Review

Endoscopic treatment of orbital cellulitis in pediatric patients: Transetmoidal approach☆,☆☆

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A B S T R A C T

Orbital cellulitis is a septic process of the soft tissues behind the orbital septum and is the most frequent cause of the monolateral exophthalmos in pediatrics.

Approximately 90% of the orbital cellulitis in pediatrics are associated to acute ethmoiditis. From 01.01.2001 to 31.12.2010 we treated 36 patients, less than 18 years of age, affected by Chandler stage II, III, or IV orbital cellulitis.

The inflammation was resolved medically in 6 patients. In the 30 cases that showed no improvement in 48–72 h, an endoscopic drainage of the pus was performed by the transetmoidal route.

In children, an adenoidectomy should be included in order to eliminate eventual infections of this lymphatic organ.

Endoscopic treatment has resulted in rapid resolution of disease without any complications. In addition, postoperative discomfort is minimal, with a rapid return to daily activities.

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Tratamiento endoscópico de la celulitis orbital en la infancia: abordaje transetmoidal

R E S U M E N

La celulitis periorbitaria es un proceso séptico de los tejidos blandos orbitarios y representa la causa más frecuente de exoftalmos unilateral en la infancia.

Aproximadamente el 90% de los casos de celulitis periorbitaria en edad pediátrica se asocian a etmoiditis aguda. En el periodo 1. de enero de 2001–31 de diciembre de 2010 se han tratado 36 pacientes menores de 18 años con celulitis periorbitaria en los estadios II, III, IV de Chandler.

Seis pacientes consiguieron la resolución de la inflamación con el tratamiento farmacológico. En 30 casos que no demostraron una mejoría en un periodo de 48 a 72 h, se efectuó un drenaje quirúrgico endoscópico del moco-pus con abordaje por vía transetmoidal.

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En los niños es muy importante no olvidar el tratamiento quirúrgico de la adenoiditis crónica que, con toda probabilidad, se presentará simultáneamente.

La cirugía endoscópica permite una rápida resolución de la enfermedad sin ninguna complicación. Además, el malestar postoperatorio es mínimo, permitiendo un rápido regreso a las actividades cotidianas.

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Introduction

Orbital cellulitis is a septic process between the ethmoid and the orbital tissue representing the most frequent cause of unilateral exophthalmos in childhood.1,2

Clinically, orbital cellulitis begins with progressive pain at the level of the lacrimal bone followed by skin reddening in the area and subsequent progressive edematization of the eyelids. If the infection continues a general septic condition appears with high fever and acute pain. Palpebral edema worsens and impairs vision. Ocular global displacement is apparent in exophthalmos or enophthalmos depending on the site of the infectious process. In severe stages ophthalmological signs appear such as ocular global motility loss, paralyzing miosis, corneal hyposthesia or anesthesia, all of which could cause loss of vision.3

In addition to the above symptoms, patients could exhibit other signs such as headaches and intense somnolency, a sign of intracranial complications.3,5

The most severe complications are related to the extension of the infectious process to vascular structures (thrombophlebitis of the cavernous sinus) as well as the brain (extradural or subdural abscess and meningitis) which cause neurological damage and could eventually be fatal.

Approximately 90% of orbital cellulitis cases in children are associated to ethmoiditis4,6 which occurs due to the dissemination of the infection from the ethmoid to the orbital tissue due to bone rarefaction arising from osteitis involving the external wall of the ethmoid which corresponds to the internal region of the orbit, particularly at the level of the lacrimal bone.

The paranasal sinuses are adjacent to the orbits and the walls are crossed by valveless vascular channels, presumably channels for migration of microorganisms.

The suture areas between the various parts of the bone walls of the orbits, the suba- and sub-orbital channels, the delicate lamina papyracea separating the ethmoid from the orbits, possible acquired (osteitis, fractures) or congenital dehisences are additional weak areas in suppurating sinusitis.7 Less frequently, orbital cellulitis could be a consequence of the conjunctivitis, dacryocystitis, insect bites, injuries or actions on adjacent tissue or septicemia.5,9

Orbital cellulitis is a significant emergency. Prior to the appearance of antibiotics it was deadly in 17% of cases and between 20% and 50% of survivors lost their eyesight. At present, prognosis has improved: mortality rates does not exceed 1–2.5% and, when detection is premature and the treatment is adequate, blindness only occurs in 3–11% of cases.4,6

Traditionally, the orbital axis is surgically drained by means of a subciliary incision between the eyebrow and the internal palpebral commissure with the inclusion of a drain. Optionally, the possibility of endoscopic surgery must be considered to enable ethmoid draining and access evacuation without leaving visible scars. However, this surgery is difficult due to the phlogosis caused by the infection. In addition and particularly in an emergency situation, the surgeon must be highly experienced in endonasal endoscopic surgery.

The purpose of this review is to assess the indications, surgical methods and efficacy of endoscopic surgery by means of a critical review of pediatric patients who have been attended in the emergency ward of the Salerno University hospital and were treated jointly by the Ophthalmology and ENT departments.

Methods

A retrospective study of patients with orbital cellulitis admitted at the Salerno University hospital between January 1, 2001 and December 31, 2010. Onset age and disease stage were assessed according to Chandler’s classification (Table 1),10 together with bacteriological results, pharmacological and surgical treatment. The short and long-term results were established in accordance with the guidelines of the Helsinki declaration.

The study included subjects under 18 years of age with orbital cellulitis in Chandler’s stages II–IV (Figs. 1 and 2). The study excluded patients with inflammatory involvement exclusively in the preseptal area (stage I) and with cavernous sinus thrombosis at admission time (stage V), attended to by neurosurgeons.

The patients underwent ophthalmological examinations twice a day (comprising visual acuity, ocular motility and pupil reflexes), ENT examinations twice a day (comprising endoscopic exploration of the nasal fossae and aspiration of secretions in the middle meatus for bacterial culture), orbit and paranasal sinus multissection helicoidal CT, as well as pediatric and neurological assessments.

Pharmacological treatment was carried out in accordance with international standards, i.e., ceftriaxone 80 mg/kg once a day, metronidazole 7.5 mg/kg three times a day, nasal wash

<table>
<thead>
<tr>
<th>Table 1 – Chandler’s classification.</th>
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</thead>
<tbody>
<tr>
<td>Stage I</td>
</tr>
<tr>
<td>Stage II</td>
</tr>
<tr>
<td>Stage III</td>
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<tr>
<td>Stage IV</td>
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<tr>
<td>Stage V</td>
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</tbody>
</table>
and decongestive (nafezoline chlorhydrate) drops twice a day, paracetamol as required.\textsuperscript{11}

Surgical drainage of the orbitary abscess was performed when patients did not exhibit improvements after 48–72 h and when CT revealed superiostium or intraorbitary abscess (Chandler's stages III and IV).

When the thickness of superiostium abscesses was under 3 mm (2 patients in this series) and did not involve the internal rectus muscle of the eye, antibiotic treatment continued. If the abscess was not resolved within 24 h surgical treatment was performed. In case of larger abscesses, surgical drainage was executed immediately.

The intra-orbitary abscesses of this study were laterally to the optic nerve and accordingly tranethmoidal approach provided adequate control of the septic process.

### Results

Between January 1, 2001 and December 31, 2010 the University Hospital of Salerno admitted 36 patients with orbitary cellulitis (Table 2). All patients exhibited suppurated ethmoidal sinusitis.

Six patients in Chandler's stage II achieved resolution of the inflammation with pharmacological treatment (Table 3).

In the remaining 30 cases microendoscopic ethmoidectomy technique was applied followed by surgical mucus-pus drainage through the lamina papyracea which was generally eroded by the septic process. In 10 cases, adenoidectomy was associated and in 2 cases myringotomy was performed.

In six cases (two in Chandler's stage III and four in stage IV), after 48 h it was necessary to review the ethmoidectomy.

All patients achieved complete resolution of the inflammatory process. In 30 intervened patients (Chandler's stage III and IV) the main findings were:

- Streptococcus pneumoniae: 30%
- Haemophilus influenzae: 26.5%
- Streptococcus pyogenes: 26.5%
- Moraxella catarrhalis: 17%.

The same result was obtained in the 6 cases submitted to surgical review. The culture results match those reported by other authors who also reported greater prevalence of Streptococcus in orbitary complications.\textsuperscript{12–14}

### Table 2 – Population characteristics.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Number of patients</th>
<th>Chandler stage, number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>6</td>
<td>II: 6</td>
</tr>
<tr>
<td>III</td>
<td>6</td>
<td>III: 6</td>
</tr>
<tr>
<td>IV</td>
<td>24</td>
<td>IV: 24</td>
</tr>
<tr>
<td>Male/female</td>
<td>24/12</td>
<td></td>
</tr>
<tr>
<td>Mean age, years</td>
<td>11.5 (interval 4.2–17.5)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3 – Results based on Chandler's stage.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Number of patients</th>
<th>Pharmacological treatment</th>
<th>Ethmoidectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>6</td>
<td>Associated to adenoidectomy in 4 cases</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>6</td>
<td>Ethmoidectomy</td>
<td>Associated to tymanotomy in 1 case</td>
</tr>
<tr>
<td>IV</td>
<td>24</td>
<td>Ethmoidectomy</td>
<td>Associated to tymanotomy in 1 case</td>
</tr>
</tbody>
</table>

Review of ethmoidectomy in 2 cases
Review of ethmoidectomy in 4 cases
Table 4 – Bacteriological results.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Bacteria, number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacteriological cultures of medium meatus secretion by means of nasal endoscope</strong></td>
<td></td>
</tr>
<tr>
<td>Stage II</td>
<td>Staphylococcus aureus, 3 Streptococcus pneumoniae, 2 Streptococcus pyogenes, 1 Haemophilus influenzae, 2 Moraxella catarrhalis, 2 Streptococcus pyogenes, 2</td>
</tr>
<tr>
<td>Stage III</td>
<td>Haemophilus influenzae, 2 Moraxella catarrhalis, 5 Streptococcus pneumoniae, 9 Streptococcus pyogenes, 5</td>
</tr>
<tr>
<td>Stage IV</td>
<td>Haemophilus influenzae, 5 Moraxella catarrhalis, 5 Streptococcus pneumoniae, 9 Streptococcus pyogenes, 5</td>
</tr>
<tr>
<td><strong>Surgical drainage secretion cultures</strong></td>
<td></td>
</tr>
<tr>
<td>Stage III</td>
<td>Haemophilus influenzae, 3 Moraxella catarrhalis, 1 Streptococcus pyogenes, 2</td>
</tr>
<tr>
<td>Stage IV</td>
<td>Haemophilus influenzae, 5 Moraxella catarrhalis, 4 Streptococcus pneumoniae, 9 Streptococcus pyogenes, 6</td>
</tr>
<tr>
<td><strong>Review of ethmoidectomy</strong></td>
<td></td>
</tr>
<tr>
<td>Stage III</td>
<td>Haemophilus influenzae, 1 Streptococcus pyogenes, 1</td>
</tr>
<tr>
<td>Stage IV</td>
<td>Haemophilus influenzae, 1 Streptococcus pyogenes, 3</td>
</tr>
</tbody>
</table>

In addition, as shown in Table 4, no differences were found between the results of the assessments carried out with nasal endoscope in the middle meatus or during surgery directly at the abscess site.

**Discussion**

Patients suspected with orbital cellulitis must be immediately explored with imaging techniques (CT) and hospitalized. In the majority of cases (83%) of orbitary cellulitis during childhood, the data reported in the literature observed intra-orbitary or subdural abscesses which give rise to a module sinusitis. Even though MR would provide more precise information about soft parts, particularly to discriminate between healthy and infected tissue, with children it is generally necessary to apply general anesthesia for adequate exploration with imaging techniques. Accordingly, due to its speed and definition, multisectio helicoidal CT is at present the most indicated method for pediatric patients as it greatly clarifies the condition of the infectious process and possible intra-orbitary complications.

Leukocytosis (>15,000 cells/mm³) and inflammatory marker alterations are generally present and facilitate the differential diagnosis with non-infectious diseases such as juvenile pseudo-tumors. In addition, it is possible to take samples at the level of the middle meatus with sterile materials for culturing and anti-biogram.

As a general rule, pharmacological treatment is attempted before surgical procedure with antibiotics active against the germs which are potentially responsible for peri-orbitary complications. The results of microbiological tests have always confirmed the adequacy of the administered pharmacological treatment. Said treatment comprises antibiotics such as amoxicillin, association of amoxicillin with clavulanic acid or cephalosporin and metronidazole.17 In all the cases in which abscesses were not observed (Chandler’s stage II) a positive response to this non-invasive pharmacological treatment was obtained.

The cases which did not exhibit improvements within 48–72 h and exhibited ophthalmological signs such as ocular globe motility loss, paralyzing midriasis, corneal hypostesia or anesthesia were those who reached the hospital with intra-orbitary or peri-orbitary abscesses. In these cases, surgical drainage of the abscess was performed with endoscopic technique, particularly those exhibiting abundant inflammatory tissue in the meatus. Endoscopic surgery has demonstrated to be less invasive than traditional orbitotomy.3,18–20

It is very important to surgically treat chronic adenoiditis at the same time in order to remove possible lymphatic tissue infection sources. In the case of extended abscesses, surgical approach can be computer-assisted tranethmoidal as it enables a more precise exploration of the orbitary region. Combined trans-ethmoidal and trans-conjunctival surgical approach is rarely necessary to resolve more extensive and complex inflammatory processes.

To conclude, patient control in accordance with the criteria described above has facilitated the resolution of inflammatory processes in all examined cases. However, close cooperation between ophthalmologists and ENT specialists is required both for diagnosis and treatment. The choice of surgery and prognosis is mainly based on the anatomical and functional conditions of the visual system as well as in the CT findings for paranasal sinus and orbit.

Endoscopic treatment enables quick solution of the disease without complications. In addition, post-surgery discomfort is very low and facilitates early resumption of daily activities.

**Conflict of interests**

No conflict of interests has been declared by the authors.

**References**