

Management implications of diagnosing orbital abscess as subperiosteal orbital abscess*

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SUMMARY

Objective: Orbital complications of rhinosinusitis can be life-threatening. Accurate diagnosis by computerized tomography (CT) scanning, immediate administration of intravenous antibiotics and surgical drainage are the recommended management strategy. Faulty diagnosis by CT scan may lead to visual deterioration, intracranial complications and even fatality. The purpose of this study is to increase the awareness of the possibility of misdiagnosing orbital abscess (OA) as subperiosteal orbital abscess (SPOA) and propose a novel surgical technique to overcome this surgical circumstance.

Materials and methods: Three cases of OA and 29 of SPOA cases that were surgically managed between 1998 and 2008 were retrospectively reviewed.

Results: Three cases of OA diagnosed by CT scan as SPOA were primarily medically treated by intravenous antibiotics. Once the therapeutic management failed to resolve the condition, endonasal endoscopic surgery (EES) was carried out, upon which the diagnosis of OA was made and drainage successfully achieved.

Conclusion: Whenever SPOA is diagnosed by CT scan and no purulent discharge is evidenced after removal of the lamina papyracea, OA should be suspected and incisions along the orbital periosteum should be made to release the pus from the orbit. The EES approach in cases of OS and SPOA can confirm an accurate diagnosis.

Key words: orbital abscess, subperiosteal abscess, sinusitis, complication, imaging

INTRODUCTION

Orbital abscess (OA) is a very serious complication of acute rhinosinusitis in children. The progression may be rapid from preseptal cellulitis to medial subperiosteal orbital abscess (SPOA) and then to OA, which may cause deterioration of visual acuity, and finally to the danger of life-threatening cavernous sinus thrombosis, meningitis and brain abscess⁽¹⁻³⁾. Diagnosis is made by history, physical examination and mainly by a computed tomography (CT) scan. The latter should enable differentiation between OA and SPOA and can be accurate in the diagnosis of SPOA in 80-100% of cases, while there is no such data regarding OA⁽⁴⁾. Clary et al. published their criteria for definition of OA from SPOA, stating that in cases of subperiosteal abscesses, CT scan reveals an edema of the extrinsic eye muscles and a homogeneous opacification between the orbit walls and the non-axial shifted periorbit. However, in their experience in cases of orbital abscesses, CT scan reveals obliteration of the extrinsic muscles and the optic nerve due to a homogeneous mass matching the signs of an abscess⁽⁵⁾.

The therapeutic management of SPOA is controversial: there are authors that recommend medical therapy alone for medial SPOA that is modest in size⁽⁶⁻⁸⁾. Surgical drainage, by either endonasal endoscopic surgery (EES) or the external approach should be performed by reaching and removing the lamina papyracea to drain the pus located between the lamina papyracea and the periorbit. There are authors who suggest a very limited procedure of removal of the ethmoid bulla to expose this part of the lamina papyracea⁽²⁾, while others suggest complete removal of the ethmoid labyrinth to widely expose the lamina papyracea.

The recommended management of OA is primarily surgery, with the external approach being the most popular. Although great progress has been made in the field of EES, there are few reports of OA treated by EES⁽⁹⁾.

We present three cases of OA in children who were initially diagnosed as medial SPOA prior to surgery, based on CT scans. All three cases were successfully drained by EES.

MATERIALS AND METHODS

Patients

Three cases of OA and 29 cases of SPOA that were surgically treated at our institute between 1988 and 2008 were retrospectively reviewed. In the SPOA group, there were 19 males and 10 females, aged 1-62 years (average 8.2 years, median 4 years). The three OA patients were male aged 8-16 years, (average 12 years). All patients had axial and coronal CT scans of the sinuses and orbits interpreted by a trained head and neck radiologist. Prior to admission, these children received a course of 2-5 days oral antibiotic therapy (amoxicillin, amoxicillin clavulanic acid and cefuroxime sodium).

Cefuroxime sodium or amoxicillin clavulanic acid was started intravenously once the diagnosis of SPOA was made. Surgical intervention was indicated when one of the following criteria existed: deterioration of visual acuity, restricted orbital motility, persistent fever $>104^{\circ}\text{F}$ (40°C) for more than 48 hours despite intravenous antibiotic treatment.

Endonasal endoscopic surgery

EES was performed using 4-mm 0° and 30° telescopes under general anesthesia. The lamina papyracea was completely exposed by removal of the uncinate process, bulla ethmoidalis and anterior and posterior ethmoid cells. If pus was detected coming from any dehiscence in the lamina papyracea, it was removed widely. One to three parallel incisions were made in the periorbit and the involved orbit was gently massaged until pus was obtained through the incisions. External pressure on the orbit continued until almost normal tonus of the orbit was

achieved and pus was no longer obtained. If no pus was obtained, a sickle was introduced very carefully through the incisions into the orbital contents to release the pus from a suspected orbital abscess. No drains were left in the surgical field. A small merocel pack was left in place between the orbit and the middle meatus until the following morning.

RESULTS

Case No. 1

A 12-year-old boy was urgently admitted to our department. He complained of severe frontal headache and pain in the right eye, with fever of 2 days' duration and treatment with amoxicillin for two days prior to admission. Physical examination revealed marked cellulitis of the upper and lower lids, proptosis and restricted upward movement of the right eye. On anterior rhinoscopy, there was inflamed nasal mucosa and a clear discharge. CT scan of the paranasal sinuses and orbits demonstrated upper SPOA of the right eye causing the eye to protrude laterally and forward. Frontal, maxillary and ethmoid sinuses on the right side were completely opaque (Figures 1 and 2). Intravenous amoxicillin clavulanate (Augmentin[®]) was begun. Under general anesthesia, the ethmoid labyrinth was removed by EES to expose the lamina papyracea. All sinuses were severely inflamed and pus was obtained from them. The lamina papyracea was exposed and removed, but no pus was obtained. One day postoperatively, no improvement was noticed in the eye and body temperature remained high. Repeat CT scan of the paranasal sinuses and orbits showed no change in the SPOA. The next day, a second endoscopic surgical attempt was made to drain the abscess with complete



Figure 1. Case 1. Coronal CT scan showing round lesion on the superomedial aspect of the right orbit that cause the eyeball to protrude lateroanteriorly.

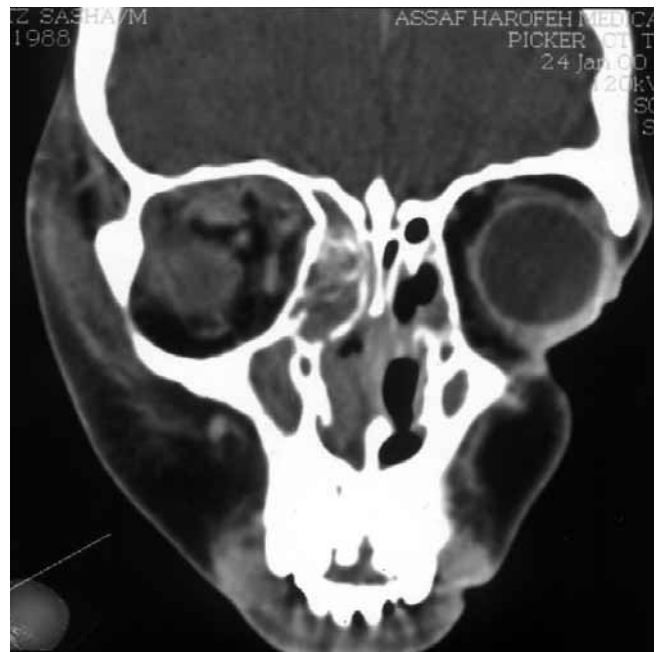


Figure 2. Case 1. Coronal CT scan demonstrates periosteal enhancement suggestive of subperiosteal abscess in the superior aspect of the right orbit. Note opacifications on both sides of the abscess. The bilateral sinuses are opaque.



Figure 3. Case 2. Coronal CT scan of the right orbit showing an abscess formation with an air-fluid level in the medial aspect of the orbit.

removal of the lamina papyracea still without obtaining pus. A sickle was gently introduced into the superior third periosteal incision through the orbital fat and the pus was released. Culture from the orbital abscess revealed *Branhamella catarrhalis*. Repeated eye examinations postoperatively showed no pathological signs. The patient was sent home 12 days later after complete resolution of the infected orbit with normal eye movements.

Case No. 2

A 15-year-old boy was admitted to the ENT department urgently because of severe cellulitis of the right eye that began on the previous day. He complained of a high fever for 4 days prior to admission without rhinitis or postnasal drip. Antibiotic treatment with amoxicillin was begun on the previous day. Ophthalmological evaluation revealed complete closure of the eye subsequent to cellulitis of the upper and lower eyelids and proptosis of the right eye, with completely restricted upward movement of the eye. There was blurring of the nasal border of the orbital disc. Cefuroxime (Zinnat[®]) and metronidazole (Flagyl[®]) were given intravenously.

A CT scan of the paranasal sinuses and orbits showed medial SPOA causing the eyeball to protrude laterally and forward.



Figure 4. Case 2. Axial CT scan of the right orbit showing an abscess formation with a laterosuperior protrusion of the eyeball.

There was partial to complete opacification of the ethmoid cells, frontal and maxillary sinuses (Figures 3 and 4). Using EES under general anesthesia, the lamina papyracea was completely exposed, after removal of the ethmoid labyrinth, and removed, but no pus was obtained. A periosteal incision was made and the pus was released. The culture revealed *Haemophilus influenzae* and coagulase-negative *Staphylococcus*. During the postoperative period, there was slow regression of the cellulitis and improvement of eye movement until complete recovery after 11 days.

Case No. 3

An 8-year-old boy was admitted to our hospital because of cellulitis of the right upper and lower eyelids, proptosis and restricted eye movements, with a 38.5°C fever for the last couple of days. He complained of pain in the right eye, rhinitis and fever for 4 days prior to admission. He was treated at home by cephalexin (Keflex[®]) per-os for one day before arrival without success. Right eye examination revealed proptosis, and restricted horizontal and vertical eye movements. Visual acuity was normal. Coronal and axial CT scan of the sinuses demonstrated opacity medial to the rectus muscle suggesting a possible mass displacing the orbit laterally and forwards. The lamina

Table 1. Orbital abscess.

Patient No	Age/sex	Ocular findings	CT Scan	Culture	IV Treatment	Surgery	Hospitalization
1	8/M	EE, proptosis vertical & horizontal restriction	SPA-med bilateral pansinusitis	<i>Haemophilus influenza</i>	Cefuroxime + metronidazole	EES	7
2	12/M	EE, proptosis vertical restriction	SPA-SM pansinusitis	<i>Branhamella catarrhalis</i>	Amoxicillin clavulanic acid	1.EES 2.Rev. EES	12
3	16/M	EE, proptosis vertical restriction blurred optic disc	SPA-SM Ipsilateral pansinusitis	<i>Haemophilus influenza</i> + coagulase-positive <i>Staphylococcus</i>	Cefuroxime + metronidazole	EES	10

EE = edema of eyelid; EES = endonasal endoscopic surgery; SPA = subperiosteal abscess; SM = superomedial; Med = medial.

papyracea was partially missing. Bilateral pansinusitis was demonstrated. SPOA was the diagnosis. Intravenous cefuroxime (Zinnat[®]) and metronidazole (Flagyl[®]) and immediate EES under general anesthesia were begun. The right ethmoid complex was completely removed and the lamina papyracea widely exposed. After the lamina papyracea was detached from the periost and pus did not drain, a longitudinal cut was made in the periost by a sickle knife. A large amount of thick pus drained out. Water irrigation and massage over the involved eye completely drained the abscess. A small merocel tampon was left in place between the middle turbinate and the periost for 8 hours and then pulled out. Culture from the orbital abscess demonstrated *Haemophilus influenza*. One day after surgery, the fever was normal and two days afterwards the eye examination was within normal limits. Seven days after surgery he was sent home.

DISCUSSION

Orbital and intracranial problems are dangerous complications of rhinosinusitis⁽¹⁰⁻¹³⁾, with SPOA being more common than OA. Most authors advocate performing CT scans of the paranasal sinuses whenever adequate medical therapy fails in the treatment of acute rhinosinusitis, and in suppurative complications^(12,14-16). Although CT scan is the most frequent tool for diagnosing SPOA and OA, the accurate predictors of SPOA can be as low as 80%^(4,17). In our series of OA, the CT scan findings suggested SPOA prior to surgery. All the patients in our series had coronal and axial CT scans prior to surgery.

From a pathophysiology point of view, the possibility that SPOA formation preceded the formation of an OA was unlikely and was ruled out in the surgery itself, since pus was not demonstrated after removal of the lamina papyracea and the periorbit was found to be intact. We assume that the OA developed as a result of hematogenous spread, as opposed to the surgical findings by Wolf et al. who demonstrated a direct spread of the infection from the sinuses into the orbit through the lamina papyracea and the periost⁽⁹⁾.

The surgical approach is the treatment of choice in cases of OA, given that the relatively rare orbital infection has a greater potential of intracranial involvement and permanent orbital damage^(2,4,18,19). Prompt surgical intervention is required in cases of OA following complete physical examination, and ophthalmological and radiographical evaluations⁽⁹⁾. The minimal exposure recommended by Frohlich et al. when treating SPOA, using a minimal EES approach and exposing only the part of the lamina papyracea that is located medial to bulla ethmoidalis⁽²⁾, is not sufficient for treating an OA according to our surgical approach, because wide exposure of the periorbit is required to precisely locate the abscess, drain it successfully and maintain continuous drainage without the need for tube drainage.

As the CT scan in our three cases demonstrated SPOA, surgical intervention was postponed until after a trial of conservative treatment and the decision to perform surgery was influenced by the ophthalmological status. Although successful antibiotic therapy in SPOA has been reported in 25-92% of cases^(1,6-7,10,20-21), no clear data about successful antibiotic therapy in OA has been reported. Consequently, when conservatively treating an OA that has been misdiagnosed as an SPOA, we might endanger the patient!

In this study, we present three cases of OA diagnosed as SPOA on CT scan. Although the radiologist's diagnosis based on the CT scan was proven to be incorrect during surgery, further evaluation of the exam after surgery did not alter the radiologist's estimation that an SPOA had existed prior to surgery. This fact might intimate that a medially based OA might be interpreted as an SPOA when using CT scan.

Undrained SPOAs have been previously reported by Oxford et al.: in three (12%) out of 25 medial SPOAs no purulence was identified intraoperatively⁽³⁾. No further interventions were performed in these patients to clarify the situation. We presume that there are some possible explanations for this condition: surgical failure, misdiagnosis, resolution of the SPOA by medical therapy, or deterioration of the SPOA to OA from the time of CT scan performance to the time of surgical action. In the first case in our series, the OA was missed during the first operation despite wide exposure of the lamina papyracea. In the second surgical intervention on the next day, the lamina papyracea was detached widely and cuts were made in the periorbit to drain pus from an OA. In this case, the periorbit was found to be completely intact and this was the reason for the misdiagnosis by CT scan.

Therefore, we recommend that when pus is not detected after wide removal of the lamina papyracea, which might suggest formation of an OA, horizontal incisions should be made according to the localization of the radiographical findings, and gentle pressure should be applied over the globe to drain the pus from the orbit. If pus is not obtained through the cuts using this manoeuvre, a sickle might be introduced through the cuts to carefully massage the orbit and drain the abscess.

CONCLUSIONS

When the surgeon does not succeed in demonstrating pus between the lamina papyracea and the periorbit in cases of medial SPOA demonstrated on CT scan, we recommend performing an incision to penetrate the periorbit up to the orbital contents in order to drain a potential OA. An extremely careful surgical manoeuvre by a trained and experienced surgeon is needed for this procedure.

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