

# Endoscopic sinus surgery for orbital subperiosteal abscess secondary to sinusitis\*

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## SUMMARY

*Subperiosteal orbital abscess (SPA) is a serious complication of paranasal sinusitis, which can lead to blindness or even death. A quick response is necessary as this condition is treatable. Early surgical intervention is indicated if there is risk of visual loss, or if no improvement is observed within 48 hours of starting medical therapy.*

*Three patients with orbital SPA secondary to sinusitis treated successfully by Functional Endoscopic Sinus Surgery (FESS) are presented in this case series. The surgical indications were impending visual loss with an abscess and cellulitis impinging on the optic nerve in one child and in the other two patients, a lack of clinical response within 48 hours after starting systemic antibiotics. CT scans, nasal endoscopy, and ophthalmologic examinations are mandatory during the evaluation process.*

*The advantages of FESS in these patients were the avoidance of external ethmoidectomy and its external facial scar, an early drainage of the affected sinuses, SPA, and the eradication of the disease from the fronto-ethmoidal region leading to an enhanced recovery and a reduced hospital stay. FESS is also a safe, convenient and minimally invasive procedure in patients presenting with serious complications of sinusitis.*

*Key words: Functional Endoscopic Sinus Surgery (FESS), subperiosteal abscess (SPA), orbital abscess*

## INTRODUCTION

A subperiosteal abscess (SPA) due to sinusitis is uncommon and carries a potential risk of blindness and death. In the pre-antibiotic era, SPAs frequently resulted in blindness, meningitis, brain abscess, or cavernous sinus thrombosis (Gamble, 1933). Although these complications are infrequent, the management still remains a surgical emergency.

The incidence of SPAs secondary to sinusitis is less than 1% in the reported cases but up to 50 % of these cases have resulted in a partial or complete visual loss despite aggressive medical therapy (Harris, 1983). The classification of Chandler et al. (1970) is the most widely accepted for orbital inflammations and includes the following stages: 1) preseptal cellulitis, 2) orbital cellulitis, 3) subperiosteal abscess and 4) cavernous sinus thrombosis. Computerized tomography (CT) scans of the paranasal sinuses and orbit are diagnostic in the identification of SPAs.

The management policy advocated is hospital admission, type IV antibiotics (cefuroxime and metronidazole or amoxicillin-

clavulanate) combined with intranasal decongestants and analgesics (Lund, 1997). Surgical intervention is indicated for patients who fail to respond to medical treatment within 24 to 48 hours (Stammler, 1991; Lund, 1997). The surgery recommended for SPA has conventionally been an external orbital drainage and/or external ethmoidectomy (Lund, 1997).

Functional Endoscopic Sinus Surgery (FESS) has opened the way for the treatment of periorbital complications of sinusitis (Arjman, 1993; Manning, 1993). Although FESS for draining SPAs has been described, there are only very few reports in the literature about the use of it (Deutsch, 1996). Lusk (1992) introduced FESS in children and has emphasized the need for great care in both patient selection and surgical conservatism. We report 3 patients with a subperiosteal abscess in whom FESS facilitated drainage of the affected sinuses and SPA, eradicating the disease from the fronto-ethmoidal region. The clinical and radiological features with the role of endoscopic sinus surgery are discussed.

## MATERIALS AND METHODS

Our study comprised of three patients with orbital SPA secondary to sinusitis treated by the authors during the period 1997 to 1999. All patients were hospitalized and had coronal and axial CT scans, ophthalmological, neurological and nasal endoscopic examinations.

Medical treatment in all patients consisted of intravenous broad-spectrum antibiotics cefuroxime and metronidazole or amoxicillin-clavunate for 5 days, followed by an additional 5 day oral course. This was also combined with intranasal decongestants and analgesics.

The decision to proceed with Functional Endoscopic Sinus Surgery (FESS) was based on the lack of a clinical response after 48 hours of parenteral antibiotics. One child with suspected SPA impinging on the optic nerve with an impending vision loss was operated on an emergency basis (Figure 1).

### Technique of FESS

All procedures were performed under general anesthesia. The technique described by Messerklinger and Stammberger (1991) and Lusk (1992) were essentially applied. In all procedures, Olympus 4 mm and 2.7 mm 0° and 30° nasal endoscopes were used. The surgical steps included local nasal decongestion, infundibulotomy, and removal of anterior ethmoid cells and their content. The frontal portion of the ground lamella of the middle turbinate was perforated and subsequently portions of the lamina papyracea were removed to expose the periorbit to achieve the best drainage of pus. Bacteriological culture samples from sinuses, pus, and tissue cultures from the anterior ethmoids were also obtained.

### Follow up

The clinical response in terms of eye signs, headache, systemic signs, and nasal discharge were monitored after the operation on a daily basis. The patients were followed up 7 days after their discharge and once more in March 2000 by telephone after 18, 24, and 28 months, respectively, in Case 1, 2 and 3.

## RESULTS

### Illustrative cases:

#### Case 1

A 5-year old boy presented with a 3-day history of a swelling of the right eye. Examination revealed an afebrile child with right eyelid oedema, erythema, and tenderness. There was a small angle exotropia with a restriction of adduction of the eyeball, with no evidence of proptosis. Tests for visual acuity were not possible as the patient was in distress. A CT scan of the orbit revealed soft tissue densities in the anterior ethmoidal cells with an intra-orbital extension, displacing the medial rectus muscle and optic nerve on the right side (Figure 1a). The patient was taken for FESS on an emergency basis in view of optic nerve compression with impending blindness. During FESS, the ethmoids were full of polypoidal mucosa, which was cleared. The lamina papyracea was perforated and 2 ml of pus extruded; the culture later grew *Hemophilus influenzae*. Postoperatively, a

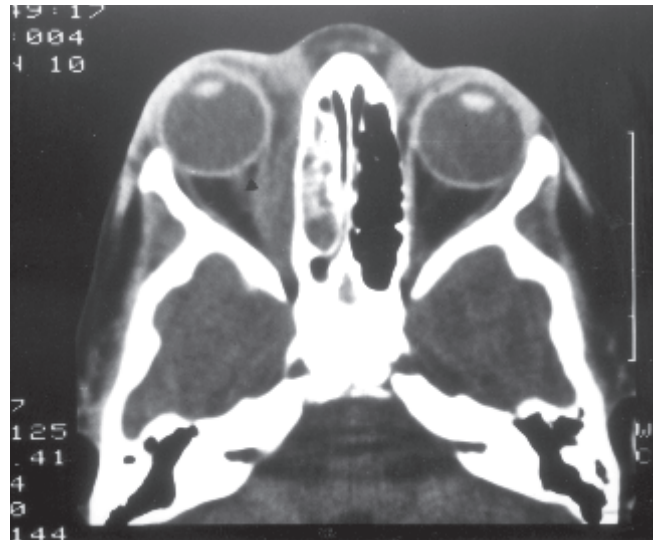


Figure 1a



Figure 1b

Figure 1. (a) Axial CT Scan showing soft tissue density all along the lamina papyracea with a mass effect over the medial rectus and optic nerve in the right orbit. The ethmoidal cells on the right side show evidence of mucosal disease. (b) Arrow showing defect in lamina papyracea created by FESS and radiological resolution of the disease.

reduction of all eye signs was noted and the child was pain free. He was discharged on the fifth day after admission with clinical resolution. A CT scan 7 days after FESS showed no evidence of residual collections or disease (Figure 1b).

#### Case 2

A 20-year old male, a known epileptic on carbamazepine, was referred to our department with a history of fever for 2 weeks, headache and progressive right eye proptosis. There was no history of nasal discharge. Ophthalmologic examination showed bilateral lid edema, conjunctival congestion, chemosis, as well as proptosis (12 mm Hertel's exophthalmometry), with the left eye more than the right one. There was no restriction of mobility, pupils and fundi were normal and there was no visual disturbance. A CT of the orbit and sinuses showed pan sinusitis (Figure 2a). There were changes of preseptal and intra orbital cellulitis with an area of low attenuation indicating a SPA. The



Figure 2a

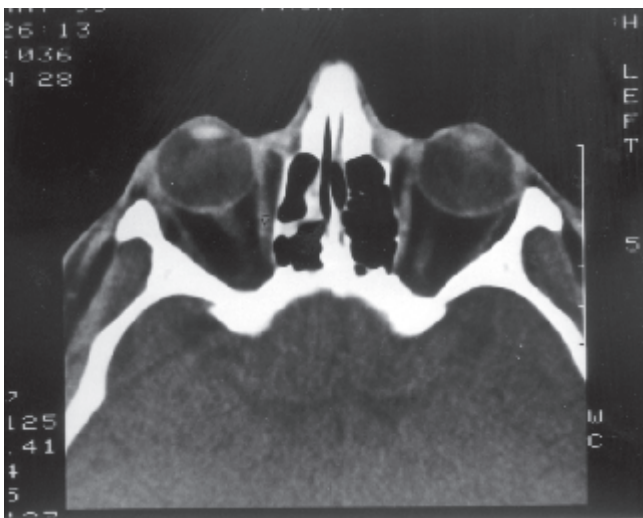


Figure 2b

Figure 2. (a) Axial CT scan showing mucosal disease in anterior air cells with an area of low attenuation in the right orbit and proptosis of the right globe. (b) There is a near total resolution of the orbital swelling and ethmoidal mucosal disease. The arrow shows a bony defect in the lamina papyracea created by FESS which was healed by a mucus membrane.

patient was hospitalized and given intravenous cefuroxime, metronidazole, with local decongestants. Lack of satisfactory improvement after 48 hours of medical treatment prompted surgical intervention. FESS was performed on the right side. A 20-minute application of adrenaline soaked gauze strip led to a stream of mucopus emerging from the middle meatus. A polyp measuring 2x1x0.3 cm and weighing 1.5 mg was removed from the ethmoids. Removal of pieces of lamina papyracea led to extrusion of 3 ml of purulent discharge. The culture was negative. A biopsy revealed an inflammatory polyp with spicules of bone showing sequestration. The patient had a rapid clinical recovery with resolution of eye signs and proptosis within 24 hours after FESS. He was discharged 5 days after surgery, symptom free. A CT scan 7 days after FESS showed a radiological resolution of the disease (Figure 2b).

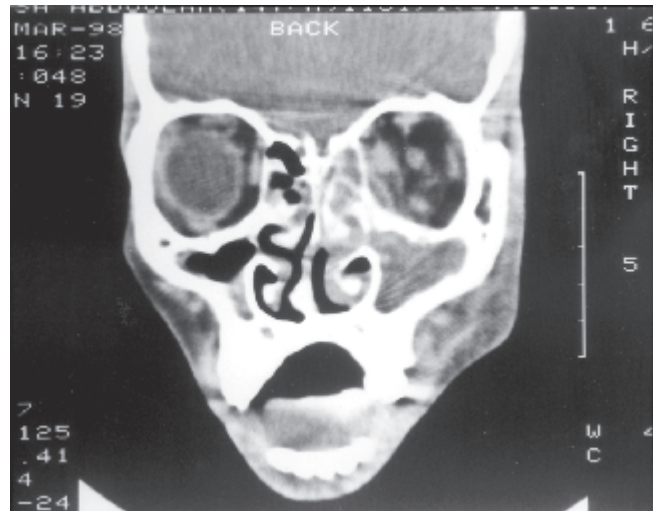


Figure 3a

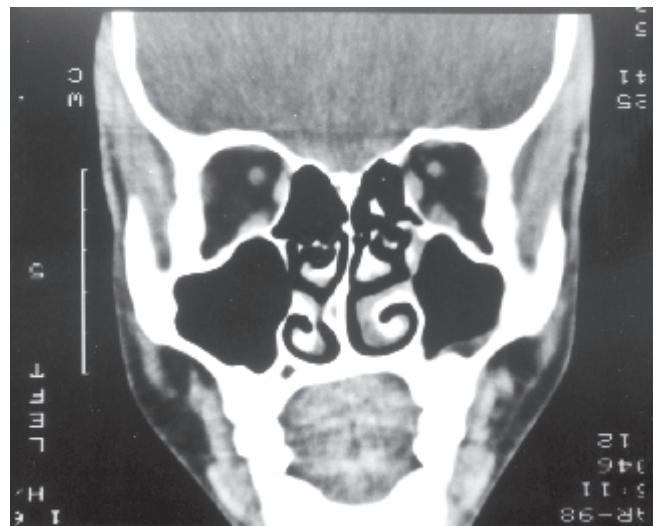


Figure 3b

Figure 3. Coronal CT scan showing extensive mucosal disease of sinuses. Soft tissue swelling is noted in the right orbit with displacement of the medial rectus muscle.

*Case 3*

A 14-year old male presented to the ophthalmology department with progressive edema of both eye lids and 3 days history of fever. Ophthalmologic examination revealed right lid edema, erythema, proptosis (22 mm Hertel's exophthalmometry) and restricted mobility of the eyeball in all directions. The pupillary reactions were normal, fundoscopy revealed no abnormality and the visual acuity was normal. There was no history of facial pain, headache or nasal discharge. On anterior rhinoscopy, the right nasal cavity was full of dried mucopus. On admission, he had a fever of 39°C and his total WBC count was 12600/mm<sup>3</sup>. A CT on the orbits and sinuses demonstrated pan sinusitis and intra orbital cellulitis with low attenuation area in the right orbit (Figure 3). The patient was treated with intravenous augmentin and metronidazole, but 24 hours later his symptoms and signs

had not improved, moreover, the total WBC count had progressed to  $14600/\text{mm}^3$ . A right FESS was done under general anesthesia. A polypoidal mucus membrane was found obstructing the middle meatus. A 1.5 cm long polyp was removed from the anterior ethmoids, while removal of pieces of the lamina papyracea led to pus extrusion. The patient had a short postoperative recovery. Culture later revealed *Moraxella catarrhalis*. Five days later he was discharged. A CT scan 7 days after FESS showed no evidence of residual collections or disease.

#### DISCUSSION

In the clinical epidemiology of diseases, three important factors have to be considered: occurrence, seriousness and treatability. Although SPAs are uncommon in occurrence, it is a serious condition because of its devastating ophthalmological and neurological complications while it affects young, otherwise healthy individuals. It becomes an important condition, as it is treatable. An unusual feature in our patients was the absence of any clinical signs or symptoms of sinusitis. None of the patients presented primarily to the ENT service, but were referred from the Ophthalmology and Neurology departments. The diagnosis of sinusitis was made on a high index of suspicion and CT scans. SPA is difficult to diagnose accurately on clinical grounds alone, especially in ill children and often objective signs of deterioration may be apparent only after irreversible damage has occurred (Deutsch, 1996).

CT scans show a characteristic elevation of the periosteum as a result of an abscess and such scans were found to be accurate in the detection of SPA in 80% of the patients. (Goodwin, 1982; Skedros, 1993). The role of MRI is useful for soft tissue details, delineating SPA and early detection of intracranial involvement. CT scans are still superior in delineating delicate bony details, and are economical.

Bacteriological specimens taken from the sinuses, abscesses and operative tissues in patients grew *Hemophilus influenzae* and in one *Moraxella catarrhalis*. There are few reports in the literature about the microbiology of SPAs. Schramm et al. (1978) reported *Staphylococci* and *Streptococci* followed by bacteroids as the predominant organisms. Morrison (1980) reported a similar pattern. *Hemophilus influenzae* and *Moraxella catarrhalis* have not been reported in these studies.

The pathogenesis involves bacteria from infected sinuses infiltrating the orbital subperiosteal space through valveless venous plexuses, direct extensions through the neurovascular foramina or through dehiscent areas of the orbital wall (Chandler, 1970; Harris, 1983). The role of sinusitis as a primary factor in orbital cellulitis is clearly evident in our patients who showed radiographic evidence of sinusitis.

Treatment of SPAs is dependent on the clinical progression of the disease. In patients with early orbital cellulitis, antimicrobial therapy is usually sufficient. As signs and symptoms progress, surgical intervention is indicated. In our patients, the criteria for operative intervention included progressive orbital cellulitis despite adequate intravenous antibiotics for 48 hours, definite evidence of a SPA on a CT scan and risk of visual loss and cavernous sinus thrombosis.

Souliere et al. (1990), and Spires and Smith (1986) recommended medical management of SPA. Harris (1983) has suggested that non-surgical treatment of SPA might lead to a chronic osteomyelitis or intracranial complications. Early surgery permits culture of the abscess and bacterial identification for antibiotic selection. Most of the reported cases of surgical drainage of SPA were done by an external approach (Gross et al., 1989; Lund, 1997). Stammberger (1991) described successful management of not only sinusitis with periorbital cellulitis, but also cases with marked periorbital abscesses and even intra-orbital abscesses by FESS. Surgery was recommended in patients with a lack of clear improvement or worsening of their general condition after 24 hours of intensive intravenous antibiotic therapy and local decongestants; 82% of pediatric patients with incipient orbital complications were managed conservatively (Stammberger, 1991).

An emergency CT scan is required when cavernous sinus thrombosis is suspected and management includes high doses of intravenous antibiotics, combined with surgical drainage. Incipient cavernous sinus thrombosis is a contraindication for FESS. Lusk (1992), Arjman (1993), Manning (1993) and Deutsch et al. (1996) have used FESS for drainage of periorbital complications. They removed the anterior ethmoid air cells and polypoid tissue. The lamina papyracea was found dehiscent and this led to extrusion of pus. Their patients were followed up for periods ranging from 18 to 30 months and found to be symptom free. Lund (1997) recommended the external surgical approach. In our patients, the role of FESS was adjunctive to medical management. The placement of an adrenaline pack for 20 minutes under the middle turbinate decreased the swelling in the osteomeatal complex thereby allowing spontaneous drainage from the fronto-ethmoid recess, making cultures possible to identify the bacterial source for the appropriate antibiotic therapy.

In case 2, a 1.5 cm long polyp with bony spicules from the lamina papyracea indicated osteolysis and dead bone. This sequestered bone was a potential source of chronic osteomyelitis, recurrent disease and intracranial complications.

In case 1, severe pain and impending blindness prompted an early surgical intervention. In this patient, the ethmoids were full of polypoidal mucosa, which was cleared and a gentle probing of the lamina papyracea followed by removal of bits of bone allowed drainage of pus. This resulted in immediate pain relief and removal of the abscess impinging on the optic nerve prevented blindness.

All patients were healthy individuals and were not immunocompromised and did not have abnormalities of mucociliary clearance like viral infection, allergy or a local anatomical cause. The limitations of FESS in such cases are: (a) availability of skilled and trained surgeons, (b) FESS is contraindicated if there is the slightest suggestion of an intracranial complication (Stammberger, 1991), (c) if the local bleeding is uncontrolled, FESS has to be abandoned as visibility and orientation is lost, (d) external surgical drainage is preferred in patients with gross disease where complete decompression of the orbit, drainage of the fronto-ethmo-sphenoid complex and orbital collections (extra-periosteal, preseptal, or intraperiosteal) is needed.

The risks involved are overlooked disease, injury to the anterior ethmoidal artery leading to periorbital or intraorbital hematoma, and injury to orbital contents, medial rectus muscle, and the optic nerve.

Besides avoiding facial scarring, FESS aided in the drainage of SPA, facilitated early drainage of the affected sinuses, removal of polypoidal tissue, polyps, and necrosed debris. By clearing the osteo-meatal complex, it eradicated disease and ventilating the sinuses lead to a functional recovery, thereby preventing disease progression and recurrences.

FESS can be recommended as a safe and effective minimally invasive technique compared to the external approach, for SPAs refractory to 48 hours of medical therapy or earlier if there is impending visual loss. There is a need to further investigate the role and study the possible effects of earlier surgical intervention with FESS.

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