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The endoscopic management of sphenoid and ethmoid mucoceles with orbital and intranasal extension*†

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SUMMARY

Mucoceles of the sphenoidal and ethmoidal sinuses act as benign neoplasms and can result in bony erosion extending from within the confines of the sinuses into the intracranial and orbital spaces. Endoscopic management of such mucoceles has been debated, and, by some, considered a radical form of therapy. A review of consecutive patients with sinus mucoceles revealed eight sphenoid and six ethmoid mucoceles. Four of these were confined to the sinuses and 11 extended outside of the confines of the sinuses. There were four with intracranial extension, two with orbital extension, three with both intracranial and orbital extension, and two involving the clivus. All 15 patients were managed with endoscopic decompression. Two patients with ethmoid-frontal mucoceles also had frontal sinus obliteration, via an osteoplastic flap along with sphenoethmoidal decompression with an endoscopic approach. Thirteen patients had more than one year of follow-up. Two patients with ethmoid mucoceles with intracranial extension had recurrences of the mucoceles which again have been decompressed endoscopically. There were no orbital or intracranial complications in relationship to these procedures or from the mucoceles. Symptoms related to the mucoceles including loss of vision and severe headaches were resolved with decompression. The endoscopic management of sphenoid and ethmoid mucoceles with orbital and intracranial extension is a safe and reliable approach, obviates the need for major intracranial surgery and diminishes post-operative morbidity. Close follow-up is necessary and secondary decompression can be accomplished should the mucocele recur.

Key words: mucoceles, sinus, endoscopy, intraorbital, intracranial

INTRODUCTION

Sinus mucoceles can occur as a result of trauma, chronic nasal-sinus disease, following sinus surgery or sinus obstruction. Gradual enlargement with known ischaemia and osteolytic enzymes and mediators (Nicolai et al., 1991; Lund et al., 1993) can result in bone destruction allowing expansion into adjacent structures (such as the sinuses and the orbit) or intracranially. Aggressive management of mucoceles with orbital or intracranial extension has been advocated (Neel et al., 1987; Moriyama et al., 1992). Recent reviews have suggested excellent control with intranasal endoscopic management (Kennedy et al., 1989; Wigand and Hosemann, 1991). Although well established in surgical treatment of frontal sinus mucoceles (Kennedy et al., 1989), the success of endoscopic management of sphenoid or ethmoid mucoceles has been reported in only a small number of patients and infrequently, in those with orbital or intracranial sequelae.

The authors reviewed their experience at two institutions in an effort to assess the effectiveness of intranasal endoscopic treatment of sphenoid and ethmoid mucoceles with orbital or intracranial invasion.

METHODS

A retrospective review of all patients with sphenoid and ethmoid mucoceles who underwent endoscopic decompression over the previous three years in the authors' practices at the Henry Ford Hospital and the Detroit Medical Centre was undertaken. The mucoceles had to primarily occur in the ethmoidal or sphenoidal sinuses. However, extensions from primary ethmoid mucoceles into the frontal sinus were included.

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Frontal sinus mucoceles isolated to the sinus or with extension into the orbit, intracranially, or into the ethmoid sinus were excluded. All patients underwent post-operative documentation of the success of decompression by endoscopic office evaluation with or without CT- or MRI scan confirmation.

RESULTS

Fifteen patients were identified with a sphenoid or ethmoid mucocele having undergone endoscopic decompression. There were 10 females and five males. The most common presentation was significant facial or head pain which occurred in 11 patients and/or visual changes which were noted in six patients. Five of the latter were identified to have either limitation of gaze or progressive visual loss. In addition, five patients had presenting complaints of nasal obstruction and four with rhinorrhoea. Five patients had previous sinus surgery. One patient had previous endoscopic sinus surgery and two years later developed a large ethmoid-frontal-orbital-intracranial mucocele. One had an intranasal ethmoidectomy and developed a frontal ethmoid-orbital mucocele three years later. One patient had a history of a frontal craniotomy ten years prior for a pituitary adenoma and a re-exploration for possible recurrence one year prior to development of symptoms. One patient had a previous medial maxillectomy for an inverted papilloma. One patient had a previous history of head trauma. An additional patient was status post-gunshot wound to the mid-face which resulted in blindness in his right eye and presented with two independent mucoceles, one in the frontal sinus extending intracranially and a separate mucocele in the ethmoidal sinus extending into the orbit and intracranially. Five patients had a history of chronic sinusitis with nasal polyposis. Two of these are the patients who developed mucoceles following previous sinus surgery.

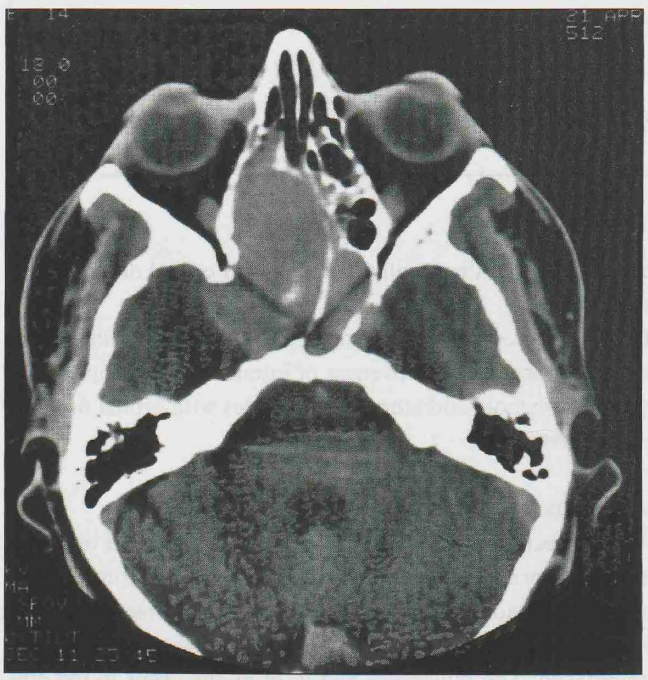
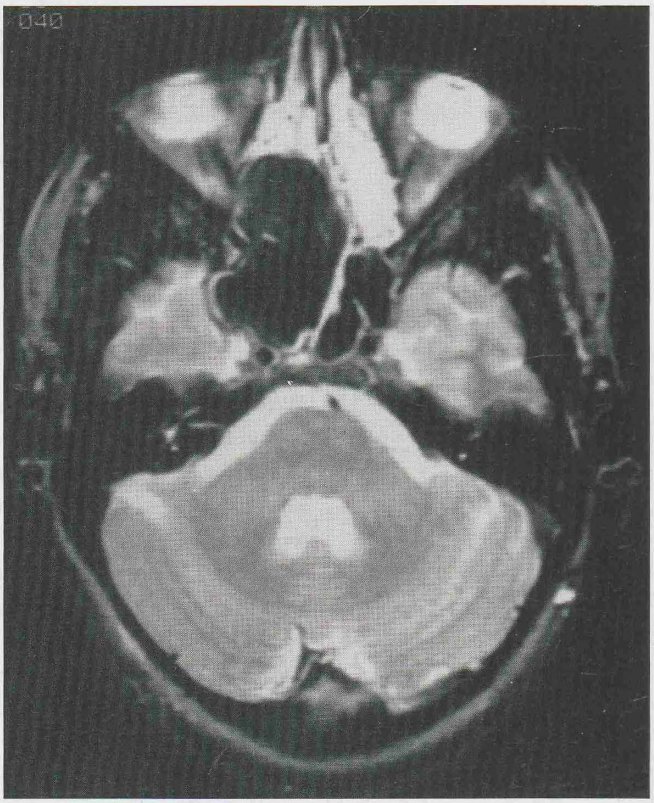


Figure 1. Axial CT scan of sinuses showing expansile mucocele involving sphenoidal and ethmoidal sinuses with intracranial extension through lateral wall of sphenoid sinus into the cavernous sinus.

The primary location of the mucoceles were the sphenoidal sinus in eight patents and the ethmoidal sinus in seven patients (Figures 1–3). Two of these patients had large ethmoid mucoceles which had extended into the frontal sinuses. However, in



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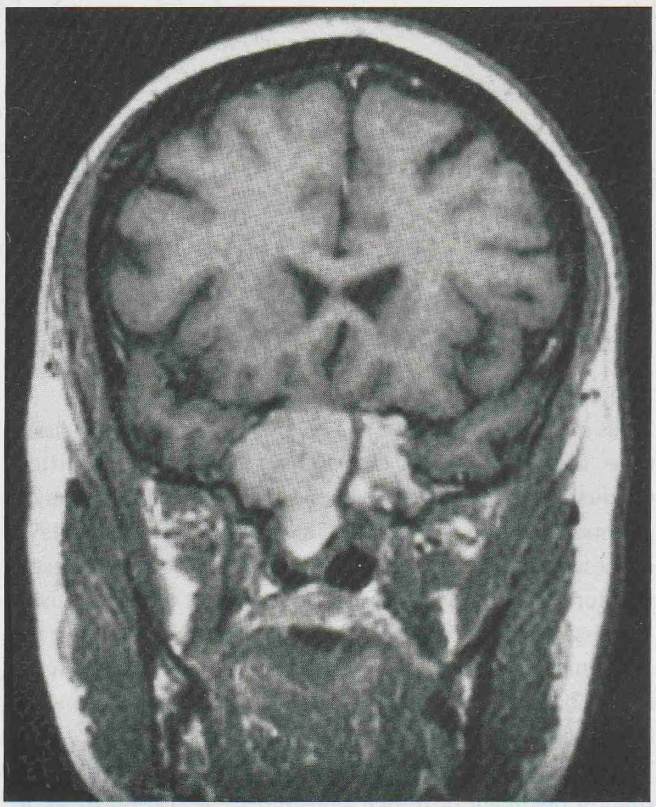

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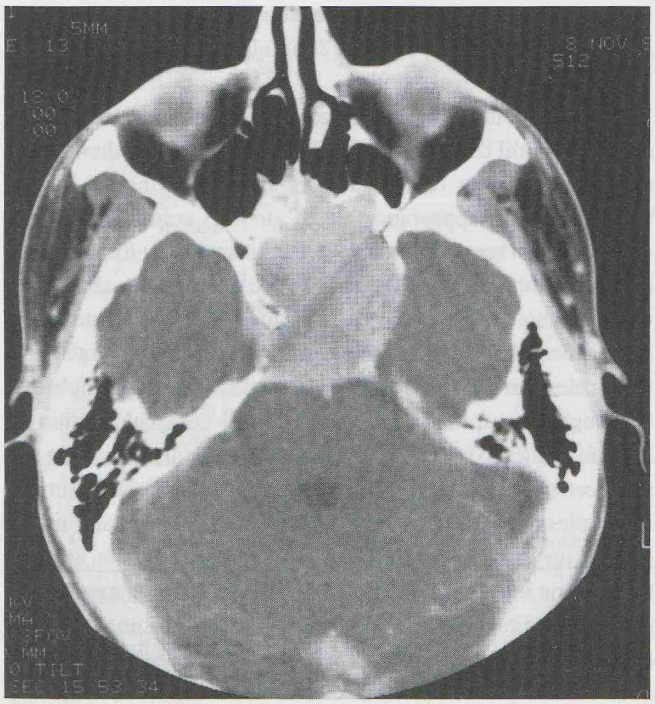
Figure 2. MRI images revealing expansile mass occupying the sphenoid and ethmoid sinuses; (a) axial T_2-weighted MRI scan; (b) coronal T_1-weighted MRI scan.



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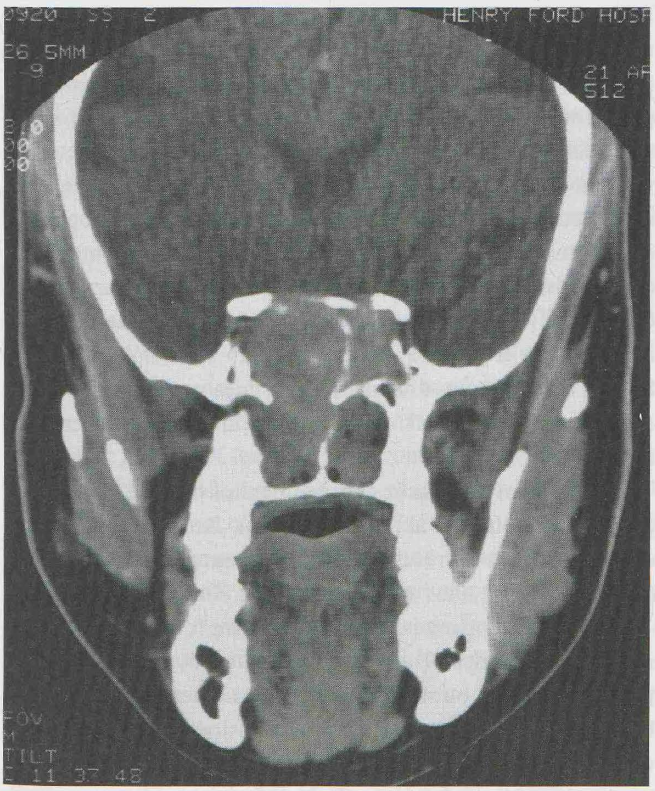


b.

Figure 3. CT scans of paranasal sinuses showing expansile sphenoid/ethmoid mass extending intracranially into the cavernous sinus (a: axial; b: coronal).

both of these, some frontal sinus aeration was still present. There were four cases of intracranial extension, three with orbital extension, three with both intracranial and orbital extension, and two cases with erosion of the clivus, one of which had intracranial extension. Only four patients had mucoceles limited to the sinuses.

All of the mucoceles were decompressed via an endoscopic surgery approach. For the isolated sphenoid sinus mucoceles, an anterior and posterior ethmoidectomy was accomplished followed by anterior decompression of the sphenoid mucoceles leaving mucocele wall on the posterior, superior and lateral sphenoid walls. The ethmoid mucoceles were marsupialized widely leaving mucocele lining on exposed dura or periorbital. Small ethmoid mucoceles confined to the sinus were endoscopically removed in their entirety. Two patients with large ethmoid mucoceles with extension into the frontal sinus were treated with combined endoscopic decompression from below and frontal sinus osteoplastic flaps with fat obliteration of the frontal sinus. One of these had extension both intracranially and into the orbit, and the other had extension into the medial and superior aspects of the orbit creating the perceived need for an osteoplastic flap.

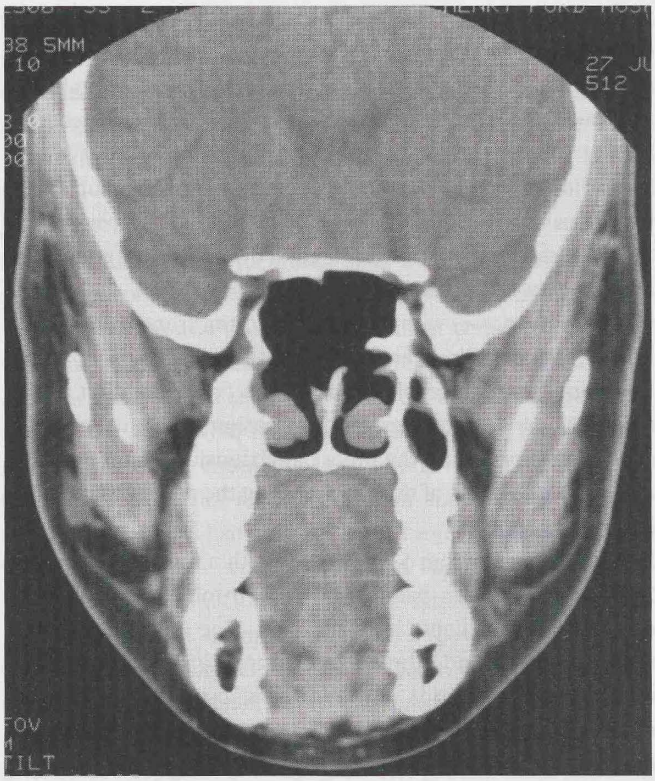
Follow-up ranges from 5–40 months with a mean follow-up of 20 months. Thirteen patients have been followed for at least one year. Two patients have recurred. One has subsequently undergone a second ethmoid decompression for his ethmoid mucocele with anterior intracranial extension. He is now 24 months after the last operation with no evidence of recurrent mucocele. The other patient who had suffered the gunshot wound to the eye, has also had recurrence of his ethmoid mucocele. He has had a subsequent decompression and is presently disease free. One patient had a small inverted papilloma that was identified in the pathology report following surgery for the mucocele. She has subsequently had evidence of inverted papilloma persistence or recurrence, however, has refused recommendations for further surgical treatment. No recurrence of mucocele has occurred.

Nine patients have had follow-up radiological evaluation of the sinuses. Two patients have had CT scan evidence of recurrence. Five follow-up CT scans and two MRIs have revealed no evidence of recurrence (Figure 4). The remaining six patients have been able to be evaluated satisfactorily by nasal sinus office endoscopy with no evidence of recurrence. Overall, 13 of 15 patients (87%) have had satisfactory treatment of their mucoceles endoscopically. With the long-term resolution of the mucocele in the additional two patients who had early recurrence, results in an overall 100% success rate for endoscopic decompression.

There have been no complications in any patient despite the high proportion with intracranial and/or orbital extension. The symptoms related to orbital involvement have resolved in all patients. In addition, all patients with mid-facial or head pain have had resolution of their symptoms with decompression.

DISCUSSION

Mucoceles of the nose and perinasal sinuses are common sequelae of sinus obstruction from chronic rhinosinusitis, mucosal hyperplasia or nasal polyps (Holt et al., 1984; Davis et al., 1993). Facial trauma, particularly to the ethmoidal and frontal sinuses have long been associated with extensive mucoceles expanding beyond the boundaries of the sinuses into the orbit, through the anterior frontal table (Pott's puffy tumour) or



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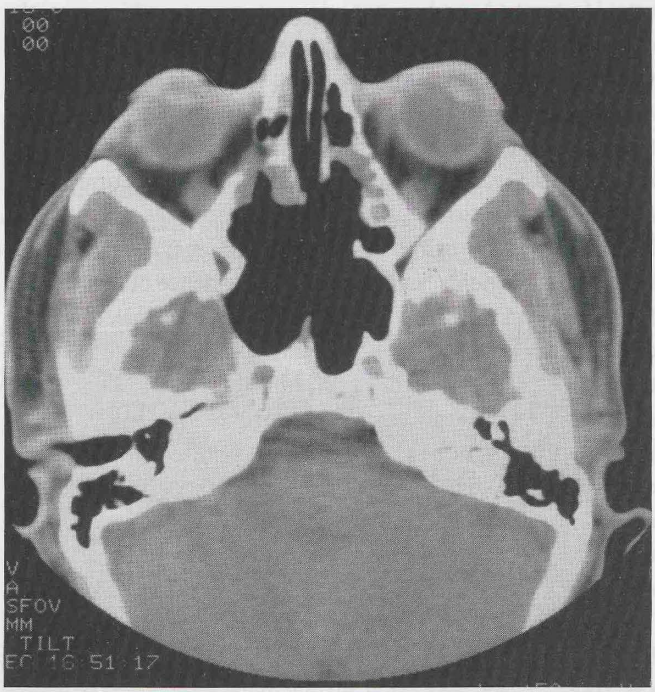

b.

Figure 4. Post-operative CT scans of paranasal sinuses of patient shown in Figure 3 showing complete mucocele decompression (a: coronal; b: axial).

through the fovea ethmoidalis, cribriform plate or posterior frontal table into the intracranial cavity. Previous sinus surgery with secondary obstruction of sinus outflow and mucociliary transport can result in mucocele development (Moriyama et al., 1992; Hasegawa and Kuroishikawa, 1993; Lawson, 1994), while frontal sinus mucoceles may be one of the delayed complications of functional endoscopy sinus surgery (FESS). Sphenoid mucoceles can be found in association with chronic ethmoidal sinusitis and/or nasal polyposis although are uncommon in isolation (Daniilidis et al., 1993).

The natural course of sinus mucoceles is for continued gradual expansion until the limits of the sinus is reached. Further expansion results in bony remodelling and bulging, giving the characteristic concave appearance noted on CT scanning. Further expansion can result in bone erosion and extension into adjacent structures such as the other sinuses, the orbit, clivus, skull base, or intracranially (Figures 1-3). The cause of bony destruction in large mucoceles has been debated. With gradual enlargement, mucoceles can erode through bone to pass into adjacent areas. Although pressure-induced osteolysis and devascularization of bone may play an important role, osteolytic mediators within the mucoceles is more likely to account for the aggressive nature of mucoceles (Lund et al., 1993). This effect may be greater in the face of an active infection. Infection may precipitate an eye-threatening intra-orbital infection or life-threatening meningitis, subdural or brain abscess (Wells et al., 1986). Fortunately, such infections are rare and urgent treatment of mucoceles is generally unnecessary. Nonetheless, surgical treatment of all identified mucoceles should be recommended.

Plain sinus radiographs may give evidence of mucocele formation although are fraught with inaccuracies of diagnosis when assessing sinus disease (Benninger et al., 1990). CT scans are preferable for definitive evaluation, assessment of bony involvement and pre-surgical planning (Kennedy et al., 1989). MRI scans are helpful in evaluation of intracranial and orbital extension. Occasionally, large mucoceles can mimic sinus neoplasms on CT scans, and T_1- and T_2-weighted MRI images may give characteristic findings consistent with a mucocele due to changes in water to protein concentration which results in the images (Som et al., 1989; cf., Figure 2). In general, MRI is very helpful in ruling out a neoplasm, but does not show the bony architecture as well as CT scan for surgical treatment (Kennedy et al., 1989).

There are many approaches to treatment of mucoceles (Neel et al., 1987; Nicolai et al., 1991; Table 1). Recent reports have shown excellent results with endoscopic management (Kennedy et al., 1989; Moriyama, 1992; Hoffer and Kennedy, 1994). There are many potential advantages for intranasal treatment of mucoceles (Table 2). These procedures are typically performed on an out-patient basis, can be performed under a local anaesthetic, require no external incisions, and likely decreases morbidity in relationship to external approaches such as external ethmoidectomy. These advantages are magnified when considering orbital or intracranial extension. By widely decompressing or marsupializing mucoceles, allowing for drainage and aeration, the major morbidity and potential complications related to intracranial procedures is obviated. With exposure of the dura or peri-orbital, the thick wall of the mucocele acts as a cover and no attempts are made to remove this mucosal lining as long as the mucocele is well opened. Attempts at removal may cause injury to the periorbital and dura which may increase morbidity. There has been no need to provide extra support to the dura.

Table 1. Treatment options for sinus mucoceles.

maxillary:	Caldwell Luc
	FESS
	transantral ethmoidectomy
ethmoid:	external ethmoidectomy
	intranasal ethmoidectomy
	FESS
	transantral ethmoidectomy
sphenoid:	transseptal sphenoidotomy
	intranasal sphenoidotomy
	transorbital sphenoidotomy
	transpalatal sphenoidotomy
	FESS
frontal:	osteoplastic flap
	Lynch procedure
	FESS

Table 2. Advantages of endoscopic management of mucoceles.

low risk of complications
ease
cost: outpatient surgery/less time from work
good visualization
minimized morbidity
can manage recurrent disease endoscopically

Osteoplastic flaps, or Lynch procedure (Neel et al., 1987), are traditionally recommended for frontal sinus mucoceles. Such approaches may not be needed, however, particularly when the frontal-ethmoidal recess is largely expanded or eroded, intranasal endoscopic access to the frontal sinus should be improved in comparison to frontal sinusitis without mucocele formation. Good results in the endoscopic management of frontal sinus disease, including mucoceles, have been reported (Kennedy et al., 1989; Wigand and Hosemann, 1991). Future cases of ethmoid-frontal mucoceles in the authors' practices will be attempted from an endoscopic approach.

Important aspects of the care of mucoceles by any method are aggressive post-operative care and close follow-up. Frequent cleaning of the mucocele cavity during office evaluation will help prevent recurrent inflammation and mucocele formation. We advocate utilization of nasal sinus irrigations by the patients at home to help clean any residual debris from the mucocele and to re-establish a normal nasosinus environment for mucociliary transport. Despite sinus mucoceles frequently being colonized with fungus, if the mucocele is well marsupialized or removed and satisfactory endonasal post-operative care and irrigations can be accomplished, no anti-fungal medications are given.

In particular with those with a predisposition for mucocele formation from chronic sinusitis, nasal polyps or previous trauma, recurrent disease might occur. Routine endoscopic evaluation in the office is critical. CT or MRI post-operative imaging may be necessary, particularly in the face of clinical or endoscopic suspicion of recurrent disease. Two patients in this series present clinical evidence of recurrent disease confirmed by endoscopy and CT imaging. Both have had successful endoscopic management with a second operation. Particularly in patients who might require major intracranial operations, revision endoscopic surgery may be preferable, even if a number of procedures are necessary.

Long-term evaluation of mucoceles is warranted. Mucocele development may take long periods of time from the inciting episode (Moriyama et al., 1992). Recurrence of mucoceles may similarly become symptomatic months or years later. Recurrent symptoms of pain or headache should be expeditiously and appropriately evaluated. Any evidence of orbital or intracranial involvement requires rapid assessment and treatment planning. With such cautions, control of potential recurrences is expected. Considering the low morbidity, low risk of complications, success of management and the ability to treat recurrent disease, we advocate the use of endoscopic management of sphenoid and ethmoid mucoceles even with intracranial or orbital extension as the preferred treatment method in most cases.

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