

Acute Orbital Cellulitis—A Review of 17 Cases

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Abstract

This is a retrospective study of 17 patients who were admitted for orbital cellulitis between August 1989 and February 1994. The epidemiology, possible source of infection, the causative organisms and effectiveness of treatment were reviewed. The results showed that one-third of the cases occurred in the first decade of life. Paranasal sinusitis was the main source of infection in 11 (65%) patients. Thirteen patients (76.5%) developed orbital and periocular abscesses requiring surgical drainage. Two out of 17 eyes lost vision despite intensive treatment.

Orbital cellulitis is a blinding ocular emergency associated with high morbidity. Immediate treatment is necessary to avoid devastating complications such as optic nerve compression, panophthalmitis or intracranial spread of infections. Cases with abscess formation required early surgical drainage. Combined orbito-otorhinolaryngologic approach is recommended for drainage of orbital abscess with associated paranasal sinus infection.

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Introduction

Orbital cellulitis is an infective inflammation of the orbital structure with a rapidly progressive clinical course. It is often the result of a contiguous spread of infection from adjacent structures like paranasal sinuses and ocular adnexa, or from distant foci in septicaemic patients. The initial inflammatory oedema could develop into intraorbital or subperiosteal abscesses. Further progression may involve the intracranial structure leading to more devastating and potentially life-threatening complications such as cavernous sinus thrombosis, subdural empyema and intracranial abscess formation (Chandler's classification).¹ Although the incidence of orbital cellulitis has remained low with better primary health care and availability of broad spectrum antibiotics, it is still a blinding ocular emergency and often a difficult problem to manage.

Materials and Methods

The clinical records of patients admitted with clinical diagnosis of orbital cellulitis to the Department of Ophthalmology, Singapore General Hospital/Singapore National Eye Centre from August 1989 to February 1994 were reviewed. The diagnostic criteria included soft tissue inflammatory signs (conjunctival chemosis, periocular erythema and tenderness), proptosis and restric-

tion of ocular motility. Only cases which satisfied at least two of the clinical diagnostic criteria were included in the study. The clinical presentation, investigation results, mode of treatment and final outcome of the patients were analysed. Investigations included full blood count, roentgenographic studies of the paranasal sinuses and orbits and microbiological studies. Conjunctival swabs, blood culture samples, and swabs or aspirates taken directly from the abscess cavities during surgical exploration were sent for culture and sensitivity tests for aerobic, anaerobic bacteria and fungi. The eventual recovery was assessed in terms of final best corrected visual acuity, ocular motility and any residual associated ocular complications.

Results

Patient Profile

The age distribution ranged from 5 to 72 years (Fig. 1) with 6 patients (35%) in their first decade of life. The mean age was 31.5 years. No sex predilection was found.

Clinical Presentation

The mean duration of symptoms prior to presentation was 3.7 days (range: 1 to 10 days). The commonest symptoms were periocular swelling (all patients), pain (15 patients) and fever (10 patients). There were more

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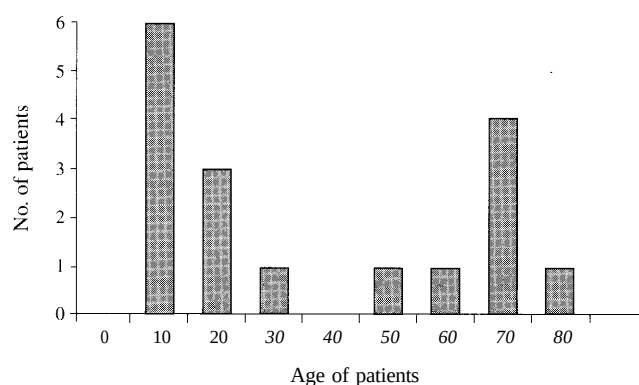


Fig. 1. Age distribution of patients with orbital cellulitis.

left eye (10 eyes) being involved than the right (7 eyes) but this has doubtful clinical significance.

Out of the 6 patients whose age was less than 10 years, 3 had recent history of upper respiratory tract infection and 3 underwent recent strabismus surgery in the same eyes. Three out of the remaining 11 older patients (aged 10 years and above) had predisposing medical problems; two of them had diabetes mellitus and one patient had septicaemia and multiple medical complications with history of paranasal sinus problem.

All patients were found to have marked periorcular swelling (in the form of lid oedema and erythema), restriction of ocular motility and severe conjunctival chemosis at the time of admission (Table I). Proptosis (forward protrusion of the globe of more than 2 mm compared to the fellow, uninvolved eye) was found in 12 patients (70.5%) of which two-thirds were nonaxial. Nine patients (52.9%) had purulent ocular discharge. Only 7 patients (41.1%) were febrile (defined as body temperature of more than 38°C) on admission. Other significant signs were lymphadenopathy (2 patients), dacryocystitis (1 patient) and mechanical ptosis of the upper lid (2 patients).

Investigation Results

Leukocytosis (total white count of more than 11 000/mm³) was present in eight patients (47%). All patients had plain radiological studies of paranasal sinuses done on admission. More than three-quarters of the patients

had abnormal radiological findings which included haziness or opacification of sinuses (11 patients), thinning of the sinus wall (1 patient) and presence of air fluid level (1 patient). Ethmoidal sinus (10 patients) and maxillary sinus (9 patients) were commonly involved while frontal sinus (4 patients) and sphenoidal sinus (2 patients) were infrequent associations. Computerised tomographic (CT) scan was done in 12 patients who did not respond favourably to initial antibiotic treatment. The indications for CT scan were:

- 1) progression of clinical signs,
- 2) clinical suspicion of orbital abscess formation,
- 3) persistent fever for 48 hours despite antibiotics therapy, and
- 4) all post-surgical cases.

Abscess formation occurred in 13 patients (76.5%). The locations of the abscess were at the subperiosteal (5 patients), intraorbital (2 patients), subconjunctival (2 patients), lacrimal (2 patients) and lid (1 patient). The subconjunctival abscesses were located anteriorly in the subtenon space; both of them developed after strabismus surgery. The remaining 2 intraorbital abscesses were deep and located between the recti muscles.

The results of microbiological studies are summarised in Table II. Fifteen conjunctival swabs were obtained of which 4 (26.6%) grew *Staphylococcus aureus*. Blood cultures were taken in 5 patients with high spiking fever and 2 (40%) showed positive results. The organisms found were β -haemolytic streptococcus group A in a 9-year-old boy and *Streptococcus* group D in a 63-year-old man with septicaemia. Eleven aspirates were taken directly from the abscess in which 9 were positive. Four were taken from the orbital cavity, 5 from the subperiosteal space, 1 from the upper lid and 1 from the lacrimal gland. The pathogenic organisms found were *Staphylococcus*, *Streptococcus* and *Pseudomonas aerogenosa*.

Treatment

Parenteral antibiotics were administered to all patients upon diagnosis. Four patients showed improvement of clinical symptoms and signs within 48 hours after admission and did not require any further investigation and surgical intervention. Thirteen patients (76.5%) required drainage of abscesses. The surgical

TABLE I: PRESENTATION OF ORBITAL CELLULITIS

Presenting Signs	No. of Patients (n = 17)
Periorcular Swelling	17 (100%)
Motility Restriction	17 (100%)
Conjunctival Chemosis	17 (100%)
Proptosis	12 (70.5%)
Fever	7 (41.1%)
Discharge	9 (52.9%)
Others	6 (35.2%)

TABLE II: RESULTS OF MICROBIAL STUDIES

Source	No. of specimen taken	Positive Cultures				
		Streptococcus			Total	
		S . aureus	β -haemolytic Group A	D P. aerogenosa		
Conjunctival	15	4	0	0	4	
Surgical	11	5	2	1	9	
Blood	5	0	1	1	2	

procedures included incision and drainage of adnexal abscesses (4 patients), otorhinolaryngologic procedures alone (drainage of the affected paranasal sinuses) (4 patients), orbital drainage followed by otorhinolaryngologic procedure as a second procedure (4 patients) and combined orbital-otorhinolaryngologic drainage (1 patient) (Table III). The timing of surgery ranged from 24 to more than 72 hours after admission. Nine patients with clinical evidence of orbital or periocular abscess formation had them drained within 24 hours. Two patients were drained 48 hours after admission when they failed to respond to medical treatment. The last patient was drained 8 days after diagnosis because he developed complications from septicaemia and his condition had to be stabilised before surgery.

Aetiology and Outcome

The primary source of infection was from paranasal sinusitis in 4 out of 6 patients in the younger age group (less than 10 years) and 7 out of the remaining 11 patients (65% of all cases). Three children were infected after squint surgery. One of them also had associated sinus infection. Their symptoms developed at a mean interval of 4 days after operation. All were younger children (less than 10 years). One developed haematoma formation at the time of surgery, while the other two cases were uneventful during the initial surgery. Other causes were: infected meibomian cyst (2 patients), dacryoadenitis (1 patient) and dacryocystitis (1 patient) (Table IV).

The average duration of follow up was 91.3 days ranging from 1 week to 2 years. The initial and final visual acuity are presented in Figure 2. Two patients had residual restriction of ocular motility together with significant corneal opacity as a result of exposure

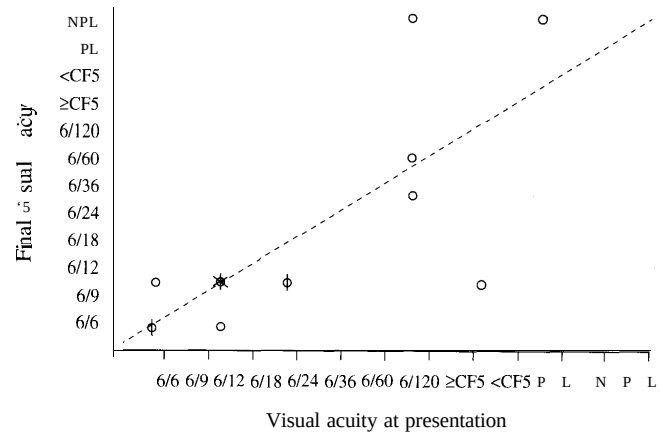


Fig. 2. Visual acuity at presentation versus final visual acuity.

keratitis. One patient developed total exudative detachment due to contiguous inflammatory changes of the tenon-scleral coat.

Discussion

The age distribution of these 17 patients admitted for orbital cellulitis showed a bimodal pattern which peaked at the age group of 0 to 10 years (35% or 6 patients) and the age group of 67 to 70 years (23.5% or 4 patients). The first peak corresponds to the paediatric age group in which there is a high prevalence of upper respiratory tract infection while the second peak corresponds to the elderly group whose immunity was weakened by age.

The onset of symptoms was rapid (mean duration 3.7 days) and all the patients presented with classical features indicative of orbital disease. Prior systemic antibiotic treatment may have altered some of the clinical parameters as only less than half of the patients were febrile on admission and leukocytosis was only present in 8 (47%) of patients. Evaluation of the aetiology showed that paranasal sinusitis was the main source of infection (65%) followed by lid disease, lacrimal disease and surgical trauma. Schram et al in his series of 303 cases of orbital cellulitis reported that 85% were due to sinusitis, 10% were cutaneous in origin and 5% were secondary to lacrimal diseases.⁷ The yield for positive conjunctival swabs was not high in orbital cellulitis.² In our series, only 4 (26.6%) patients had positive conjunctival culture results and they presented with discharging abscesses clinically. Five patients with high spiking fever had blood cultures taken and 2 patients had positive culture results. Although blood cultures are often negative especially in older patients, it is still considered by many to be useful adjunctive tool in detecting the causative pathogens responsible for the infection.^{3,4} The best yield of pathogens was obtained from specimens taken at the time of surgical drainage (81.8%). Although anaerobic infection is common in sinusitis, no anaerobic organism was found in our cultures. Inappropriate specimen col-

TABLE III: DEFINITIVE SURGICAL PROCEDURES PERFORMED

Surgical Procedures	No. of Patients
Combined Orbito-Otorhinolaryngologic Drainage	1
Orbital Followed by Otorhinolaryngologic Drainage	4
Otorhinolaryngologic Drainage	4
Simple Incision and Drainage	4
Total	13

TABLE IV: AETIOLOGY OF ORBITAL CELLULITIS

Aetiology	No. of Patients (%)
Paranasal Sinusitis	11 (65%)
Lid Disease	2 (11.7%)
Lacrimal Disease	2 (11.7%)
Post-Surgical	3
Total	17

Note: 3 patients developed orbital cellulitis after surgery, one of them had associated sinus infection and is grouped under sinusitis.

lection may be a significant factor.⁵

The roentgenographic studies revealed an interesting pattern. For the younger children (<10 years), they frequently had coexistent maxillary and ethmoid sinus infection (75%), as compared to the older age group (>10 years) who seemed to have more than two sinuses involved (85.7%), i.e. ethmoid (100%), maxillary (71.9%), frontal (51.7%), and occasional sphenoid sinus (14.2%). A similar observation was reported by Fearon⁶ which rated the incidence of ethmoid disease in orbital cellulitis to be as high as 75% in children and that it was usually associated with maxillary infection. In his series on adolescent and adults sinusitis, frontal sinus disease coexisted in 71% and some had pansinusitis. Hence, ethmoid and maxillary sinuses are most commonly involved in orbital cellulitis in the first decade of life, after which frontal sinus disease became more common.^{6,7} The varying patterns of sinus involvement in different ages can be explained by the fact that the development of paranasal sinuses occurs at different stages of life.

Cases with periocular source of infection included two cases of lacrimal pathology-dacryocystitis and dacryoadenitis and two with infected chalazion. The lid chalazions were inadequately treated and the infection extended beyond the orbital septum and involved the orbital soft tissues. The organisms obtained in both cases were *Staphylococcus aureus*. Orbital infection following squint surgery occurred in 3 patients of which one had coexisting sinus infection. The organisms involved were *β-haemolytic streptococcus* and *Staphylococcus aureus*.

The incidence of abscess formation in our review was as high as 76.5%. A large study from the Hospital for Sick Children in Toronto which analysed 6770 patients with sinus infection, found 159 cases developed orbital cellulitis.⁶ The frequency of abscess formation in that study was 10.7%. In other series which included all age groups, the results varied from 54% to 100%. We had 5 cases of subperiosteal abscess (SPA) in our study. All were associated with acute sinus infection. Subperiosteal abscess is an accumulation of pus in the subperiosteal space often seen as a complication of sinus infection which spread either via direct extension, the valveless venous network, neurovascular foramina or phlebitis extension through the thin sinus wall or bony dehiscence and sometimes resulting in osteomyelitis and necrosis of the bony wall. It presents with severe proptosis and globe displacement (Fig. 3) and CT scan findings of a raised homogenous opaque mass between the wall and periorbita, and with contrast media, the periorbita could be clearly defined (Fig. 4).⁸ Four of our cases were medially situated with associated ethmoid sinus infection and one had laterally located SPA from a ruptured frontal mucocoele that tracked infero-laterally along the lateral orbital wall. All required surgical drainage. The

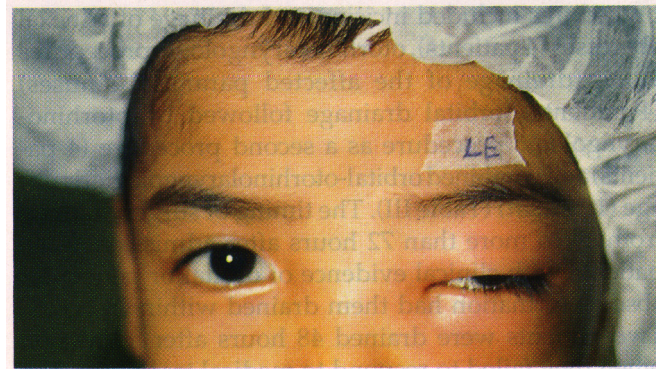


Fig. 3. Clinical picture of a child with left orbital cellulitis complicated with medial subperiosteal abscess. Note the lateral displacement of the left globe.



Fig. 4. CT scan of a left medial SPA showing a raised homogenous opaque mass between the ethmoid bone and periorbita.

patient with lateral SPA lost her vision eventually despite urgent surgical intervention as she had an acute rupture of frontal mucocoele that gave rise to rapid development of SPA. The sudden increase in intraorbital pressure resulted in irreversible compressive optic neuropathy. The intraorbital abscess that resulted from suppurative changes involving the orbital tissues appeared on CT scans as homogenous or heterogenous mass, located within the orbital structures, sometimes accompanied by an air-fluid level. There were 2 patients with intraorbital abscesses; one of them had prior squint surgery. On surgical exploration, both were found to be located in the intermuscular spaces with necrosis of adjacent scleral walls. The other was a case of an elderly man with septicaemia, pansinusitis and orbital cellulitis. The organisms cultured were *Staphylococcus* and Group D *Streptococcus* respectively. The subconjunctival abscesses located anteriorly in the subtenon space were seen in two patients who developed orbital abscess after strabismus surgery. *β-haemolytic streptococci* were cultured from these cases. Abscesses involving the ocular adnexa were mainly soft tissue masses in the periocular region i.e. lids and lacrimal tissues. The

surgical cultures of these abscess showed staphylococcal infection.

Combined orbito-otorhinolaryngologic procedures were required for adequate drainage in 5 patients (38.4%) who had SPA and associated sinus abscesses. Four of these patients underwent orbital drainage alone initially via extraperiosteal approach to release pus from the subperiosteal space; unfortunately the abscesses re-accumulated the following day and required another otorhinolaryngologic drainage to remove the infected material from the adjacent sinuses to achieve complete evacuation of pus. Those with subconjunctival and adnexal abscess were incised and drained directly.

Two patients were blinded by optic nerve compression from raised intraorbital pressure following orbital cellulitis and abscess formation. One was a 71-year-old lady with lateral SPA due to a ruptured frontal mucocoele. The second case was a 63-year-old man who was medically unfit for surgical drainage or decompression. Significant morbidity was seen in cases complicated by intraorbital abscess formation. The severe inflammatory reaction often resulted in severe tissue destruction followed by fibrosis scarring and adhesion of intraorbital structures. Two patients developed motility problem from extraocular and intermuscular tissue fibrosis. The first case was an elderly man who was blinded by the infection, and he developed a "frozen globe" from severe restriction of ocular muscle movement. The second patient was a 6-year-old boy who underwent a bimedial resection surgery, and developed muscle slippage which resulted in ocular deviation and loss of ocular mobility. He required a second surgery to correct his motility dysfunction. Both patients also developed corneal opacities from exposure keratopathy as a result of severe proptosis of their globes.

Recommendations

All patients presenting with symptoms and signs of orbital cellulitis require immediate hospitalisation for management. Effective treatment should be promptly instituted to prevent deterioration of conditions and irreversible damage to vision as well as serious systemic complications.

Simple blood tests such as full blood count and differential count are useful to differentiate orbital cellulitis from other orbital inflammation, although prior antibiotic treatment by other medical practitioner may alter the blood profile of the patient. In cases with high fever and leukocytosis, especially in children, blood culture should be taken. Specimens obtained from the conjunctival fornices, nasopharynx and especially direct aspirate from abscess cavity are useful in detecting pathogenic microorganisms. Roentgenographic studies and CT scans are important investigations in assessing severity of orbital inflammation and

localisation of abscess formation.

The organisms involved in orbital cellulitis are mainly penicillin-resistant organisms. In adults with associated sinus infection, mixed bacteriology with gram-negative and occasional anaerobes should be suspected. The initial antibiotic regime in adults is parenteral ampicillin/cloxacillin (100 to 150 mg/kg/day in divided doses) with gentamicin.⁹ For patients with penicillin allergy or methicillin-resistant staphylococcal infection, intravenous clindamycin (10 to 20 mg/kg/dose 6 hourly with maximum dosage of 1 g 6 hourly) or cefotaxime is the alternative. In cases with history of trauma, combination of intravenous vancomycin (20 mg/kg/dose 12 hourly with maximum dosage of 500 mg/dose), cloxacillin and cefazolin should be given. For cellulitis in children the effective drug of choice is parenteral cefuroxime (zincef) (100 mg/kg/dose in divided doses). Alternative antibiotics are ampicillin/cloxacillin (100 to 150 mg/kg per day in 4 doses), with chloramphenicol (75 mg/kg/day in four doses) when haemophilus infection is suspected,⁴ or clindamycin/cephalosporin for penicillin-allergic patients.* Systemic antibiotic treatment should be continued until signs of periocular swelling and inflammation have resolved. Those with bacteraemia will require 1 to 2 weeks of intravenous therapy.

All abscesses require early surgical drainage to evacuate the purulent content and reduce morbidity. The mechanical effect of increased intraorbital pressure due to abscess formation could compromise optic nerve circulation rapidly and is frequently the cause of visual loss in patients with orbital cellulitis. Hence, in orbital infection in which there is acute proptosis with signs indicating compression of optic nerve, temporary orbital decompression can be achieved by performing lateral canthotomy with inferior cantholysis. Such simple procedure is important in preventing irreversible optic nerve compression prior to proper surgical drainage. Orbital drainage via transconjunctival or transseptal approach is often adequate for isolated orbital abscess. When there is associated sinus infection, combined orbito-otolaryngologic procedure should always be considered, and any primary source of infection, once identified should be treated aggressively.

Corneal protection should be observed in the management of these patients. Visual loss from exposure keratitis due to severe proptosis can occur if it is neglected. A complete patient management should also include close monitoring of neurological signs to detection of early central nervous system and systemic involvement.

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