

Orbital Cellulitis: Medical and Surgical Management

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Abstract

Introduction: Orbital cellulitis is a potential sight-threatening infection of the ocular adnexal structures posterior to the orbital septum. Acute bacterial sinusitis remains the most common cause of orbital cellulitis.

Methods: A retrospective chart review was performed for patients admitted to The Royal Victorian Eye and Ear Hospital with a diagnosis of orbital cellulitis over a five-year period to July 2009.

Results: 78 patients were identified for inclusion in the study, median age 42 years. Sinusitis was the most common predisposing factor, and was present in 52 patients (67%). All patients were treated with intravenous antibiotics. Surgical drainage was required for 28 patients (36%). Of these patients, 3 underwent endoscopic drainage only, 21 underwent open drainage, and 4 patients underwent a combination of open and endoscopic drainage. The most significant complication seen was persistent decreased visual acuity despite treatment, which was present in 5 patients (6%).

Discussion: Orbital cellulitis remains a potentially sight-threatening infection that requires careful management, preferably by combined ENT and Ophthalmology teams. Surgery is reserved for those patients in whom signs of visual compromise are present initially, or in those who fail to improve with maximal medical management. Currently endoscopic drainage is not the most common surgical approach, however for selected patients it appears a safe comparable alternative.

Keywords: Orbital cellulitis; Orbit; Rhinosinusitis; Endoscopic sinus surgery

Introduction

Bacterial orbital cellulitis is a relatively uncommon, though potentially sight-threatening, infection of the ocular adnexal structures posterior to the orbital septum. Acute bacterial sinusitis remains the most common cause of orbital cellulitis [1,2].

Chandler and colleagues [3] modified a system devised by Smith and Spencer [4] in 1948 for the classification of the orbital complications of acute sinusitis. These were:

- Group I: Inflammatory oedema. Now more commonly termed pre-septal cellulitis.
- Group II: Orbital cellulitis. Orbital inflammation with no discrete collection.
- Group III: Subperiosteal abscess. Orbital cellulitis with localised collection between the bony orbit and periorbita.
- Group IV: Orbital abscess. Orbital cellulitis with localised intra-orbital collection.
- Group V: Cavernous Sinus Thrombosis. Orbital cellulitis with infective thrombophlebitis extending into the cavernous sinus system.

Localised orbital collections, such as subperiosteal or orbital abscesses have traditionally been treated with external surgical drainage [5]. More recently, in highly-selected patients, medial subperiosteal abscesses have been treated successfully with medical therapy only [6]. In experienced hands endoscopic sinus surgery has emerged as an important alternative to external drainage.

Ferguson and McNab [1] documented the treatment and outcomes of orbital cellulitis from all causes at the Royal Victorian Eye and Ear Hospital (RVEEH) and Royal Children's Hospital in their 1999 paper,

reviewing the period from July 1993 to July 1997. In their paper acute sinusitis was the most common cause of orbital cellulitis. Other causes included dacryocystitis, intra-orbital foreign body, and upper respiratory tract infection without sinusitis.

Here we aim to review all patients admitted with a diagnosis of orbital cellulitis, with or without localised collection, to the RVEEH over a five-year period to July 2009. In particular we aim to identify any changes that have occurred as endoscopic techniques have achieved greater acceptance as a surgical option.

Patients and Methods

After receiving institutional ethics approval a retrospective review was performed on the clinical records of all patients admitted to the RVEEH with a diagnosis of Orbital Cellulitis under the Diagnostic Related Group for the period from July 2004 to July 2009.

These histories were then reviewed to confirm whether the patient did in fact have a definite diagnosis of orbital cellulitis. The following, previously established, criteria were used: presence of conjunctival chemosis, external ophthalmoplegia, proptosis, decreased visual acuity or radiological evidence of orbital collection or inflammation.

Presence of predisposing condition and duration of symptoms were

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noted, along with physical findings on examination. Other parameters considered included temperature on presentation, leucocytosis and bacterial growth using microbiological cultures.

The history, examination, antibiotic selection and timing of any surgical intervention were documented. Finally, timing of resolution was noted along with the presence of any complications.

For the purposes of this study proptosis was defined as >2mm globe extrusion compared to the non-affected eye, as measured with a Hertel exophthalmometer.

Raised intraocular pressure was defined as >2mmHg above that of the non-affected eye, as measured using applanation or electronic tonometry.

The ideal method of identifying reduced acuity would be to compare examination findings to a baseline, premorbid measurement. However this information was not available for the majority of our patients and so reduced visual acuity was defined for our purposes as corrected visual acuity 1line less than the non-affected eye on a Snellen Chart. This method of comparing acuity at a discreet point in time does not take into account previous asymmetry and may overestimate the number of patients with reduced acuity due to orbital cellulitis. Colour vision was assessed using Ishihara charts, with brightness and red saturation subjectively self-reported.

Results

Demographics

Seventy-eight patients meeting the diagnostic criteria were identified. This group comprised 49 males (63%) Table 1, with a male to female ratio of 1.7:1.

Mean age of presentation for all patients was 42 years (range 4-93 years). In total 17 patients were less than 16yrs of age (22%).

Presentation

The majority of patients presented with local ocular symptoms of erythema, pain and oedema. The median duration of symptoms before presentation was 3 days (range 1-21).

On clinical examination the most common signs of orbital cellulitis were reduced visual acuity when compared with the non-involved eye (54 patients, 69%), ophthalmoplegia (47 patients, 60%) and raised intra-ocular pressure (43 patients, 55%). Six patients (8%) showed a relative afferent pupillary defect, and eleven patients (14%) had reduced colour vision (Table 2).

Imaging

74 patients (95%) had a computerised tomography (CT) scan of the orbits and sinuses, either by the referring hospital or at RVEEH. CT scan was generally performed at the time of presentation to the RVEEH emergency department. All patients under 16 years of age were investigated with a CT scan.

On CT scan 17 patients (22%) had orbital cellulitis with subperiosteal abscess reported, while 11 (14%) had orbital cellulitis with an orbital abscess.

	Age 16+yrs	Age <16yrs
Male	37	12
Female	24	5

Table 1: Demographics.

Therefore overall 50 patients (64%) were in Chandler Classification Group II (orbital cellulitis), 17 patients (22%) were in Chandler Classification Group III (subperiosteal abscess) and 11 patients were in Chandler Classification Group IV (orbital abscess). No patients were found to have cavernous sinus thrombosis (Chandler Classification Group V).

Predisposing conditions

As in earlier studies sinus disease was the most common predisposing factor identified. 52 patients (67%) had radiologically confirmed sinus disease. Of these, 38 (73%) had multiple sinuses involved, with 46 (88%) having ethmoid involvement, either alone or in combination.

Eight patients (10%) had suffered recent orbital trauma, including orbital wall fractures or penetrating orbital injury. In two patients dacryocystitis with orbital extension was the predisposing condition.

In eight patients (10%) no predisposing condition was identified.

Microbiology

41 patients (53%) had a specimen sent for microscopy, culture and sensitivities. These samples were either blood cultures, 14 patients (18%); conjunctival swab, 11 patients (14%); nasal swab, 11 patients (14%) or culture from surgical specimen (eg. pus from maxillary sinus), 12 patients (15%). Patients may have had more than one specimen collected (Table 3).

Of the investigations performed 33 (69%) yielded an organism. However some methods of sampling were more sensitive than others. Surgical specimens were positive in 11 of 12 patients (92%), while blood cultures were positive in 4 of 14 patients (29%) (Table 3).

Staphylococcus aureus was the most common pathogen identified. No patients had methicillin resistant staphylococcus cultured.

Other common pathogens included streptococcus species, in particular streptococcus pyogenes. Anaerobic species were isolated

Sign	Present	Absent	Not recorded
Decreased visual acuity	53	25	0
Ophthalmoplegia	47	22	9
Proptosis	34	33	11
Chemosis	39	9	30
Raised intra-ocular pressure	43	16	19
Diplopia	20	11	47
Pupil Asymmetry	3	74	1
Relative afferent pupillary defect	6	16	46
Reduced colour vision	11	39	28
Reduced red saturation	10	17	51

Table 2: Presenting Signs.

Sample	Growth present	No growth	Yield (% +ve)
Blood Cultures	4	10	29
Conjunctival swab	8	3	73
Nasal swab	10	1	91
Surgical specimen	11	1	92

Table 3: Culture specimens.

in only two patients, although it appears anaerobic cultures were not regularly performed.

Treatment

All patients were admitted to the RVEEH and treated with intravenous antibiotics. Three patients were treated with antibiotic monotherapy (in all cases ceftriaxone), but all others were treated with multiple antibiotics, most commonly with the combination of a third generation cephalosporin and flucloxacillin. A smaller proportion 13 patients (17%) were also treated with metronidazole. Other antibiotic agents, including gentamicin, clindamycin or ticarcillin-clavulanic acid were used less frequently.

On discharge, oral antibiotics were used in at least 74 patients (95%), the remaining four patients did not have discharge medications documented in their histories, though would likely have also received antibiotic therapy.

On discharge oral amoxicillin with clavulanic acid was used in 43 patients (55%), either alone or in combination with metronidazole. Other common agents used were first or second-generation cephalosporins, 14 patients (18%) and flucloxacillin, 9 patients (12%).

Topical nasal medications, including corticosteroid, decongestant and/or saline sprays were used in 42 patients (54%). The majority of patients in whom nasal medications were not used had no evidence of sinus disease on CT scanning.

Systemic corticosteroid therapy was prescribed for 28 patients (36%). In 20 patients (26%) this was limited to twenty-four hours of therapy only.

Surgical treatment of orbital cellulitis included procedures to drain a subperiosteal or orbital abscess and surgical drainage of infected sinuses.

Open surgery was either an external ethmoidectomy via a Lynch incision and performed by an Ear, Nose and Throat Surgeon, or a transconjunctival or transcaruncular approach performed by an Ophthalmologist.

Endoscopic sinus surgery was used to treat both sinus disease and also for treatment of selected patients with a subperiosteal abscess.

Some patients had a combination of surgical approaches used.

Surgical drainage was required as an initial treatment for 14 patients (18%). All of these patients underwent open (non-endoscopic) drainage. The indications for immediate surgery included reduced visual acuity or relative afferent pupil deficit in the affected eye at the time of presentation, or evidence of orbital abscess on initial CT scan.

Of the 14 patients who initially received surgical drainage, four (29%) required repeat drainage during their admission. One (7%) was treated endoscopically and three patients (21%) received repeated open drainage, in all cases via an Ophthalmological approach.

14 patients (18%) underwent surgical drainage after an initial trial of medical management. All 14 patients failed to improve despite at least twenty-four hours of conservative therapy. Of these 14 patients, three (21%) underwent endoscopic drainage only, nine (64%) underwent open drainage, and three (21%) underwent a combination of open and endoscopic drainage.

Outcomes

After discharge, seven patients underwent a delayed elective

surgical procedure to treat the underlying cause of their infection. Four patients underwent endoscopic sinus surgery, two patients underwent dacryocystorhinostomy, and one patient underwent a dental procedure.

Two patients (3%) represented to hospital with a recurrence of symptoms within three days of discharge. Neither had received surgery as inpatients during their initial stays. Both patients then underwent emergency endoscopic drainage of the affected sinuses. They were each discharged after their symptoms had resolved.

Decreased visual acuity was the major complication seen, and was present in five patients (6%). Of these, three patients had a visual acuity in the affected eye of between one and three lines worse on a Snellen's chart than that of the unaffected eye. Although a pre-morbid acuity was not recorded for these patients, none had any previous evidence of impairment. The other two patients required enucleation or evisceration as part of their management due to orbital cellulitis with endophthalmitis.

Discussion

Orbital cellulitis is a relatively uncommon infection often arising due to sinus disease. The presenting symptoms of patients with orbital cellulitis have been well described previously and are documented again in this patient group [1].

Most patients presented with symptoms of lid erythema and oedema, often following an upper respiratory tract infection or rhinosinusitis. Evidence of orbital inflammation, manifesting as chemosis, ophthalmoplegia and proptosis are important signs differentiating orbital cellulitis from pre-septal cellulitis [2,3].

CT Scanning remains the hallmark of investigation. Although all children in this study underwent CT scanning, in other studies some have been managed expectantly with frequent close examination. As the risks of radiation exposure become better recognised [7] and magnetic resonance imaging (MRI) scans become more widespread this modality may become the investigation of choice in children [8].

Culture results in this study were varied, depending on the site and method used. As in previous studies [9,10] there was a higher success rate for identifying a pathogen with surgical specimens (92%) than with blood cultures (29%), despite the fact that most surgical specimens would have been collected after the commencement of antibiotics.

Antibiotic regimens varied moderately between patients, and in all cases were commenced before a causative organism was identified. The most common involved multiple agents, appropriately covering *Staphylococcus*, *Streptococcus* and anaerobe species.

Steroids, either oral or intravenous were prescribed in 20 cases (25%), and their utility in reducing the acute inflammation of orbital cellulitis or collection cannot be accurately assessed in this cohort. However one of two patients who were readmitted soon after discharge and required surgical drainage had been on intravenous steroids including the day of discharge.

Reflecting the nature of the hospital, early ophthalmology and otolaryngology consultation was the standard of care for these patients. In any serious infection of the orbits, particularly in cases where rhinosinusitis is suspected to be a contributing factor, dual specialty involvement is warranted to identify any complication that may warrant early surgery and to adequately treat any predisposing condition.

Surgery was required in 28 (36%) patients during their admission.

This rate is lower than the previous study by Ferguson and McNab (69%), both for adults 38% versus 55%, and was more marked for children 29% versus 76%.

The lower numbers of children involved in this study is predominantly due to the cohort being drawn only from the RVEEH, a combined adult and paediatric health service, and not also the Royal Children's Hospital, unlike the 1999 paper.

The reduction in frequency of surgery may reflect an earlier presentation of patients with ocular symptoms, along with earlier referral from peripheral hospitals. It may also suggest more confidence for clinicians to manage these conditions conservatively with surgery reserved for the most serious cases.

The need for, and the appropriate timing of surgery is one of the more difficult assessments in the treatment of orbital cellulitis.

Evidence of visual compromise, either as reduced visual acuity or a relative afferent pupillary defect may be identified during the ophthalmological examination and may necessitate early surgical intervention [11,12].

In this study, all patients with Chandler Group IV (orbital abscess) diagnosis received surgical intervention.

Selected patients in Chandler Group III (subperiosteal abscess) were treated medically initially if there were no signs of visual compromise on ophthalmological examination.

The transcaruncular approach, in addition to the transconjunctival approach for orbital collections is a relatively recent development [13,14]. Its increasing usage at RVEEH reflects both the growing evidence in its favour, and also the increasing experience of the Ophthalmologists in accessing the medial orbital wall via such an approach.

Although still less common, endoscopic sinus surgery was used in nine patients (12%). This largely reflects the fact that at RVEEH patients with orbital cellulitis are treated by both a subspecialty Orbital Plastics ophthalmology team and an Ear, Nose and Throat team. It appears also that endoscopic approaches were not used in the most serious cases, which were treated via an open approach [15,16]. However no patient who was treated with endoscopic drainage required further surgery.

Conclusion

Although still a relatively uncommon presentation, orbital cellulitis remains a potentially sight threatening infection that requires careful examination and treatment, preferably by combined ENT and Ophthalmology teams.

Surgery is reserved for those patients in whom signs of visual compromise are present initially, in those with an orbital abscess, or in those who fail to improve with maximal medical management. The timing of any surgical intervention, and the surgical approach used remains varied.

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