient admission and operative procedure lists of the Department of Otorhinolaryngology at the Ludwig Maximilian University in Munich, Germany, were scanned for patients who had undergone osteoplastic frontal sinus obliteration for the treatment of a frontal sinus mucocele that was inaccessible to an endoscopic approach. The decision to operate was based on an evaluation of the patient's history, physical examination, clinical course and status, and a preoperative MRI and / or CT

*Received for publication: May 24, 2007; accepted: November 15, 20077

scan in each case. A bicoronal approach with a subperiosteal dissection down to the supraorbital rims is normally recommended to access the frontal sinus. In our patients, scars from previous external sinus procedures (usually eyebrow approaches), were commonly re-used for access.

Survey

A questionnaire rating the degree of symptoms on a visual analogue scale (VAS) of 0 to 10 (with 0 being equal to "no symptoms" and 10 being equal to "highest imaginable intensity of the symptoms") pre- and post obliteration was sent out to the patients. Informed consent for the inclusion into the survey was obtained from all patients.

RESULTS

A total of 11 patients that fulfilled the above mentioned criteria were identified out of a total of more than 7.000 sinus procedures within the defined time period. Out of these, 10 patients (8 males, 2 females) answered the questionnaire and were therefore included into the evaluation. The mean age of these 10 patients was 42.3 years (range 36 – 65 years) at the time of surgery, and the questionnaires were completed after a mean postoperative period of 15,5 months (range 3 –19 months).

All 10 patients had recurrent or persistent, lateralized mucoceles within the frontal sinus. The most common symptoms were chronic, pressure-like pain in the forehead region (n=10), generalised malaise (n=10) and constant nasal obstruction (n=10) (Table 1). The average VAS ratings preoperatively for these symptoms were 7.6 points vs. 0.94 postoperatively for the pressure-like frontal pains, 6.1 points vs. 0.94 points for generalised malaise and 5.2 points vs. 2.0 points for the constant nasal obstruction.

The subjectively rated intensity of disease-specific symptoms decreased postoperatively for all main symptoms except for hyposmia (Table 2, Figures 1 and 2). The overall postoperative outcome (consisting of both the improvement in preoperative complaints and the cosmetic result) was 0.6 points (scale from 0 to 10, where 0 is the best result). Ten out of 10 patients had a subjective improvement of their symptoms; none reported a worsening of any of their disease-specific symptoms. Postoperatively, all patients presented various frontal sensitivity disorders such as localized numbness (60%) or pruritus (30%) of variable intensity (Table 3). A limitation in raising the eyebrows was rare (2 out of 10 patients), but affected the patients more than the other postoperative symptoms. In these cases, a partial paralysis of the facial nerve due to a possible, intraoperative damage must be considered. In one case, a patient reported postoperative shooting pain attacks consistent with a neuralgic syndrome of the supraorbital nerve region, and another patient complained of hypohidrosis of the operated forehead side. More than half of the patients (7 out of 10) complained about symptoms at the abdominal donor site such as hardening of soft tissue, pain on palpation or pruritus during the first months following surgery (median: 1.5 months). No significant cosmetic deformities were reported by the patients; no loss of hair was documented.

As expected, most patients had been treated both conservatively (7 out of 10) and surgically (10 out of 10) for their sinus disease before the osteoplastic frontal sinus obliteration was

Table 1. Pre- and postoperative symptoms related to the frontal sinus mucoceles, broken down by the number of patients affected*.

Symptom	preoperative	postoperative
Pressure-like pain	10	02
Reduction of general condition	10	03
Nasal obstruction	10	06
Headache	08	03
Chronic / recurrent sinusitis	08	--
Tiredness	05	02
Postnasal dripping	04	04
Hyposmia	04	04
Reduced orbital motility	03	02
Diplopia	01	--

* Data as subjectively provided by the patients using a non-standardized questionnaire.

Table 2. Pre- and postoperative symptoms related to the frontal sinus mucoceles (n=10), broken down by the mean subjective intensity as rated on a VAS (0 to 10)**.

Symptom	preoperative	postoperative
Pressure-like pain	7,6	0,9
Reduction of general condition	6,1	0,9
Nasal obstruction	5,2	2,0
Headache	5,0	0,8
Tiredness	2,8	0,8
Postnasal dripping	3,0	1,3
Hyposmia	2,9	2,9
Reduced orbital motility	1,2	0,1

** Data as subjectively provided by the patients using a non-standardized questionnaire including visual analogue scales (VAS). Mild: VAS 0-3, Moderate: VAS >3-7, Severe: VAS >7-10.

Table 3. Surgery-related symptoms and unwanted effects following frontal sinus obliteration (n=10), broken down by number of patients affected and mean subjective intensity as rated on a VAS (0 to 10)***.

Symptom	Number of patients	Intensity
Frontal numbness	05	4,0
Frontal pruritus	03	4,3
Impeded raising of eyebrows	02	7,5
Frontal tension	02	5,5
Inflammation of the frontal scar	01	4,0
Frontal hypersensitivity	01	3,0
Frontal hypohidrosis	01	
Frontal neuralgic syndrome	01	
Abdominal scar	07	
(Hardening of soft tissue, pain on palpation or pruritus)		

*** Data as subjectively provided by the patients using a non-standardized questionnaire including visual analogue scales (VAS). Mild: VAS 0-3, Moderate: VAS >3-7, Severe: VAS >7-10.

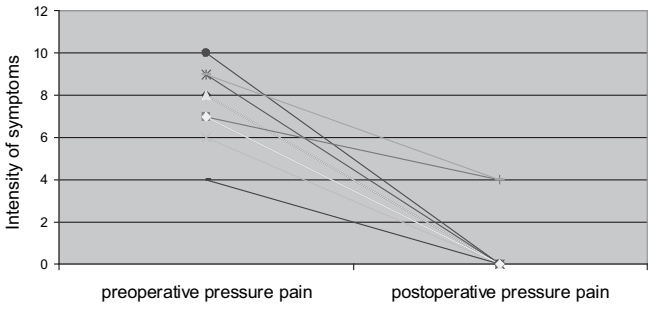

Figure 1. Intensity of pressure-like frontal pain before and after surgical obliteration.

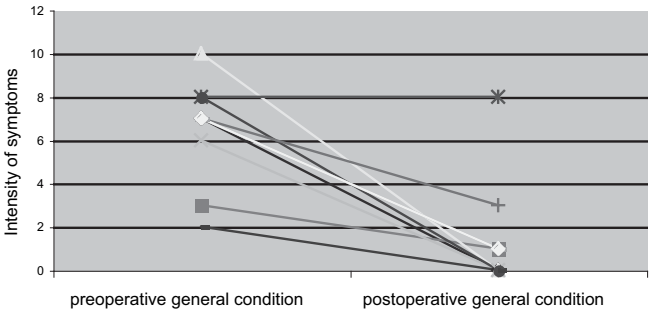

Figure 2. Intensity of the felt reduction of the general condition before and after obliteration.

performed. A large percentage has been persistently or recurrently treated with antibiotics (50%) and topical steroids (70%). Postoperatively, the use of antibiotics was reduced from 2.5 courses / year to 0. Patients had a mean of 3.2 (range 1 to 10) previous paranasal sinus procedures prior to their frontal sinus obliterations. The total number of days off work per year attributable to their disease decreased from an average of 25.6 days to 0 days. The operative procedures themselves took from 90 minutes to 3 hours, the days of hospitalization ranged from 8-11 days. All patients were back to work within less than 4 weeks following surgery.

In general, 9 out of 10 patients were satisfied with the outcome of this procedure, with all of them indicating that they would choose to undergo the frontal sinus obliteration again if faced with a similar situation. All 10 patients would also recommend it to others.

DISCUSSION

Only a few studies so far have assessed subjective, patient based outcomes following osteoplastic frontal sinus obliteration. These publications referred to larger, mixed groups of patients with chronic sinusitis, trauma or neoplasia as underlying conditions [5-6, 9-10]. In these studies, mucoceles accounted for a smal subgroup and were not specifically evaluated. This study presents a patient-based evaluation of the operative outcome following frontal sinus obliteration for endoscopically - inaccessible mucoceles of the frontal sinus.

Today, the treatment of frontal sinus pathology is usually accomplished with endoscopic techniques [11-16], but in rare cases such as endoscopically inaccessible mucoceles that are located within the lateral aspect of the frontal sinus, obliteration is still a valid alternative treatment option [17-19]. A survey focusing on the current management of frontal sinus disease in the United Kingdom showed that 54% of the surgeons are using an external approach to treat frontal sinus mucoceles independent of their location; only 39% attempt an endoscopic drainage if the cyst lies sufficiently close to the midline [20]. Correa [21] stated that patients with a narrow anterior-posterior diameter of the frontal recess, a highly compartmentalized frontal sinus, an extensive polypoid degeneration of the frontal sinus mucosa or those with highly thickened secretions are candidates for obliteration. Mucoceles in our group of patients were located laterally in the frontal sinus and therefore could not be accessed endoscopically. In our study, patients had undergone up to 10 previous endoscopic procedures each (range 1 to 10) without any significant improvement, and it was therefore decided to perform an obliterative procedure using abdominal fat via an open approach. This decision is supported by Anand et al. [22], who concluded, in a study published in 2005, that patients at a high risk of recurrence should be considered for osteoplastic frontal sinus surgery, if a prior endoscopic approach had failed.

As described in the current literature, successful frontal sinus obliteration requires meticulous removal of all visible sinus mucosa and the inner cortex of the sinus wall. Furthermore, a permanent occlusion of the frontal recess that subsequently forms an osseous or fibrous barrier between the obliterated sinus and the nasal cavity is mandatory [4, 23]. In the literature, a wide variety of implant materials for obliteration has been described, and the discussion concerning the ideal material (i.e. autologous materials or synthetics) is still ongoing. Currently, autologous fat transplantation [24, 25] is regarded as the gold standard and the material with the largest experimental base.

The main symptoms of our patients were similar to those found in previous clinical trials on frontal sinus treatment. Pressure-like pain, nasal obstruction and generalised malaise were the chief complaints in our group of patients. We found an impressive reduction in the average score postoperatively in all subjective outcome variables tested (Tables 1 and 2). The intensity of all chief symptoms decreased, except for hyposmia. Mendians et al. [5] has previously reported a high rate (82%-95%) of improvement of headache, chronic discharge and chronic nasal congestion after frontal sinus obliteration for a heterogeneous population (n=19 patients; n=2 mucoceles). In another study [6] on chronic sinusitis (n=39 patients; n=7 mucoceles), only 43,5 % of the patients described the obliteration they had undergone as the most beneficial form of all their prior therapies (antibiotics, steroids, prior sinus surgery).

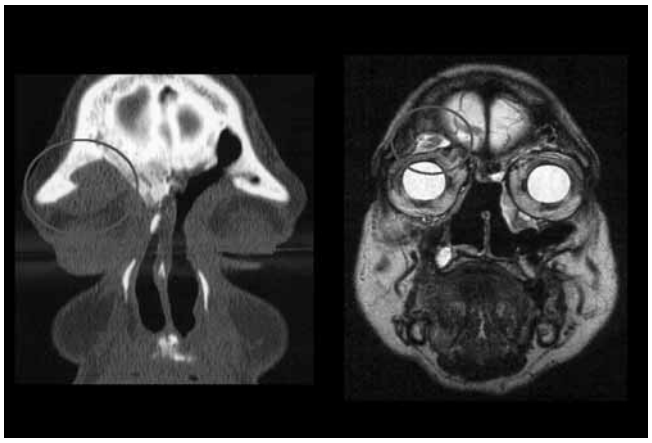

Figure 3. Axial image of a frontal mucocele before obliteration (left); postoperative abdominal fat graft within the frontal sinus approximately 1 year after surgery (right).

In comparison, 90% of our patients were highly satisfied with the result of this procedure, and all 10 patients indicated that they would undergo frontal sinus obliteration again if faced with a similar situation. We feel that this discordance might be due to the fact that mucoceles are distinct, localized forms of pathology, whereas chronic sinusitis affects larger areas of the mucosal lining of the sinuses and is usually not restricted to the frontal sinus. This stands in agreement with the above mentioned study of Alsarraf et al. [6], where the authors found that "non-chronic sinusitis patients faired much better than chronic sinusitis subjects, with 100% decrease in clinic visits, 75% decrease in medication use, and 0% requiring revision surgery" (n=39 patients in total; n=11 non-chronic sinusitis patients; n=7 patients with mucoceles).

A large percentage of our patients had been treated with antibiotics and topical steroids proceeding surgery. The use of antibiotics could be reduced from an average of 2 to 3 courses per year to none. The total number of days of missed work due to disease-related symptoms decreased from approximately 26 days per year to none within the follow-up period (median: 15.5 months). Furthermore, in most of our patients, multiple prior attempts to resolve their symptoms with an endoscopic approach had already failed. Only after the obliterative procedure was performed, these patients were relieved from their main, disease-related symptoms, and at least so far there was no need for revision surgery in any of the 10 patients. These results are comparable to Moshaver et al. [26], who reported highly satisfying, long-term results after frontal sinus obliteration with pericranial flaps in 4 patients with frontal sinus mucoceles.

A general disadvantage of the described method as compared with an endonasal approach is the more complex and invasive surgical technique and a slightly increased morbidity associated with the removal of abdominal fat. Many patients complained about problems such as soft tissue hardening, pain on palpation and pruritus at the abdominal donor-side for the first 4 weeks following surgery, with all these symptoms resolving spontaneously afterwards. In almost every patient a visible eyebrow scar remained after surgery, but none of these were rated as cosmetically bothersome by the patients. Some of the previous sinus procedures partly dated back to 1980's; therefore, these patients had already some form of eyebrow incision that was reopened and used for access. The supraorbital nerve was avoided and preserved by microscopic magnification during dissection. In cases without a preexisting scar at the eyebrow, we would follow current recommendations and use a bicoronal incision for access. As witnessed in our study, the open approach carries the risk of new, surgery-related complications such as reduced ability to raise the ipsilateral eyebrow (n=2), neuralgic symptoms of the supraorbital nerve region (n=1) or the induction of a hypohidrosis on the operated forehead side (n=1). In a study on patients suffering from frontal sinus mucoceles (n=54 patients in total; n=16 patients where abdominal fat was used for obliteration), Taghizadeh et al. [27] found that short term swelling and localized pain were the most common complications after frontal sinus obliteration with fat. Adverse events that occurred only in a small number

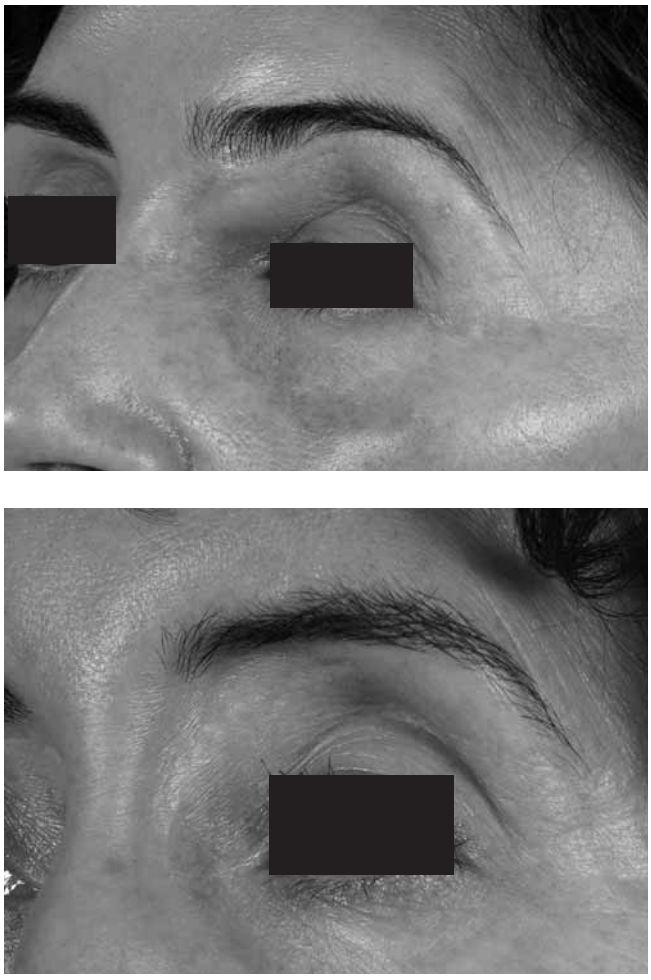

Figure 4. Photography of patient before (upper) and after (lower) surgery.

of patients in that study included supraorbital hypoesthesia, abdominal complications, and one case of a contouring defect of the frontal bone. In the cited study, two out of 12 patients developed recurrent mucoceles following frontal sinus obliteration with abdominal fat after 4 and 6 years, respectively. In a presentation of 250 cases, Hardy and Montgomery [25] described an overall complication rate of 18% after obliteration, including recurrent disease, infection of the fat graft, cerebrospinal fluid leak and abdominal wound complications. Furthermore, they described a revision rate of 5%. This stands in agreement with the results of Mendians et al. [5], who reported no major surgical complications but also had a revision rate of 5%, however without significant findings. As the number of treated patients in the presented study is fairly low and the follow-up period was only 15.5 months in the mean, the data does not allow percentage estimations of complication- or long-term recurrence rates. The short-term outcome however, was very good and highly motivating for the treating surgeons, even more so if one takes into account the long list of failed previous therapeutic attempts.

CONCLUSION

In summary, frontal sinus obliteration continues to be a valuable treatment option in selected patients with endoscopically inaccessible mucoceles. In our group of patients (n=10), we found relatively low morbidity, no severe complications and an excellent patient satisfaction. The patients had a significant improvement in all their disease-related symptoms (pressure-like pain in the frontal region, general condition, nasal obstruction), though a much longer follow-up period (ideally 10 years) is necessary before the long-term outcome can be assessed. On the basis of our results, we can recommend frontal sinus obliteration for appropriate cases of frontal sinus mucoceles.

REFERENCES

1. Ung F, Sindwani R, Metson R. Endoscopic frontal sinus obliteration: a new technique for the treatment of chronic frontal sinusitis. Otolaryngol Head Neck Surg. 2005; 133: 551-555.
2. Rice D. Chronic frontal sinus disease. Otolaryngol Clin North Am. 1993; 26: 619-622.
3. Schaefer S, Close L. Endoscopic management of frontal sinus disease. Laryngoscope. 1990; 100: 155-160.
4. Rohrich R, Mickel T. Frontal sinus obliteration: in search of the ideal autogenous material. Plast Reconstr Surg. 1995; 95: 580-585.
5. Mendians A, Marks S. Outcome of frontal sinus obliteration. Laryngoscope. 1999; 109: 1495-1498.
6. Alsarraf R, Kriet J, Weymuller E. Quality-of-life outcomes after osteoplastic frontal sinus obliteration. Otolaryngol Head Neck Surg. 1999; 121: 435-440.
7. Weber R, Draf W, Keerl R, Constantinidis J. Aspects of frontal sinus surgery. III: Indications and results of osteoplastic frontal sinus operation. HNO. 1995; 43: 414-420. German.
8. Ulualp S, Carlson T, Toohill R. Osteoplastic flap versus modified endoscopic Lothrop procedure in patients with frontal sinus disease. Am J Rhinol. 2000; 14: 21-26.
9. Weber R, Draf W. Osteoplastische Stirnhöhlenoperation mit Obliteration. HNO. 1998; 46: 900-902.
10. Bottermann B, Berghaus A. Obliterierende Stirnhöhlenoperation mit Bauchfett. HNO. 1998; 46: 919-924.
11. Wormald P, Ananda A, Nair S. Modified endoscopic lothrop as a salvage for the failed osteoplastic flap with obliteration. Laryngoscope. 2003; 113: 1988-1992.
12. Landsberg R, Segev Y, Friedman M, Fliss D, Derowe A. A targeted endoscopic approach to chronic isolated frontal sinusitis. Otolaryngol Head Neck Surg. 2006; 134: 28-32.
13. Langton-Hewer C, Wormald P. Endoscopic sinus surgery rescue of failed osteoplastic flap with fat obliteration. Otolaryngol Head Neck Surg. 2005; 13: 45-49.
14. Wormald PJ. Surgery of the frontal recess and frontal sinus. Rhinology. 2005; 43: 82-85.
15. Bockmühl U, Kratzsch B, Benda K, Draf W. Surgery for paranasal sinus mucoceles: efficacy of endonasal micro-endoscopic management and long-term results of 185 patients. Rhinology. 2006; 44: 62-67.
16. Eviatar E, Katzenell U, Segal S, Shlamkovitch N, Kalmovich LM, Kessler A, Vaiman M. The endoscopic Draf II frontal sinusotomy: non-navigated approach. Rhinology. 2006; 44: 108-113.
17. Goodale R, Montgomery W. Experiences with the osteoplastic anterior wall approach to the frontal sinus. Arch Otolaryngol. 1958; 68: 271-283.
18. Goodale R, Montgomery W. Anterior osteoplastic frontal sinus operation: five years experience. Ann Otol Rhinol Laryngol. 1961; 70: 860-880.
19. Goodale R, Montgomery W. Technical advances in osteoplastic frontal sinusectomy. Arch Otolaryngol. 1964; 79: 522-529.
20. Molony N, Ah-See K, Rachmanidou A, Draf W. A survey of contemporary management of frontal sinus disease in the United Kingdom. Eur Arch Otorhinolaryngol. 2000; 257: 247-250.
21. Correa A, Duncavage J, Fortune D, Reinisch L. Osteoplastic flap for obliteration of the frontal sinus: five years' experience. Otolaryngol Head Neck Surg. 1999; 121: 731-735.
22. Anand V, Hitzik D, Kacker A, Honrado C. Osteoplastic flap for frontal sinus obliteration in the era of image-guided endoscopic sinus surgery. Am J Rhinol. 2005; 19: 406-410.
23. Kennedy D, Bolger W, Zinreich S. Diseases of the sinuses: diagnosis and management. Hamilton, London: B.C. Decker Inc, 2001.
24. Weber R, Draf W, Keerl R, Kahle G, Schinzel S, Thomann S, Lawson W. Osteoplastic frontal sinus surgery with fat obliteration: technique and long term results using magnetic resonance imaging in 82 operations. Laryngoscope. 2000; 110: 1037-1044.
25. Hardy J, Montgomery W. Osteoplastic frontal sinusotomy: an analysis of 250 operations. Ann Otol Rhinol Laryngol. 1976; 85: 523-532.
26. Moshaver A, Harris J, Seikaly H. Use of anteriorly based pericranial flap in frontal sinus obliteration. Otolaryngol - Head Neck Surg. 2006; 135: 413-416.
27. Taghizadeh F, Kromer A, Laedrach K. Evaluation of hydroxyapatite cement for frontal sinus obliteration after mucocele resection. Arch Facial Plast Surg. 2006; 8: 416-422.

Andreas Leunig, MD.
Department of Otorhinolaryngology
University of Munich
Klinikum Grosshadern
Marchioninistr. 15
81366 Munich
Germany

Tel: +49-(089)-7095-0
Fax: +49-(089)-7095-5884
E-mail:
andreas.leunig@med.uni-muenchen.de