

Acute isolated sphenoid sinusitis in children

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ABSTRACT

Background: Isolated pediatric sphenoidal sinusitis is an uncommon disorder with sphenoiditis more commonly found as part of pansinusitis. Recognizing the condition on history and examination alone is difficult and delayed diagnosis many occur in many cases. Nasal endoscopy, computed tomography (CT), and magnetic resonance imaging (MRI) are essential adjuncts to confirm diagnosis. This study was designed to confirm the clinical features and diagnostic difficulties associated with isolated sphenoidal sinusitis in children.

Methods: A 16-year review was performed of cases diagnosed and treated in a tertiary teaching hospital.

Results: Two different groups of patients were identified. One group presented with fever and headache, frequently associated with neurological complications. Swimming and/or diving could be identified as possible causative agents. The second group presented with headache alone and a less severe clinical presentation.

Conclusion: Isolated pediatric sphenoidal sinusitis may be more prevalent than was previously thought with CT/MRI helping establish the diagnosis in many cases. Pediatricians should be aware of this unusual but still potentially devastating condition. A nasal endoscopy is a useful diagnostic tool in this patient group, being noninvasive and well tolerated in children and adolescents.

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Sinusitis is a frequent disease in children, generally occurring in association with upper respiratory tract infections (URTIs) or an atopic condition.¹ Acute noncomplicated sinusitis is typically secondary to viral or bacterial infections.² More specifically, an estimated 5–10% of viral, upper respiratory infections in children develop into acute bacterial sinusitis, mainly of the ethmoidal–maxillary sinus.^{3,4} Rhinosinusitis is a common disease in the pediatric population and it can be classified as infectious or allergic, acute or chronic, and associated or not with nasal polyps.⁵ Isolated sphenoid sinusitis, on the other hand, is an uncommon disorder. It usually occurs in association with other paranasal sinus infections.⁶ Sphenoid sinusitis usually appears in association with an inflammation of the maxillary and posterior ethmoid sinuses. The sphenoid sinus presents peculiar attributes, because it is lined with ciliated pseudostratified epithelium with fewer mucous-secreting cells, which contributes to fewer drainage problems when compared with other sinuses.⁷ Therefore, in clinical practice, isolated sphenoid sinusitis represents an uncommon disease occurring in <3% of all sinusitis cases.^{7–9} Sphenoid sinusitis typically affects preadolescent and adolescent patients, because the chronological development of the sphenoid sinus does not begin until the age of 4–6 years.^{10,11} Because of its crucial position, sphenoid sinus infection may be complicated by several other serious conditions. In fact, the sinus is adjacent to 13 other structures that may be affected by the disease: cranial nerves II, III, IV, V, and VI; dura mater; pituitary gland; cavernous sinus; internal carotid artery; sphenopalatine ganglion; sphenopalatine artery; and the pterygoid canal and nerve.⁷

At the beginning of the disease, patients generally lack nasal symptoms and the condition may remain undiagnosed until an advanced stage because of nonspecific symptoms, such as headache, refractory to medical management.^{12–16} Therefore, a diagnosis based on history and physical examination alone is difficult. The detection of isolated sphenoid sinusitis may thus be delayed in many cases and is diagnosed secondary to other investigations for persisting symptoms and/or its septic, neurological, ophthalmologic, and vascular compli-

cations.^{8,9,17} In fact, the frequently delayed diagnosis of the condition further facilitates intracranial complications.

Plain radiographs are not useful, and the common diagnostic study of choice is a high-resolution computed tomography (CT) scan (axial and coronal views).^{6,18} Magnetic resonance imaging (MRI) with contrast should be used for those cases with cranial nerve abnormalities. Recently, the introduction of rhinosinusal endoscopy with rigid and flexible instruments, for both diagnostic and surgical aims, has modified the diagnostic approach of sinus infection, including isolated sphenoiditis.^{19–21} Offering the possibility of an *in situ* examination, it provides reliable visualization of all accessible areas of the sinus drainage.

In fact, this approach is crucial to visualize the inferior and middle turbinate; the ostiomeatal complex (OMC), which drains the frontal and anterior ethmoid and the maxillary sinuses; and the sphenothmoidal recess (SER), which drains the sphenoid, as well as the posterior ethmoid sinuses.

Recently, the number of patients diagnosed with isolated sphenoiditis has been increasing, probably because of the increased availability of CT, MRI, and nasal endoscopies.²²

Treatment of isolated sphenoiditis includes antibiotic treatment based on culture tests and in acute cases saline irrigation as well.²³ Early treatment with antibiotics is recommended to reduce morbidity and mortality. In fact, the i.v. therapy should be prolonged for 3–4 weeks.

Surgical intervention should be performed immediately in patients that show no signs of improvement after the first 24–48 hours of antibiotic therapy, with a suspected fungal infection, or with symptoms of cranial nerve involvement.²³

During the last 16 years at Pediatric and Ear, Nose, and Throat (ENT) Departments, we have treated 27 pediatric patients who were diagnosed with acute isolated sphenoid sinusitis.

PATIENTS AND METHODS

Patients

We reviewed records of 27 patients; they were all admitted to the Pediatric and ENT Departments of the San Matteo University Hospital of Pavia between January 1994 and January 2010 and, subsequently, they were diagnosed with acute isolated sphenoid sinusitis. They ranged in age from 7 to 17 years (mean age, 12.5 years). Twelve were male and 15 were female patients. In all patients, diagnosis was

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Table 1 Acute severe and nonsevere sphenoid sinusitis additional cases

	Severe	Nonsevere
Cases	11	16
Age, yr (mean age)	8–17 (12.1)	7–15 (12.8)
Duration complaints before diagnosis (days)	1–12 days	10–25 days
Signs and symptoms		
Headache	11	16
Fever	9	2
Nasal discharge	2	0
Neck rigidity	5	0
Stupor	4	0
Cranial nerves abnormalities (III, V, VI, and VII)	3	0
Initial diagnosis		
Sinusitis	8	4
Tension-type headache	3	8
CNS infection	0	0
CNS tumor	3	2
Periorbital cellulitis	0	0
Associated factors		
Swimming and diving	5	2
URTI	5	4
Allergic rhinitis	3	8
Sinus polyps	0	0
Diagnostic approach		
Nasal endoscopy	11	16
CT scan	11	14
MRI	0	0
Treatment		
Antibiotic therapy i.v.	11	16
Sphenoid surgery	3	0

CNS = central nervous system; CT = computed tomography; MRI = magnetic resonance imaging; URTI = upper respiratory tract infection.

previously made with nasal endoscopy and in 24 cases, later confirmed by a CT scan.

Nasal Endoscopy

Nasal endoscopy was performed either with a rigid instrument 2.7 mm in diameter with 30° angle of vision, or with a flexible instrument 3.8 mm in diameter with a 250W light source. Before the procedure a topical anesthesia with ossibuprocaine chlorhydrate 0.01% and xylo-metazoline chlorhydrate 0.1% was administered with a cotton swab placed into the nose, in between the medial face of the inferior turbinate and septal mucosa and left inside the nose.

Cultures

A small flexible cotton swab was used to obtain a nasal culture directly from the drainage under endoscopic view. This type of procedure takes from 1 to 3 minutes for both nasal cavities.

CT Scanning

Standard CT images of the paranasal sinuses were obtained in both axial and coronal planes. The slices were of 2–3 mm with feed of 3–4 mm.

RESULTS

Eleven of our patients showed acute severe sphenoiditis and 16 of them suffered from acute nonsevere sphenoiditis (Table 1).

Considering the patients with acute severe sphenoiditis, the initial suspected diagnosis was rhinosinusitis in eight patients and intracranial tumor in three patients. The supposed diagnosis was based on clinical signs detected by the pediatrician or by the ENT specialist and symptoms referred by the patient (e.g., association of headache, nasal obstruction, and fever). All of them had headache, nine of them presented with high fever, two of them exhibited nasal discharge, five had neck rigor, four were experiencing stupor, and three exhibited cranial nerve abnormalities. As associated factors, five of our patients reported swimming and diving, URTIs were reported in five patients and allergic rhinitis was reported in three. The diagnosis was preliminarily made by nasal endoscopy in all of our patients; the typical finding to obtain such diagnosis is a purulent or mucopurulent drainage from the SER area, without pathological secretions in other areas, such as the OMC and the middle meatus. Endoscopic diagnosis was then confirmed by CT scanning in all 11 patients with acute severe sphenoiditis.

Cultures were taken directly from the SER area, under endoscopic transnasal view, in accordance with patient's compliance: *Staphylococcus aureus* was isolated in four subjects and *Streptococcus pneumoniae* was isolated in three. The initial suspected diagnosis for this specific group was rhinosinusitis in eight cases, headache in three cases, and central nervous system tumor in three cases. Only patients suspected of rhinosinusitis were on antibiotic therapy at the time of the cultural examination. Treatment was i.v./oral antibiotic therapy, i.e., cephalosporins or amoxicillin-clavulanate for 21 days. In three patients, endoscopic surgery was needed to obtain complete recovery. All patients recovered without sequelae.

Of the patients who presented with acute nonsevere sphenoiditis, eight of them were initially diagnosed as having a tension-type headache and four of them as having sinusitis. Headache was the main symptom reported from all of our patients; two of them presented with fever as well, and none of them presented nasal discharge. As associated factors, two patients reported swimming and diving, and four patients had a history of URTI. Eight of them suffered from allergic rhinitis. Subsequently, all of these patients were diagnosed using nasal endoscopy and 14 cases followed by CT scanning. The initial suspected diagnosis was tension-type headache in eight cases, and in four the diagnosis was sinusitis. A preliminary diagnosis of central nervous system tumor was made in two patients. All patients were treated with i.v./oral antibiotic therapy, i.e., cephalosporins or amoxicillin-clavulanate for 15–20 days. Complete regression of symptoms was detected in all cases.

Besides wide-spectrum antibiotic treatment, children from each group were treated with abundant saline solution nasal irrigations. Topical daily endoscopic medication of the SER with xylometazoline hydrochloride 0.1% and ossibuprocaine chlorhydrate 0.01% cotton swabs were performed only in children >12 years of age. In both groups, a follow-up with nasal endoscopy was performed at the end of the medical and/or surgical treatment. Referred clinical symptoms were investigated after therapy as well, and complete symptoms regression was detected in all patients. No further radiological examinations were performed on our patients.

DISCUSSION

In our series of pediatric patients with acute isolated sphenoid sinusitis, we identified two different groups of patients. The first group (11 patients) presented with acute severe isolated sphenoid sinusitis; the second group (16 patients) showed acute nonsevere sphenoid sinusitis (Table 1).

The clinical picture of acute severe sphenoiditis is mainly characterized by high fever, intense headache, and frequent appearance of serious neurological abnormalities, such as stupor, neck rigor, orbital symptoms, and cranial nerve paralysis. Headache is usually nonspecific and may present anywhere in the craniofacial area. It should be noted that the absence of nasal symptoms does not exclude a diagnosis of acute isolated sphenoiditis.

In acute nonsevere sphenoid sinusitis, symptoms may be vague and atypical. Patients generally present with constant headache and no fever or severe neurological abnormalities. A headache was the main symptom. It is important to emphasize that none of the patients in either series showed nasal discharge or any neurological symptoms.

Isolated sphenoid sinusitis, although rare, is a potentially devastating entity. Because of its position, the sphenoid sinus is often referred to as the most neglected of the paranasal sinuses.²⁴ Because of the location of the sphenoid sinus, nearby structures may be involved in infective or pathological disorders of this sinus. In fact, sphenoid sinusitis can lead to orbital cellulitis and abscess, orbital apex syndrome, blindness, sepsis, meningitis, epidural and subdural abscess, cerebral infection, pituitary abscess, cavernous sinus thrombosis, and internal carotid artery thrombosis.⁷

Nasal airflow passes under the ostial drainages of the sphenoid sinus; thus, bacterial and irritant agents' transport is limited. The sphenoid sinus is, therefore, rarely infected by microbial agents unless virulent microorganisms are involved.¹⁶ In the severe form of sphenoiditis the predominant pathogens are usually Gram-positive organisms, viz., *S. aureus* and various *Streptococcus* sp., particularly, *S. pneumoniae* are occasionally cultured; *Chlamydia* and *Klebsiella* have also been reported. The sphenoid is the second most-common sinus to be infected with fungi, especially with *Aspergillus*; therefore, fungi need to be considered as well, especially in immune-compromised patients.^{8,9,25}

There are various predisposing factors for acute sphenoiditis, including anatomic obstructions, injuries, radiotherapy, immunosuppression, sinonasal polyps (rare in adolescents), and primary and metastatic tumors.⁶ Swimming and diving have been included in the predisposing factors as well, most likely because they could facilitate the ascent of nasal microorganisms in this sinus or the entry of water contaminated by chemicals or bacteria.^{9,26} Additionally, allergic rhinitis and less frequently URTIs are involved—either in severe or nonsevere forms of sphenoid sinusitis.²⁷ Other possible predisposing factors are diabetes mellitus or maxillofacial trauma.^{9,16,26} Prolonged antibiotic therapy, and in the case of failure, endoscopic surgical drainage of the pus are the cornerstones of the treatment.

Because sphenoid sinusitis is a potentially devastating^{8,9,13} although curable condition, either with the use of antibiotics or endosurgery, pediatricians need to have a high index of suspicion when they treat adolescent or preadolescent patients complaining of headaches.²⁸ Until the era of endoscopic sinus surgery, the access to the sphenoid sinus was considered difficult, because of its isolated position deep in the cranial cavity. Today, diagnosis is easily made using nasal endoscopy. It entails not only visualization of the OMC in the middle meatus, through which the frontal, anterior ethmoid, and maxillary sinuses drain, but also allows the physician to visualize the SER into which the sphenoid drains. Easier, faster, and less expensive than other imaging techniques, nasal endoscopy is a well-tolerated and noninvasive technique that allows a rapid diagnosis of sphenoiditis even in children. A CT scan and/or an MRI should be viewed as more complex and expensive diagnostic steps to be performed in selected cases based on clinical and endoscopic findings. Endoscopic transnasal sphenoidectomy is currently the most frequent surgical treatment for isolated sphenoiditis.²²

Isolated sphenoid sinusitis in children is underdiagnosed and, although uncommon, is less rare than previously believed and its incidence is currently rising. The disease may present with headache and orbital symptoms or may mimic meningitis and central nervous system tumors. Prompt diagnosis, preferably through nasal endoscopy, and antibiotic treatment are essential to minimize mortality and morbidity. In most pediatric patients conservative treatment is satisfactory. On the other hand, whenever symptoms progress or continue

for >24–48 hours or complications develop, the condition needs to be resolved through immediate surgical drainage.

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