

# Orbital Cellulitis: A Rare Complication after Orbital Blowout Fracture

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**Purpose:** To report the incidence of orbital cellulitis after orbital blowout fracture.

**Design:** Retrospective, noncomparative, interventional case series.

**Participants:** All patients with orbital cellulitis and a history of recent orbital fracture.

**Methods:** A medical record review of clinical history, imaging studies, and surgical and treatment outcome was performed.

**Main Outcome Measures:** Resolution of orbital cellulitis and surgical and imaging findings.

**Results:** Four patients (3 male; mean age, 30 years [range, 4.5–58]) were treated for orbital cellulitis complicating orbital fracture. All patients had evidence of paranasal sinusitis before or after the orbital injury, and 2 also reported forceful nose blowing after sustaining orbital trauma. Although 3 patients received prophylactic oral antibiotics after the fracture, this failed to prevent infection. Sinusitis commenced 1 to 2 weeks before and as late as 5 weeks after orbital injury. All patients were treated with IV antibiotics. Two developed an orbital abscess that required surgical drainage; 1 patient improved after an endonasal maxillary antrostomy. One patient improved on IV antibiotics alone and underwent fracture repair at a later stage. These 4 patients represent 0.8% of all cases of orbital fractures treated in the study period.

**Conclusions:** Orbital cellulitis is a rare complication of orbital fracture, and seems to be more common when paranasal sinus infection preexists or occurs within several weeks of the injury. Oral antibiotics given after the orbital injury may not prevent orbital cellulitis or abscess formation. Surgery may be required to drain orbital abscess or in nonresolving cellulitis to drain the paranasal sinuses. Fracture repair, if indicated, should be delayed, particularly if an alloplastic implant is used. *Ophthalmology* 2005;112:2030–2034 © 2005 by the American Academy of Ophthalmology.

Orbital cellulitis is a serious condition that usually occurs secondary to infection in the maxillary and ethmoidal paranasal sinuses. If left untreated, it can lead to blindness, cavernous sinus thrombosis, meningitis, or cerebral abscess.<sup>1–5</sup>

Orbital fractures are a common sequela of blunt orbital trauma but are only rarely associated with orbital cellulitis.<sup>6</sup> Previous reports have described orbital cellulitis after naso-orbital fractures with preexisting sinusitis.<sup>7–9</sup> It has been postulated that fracture of the orbital floor may compromise the blood supply to the inferior orbital fat, thus predisposing the patient to anaerobic cellulitis.<sup>10</sup> The presence of blood clots in the sinuses may also increase the risk of infection. The use of antibiotic prophylaxis in orbital fractures that involve the sinuses remains controversial, with no evidence

that this decreases the incidence of posttraumatic infection.<sup>11,12</sup>

The purpose of the current study is to report 4 patients who developed acute severe orbital cellulitis with or without an orbital abscess, after sustaining an orbital blowout fracture. All patients had coexistent paranasal sinusitis that occurred before or after the orbital trauma.

## Materials and Methods

A medical record review of all patients who developed orbital cellulitis within 6 weeks of an orbital fracture at the Royal Victorian Eye and Ear Hospital, Melbourne and the Royal Adelaide Hospital was performed. The search was performed in a computerized database of all outpatients and inpatients for *orbital cellulitis* and *orbital fracture*; medical records that included both diagnoses were pulled out and evaluated. If orbital cellulitis occurred within 6 weeks of orbital fracture, patients were included in the study.

All patients were treated between January 1995 and March 2005 in the Royal Victorian Eye and Ear Hospital and between May 1989 and September 2002 in the Royal Adelaide Hospital.

Data regarding clinical presentation, imaging studies (computed tomography [CT] and/or magnetic resonance imaging), microbiology, and surgical findings were collected and analyzed.

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## Results

A total of 497 patients with orbital fractures were treated at the Royal Victorian Eye and Ear and Royal Adelaide hospitals in the study periods. Four patients (0.8%) who developed orbital cellulitis were identified.

Four patients (3 male; mean age, 30 years [range, 4.5–58]) were treated for orbital cellulitis after orbital blowout fracture. All patients had radiological evidence of paranasal sinusitis either at the time of orbital injury or occurring within days or weeks. In addition, 2 patients reported forceful nose blowing after sustaining orbital trauma. Three patients received prophylactic oral antibiotics after orbital fracture, but this did not prevent development of orbital cellulitis or orbital abscess. Sinusitis had commenced from 1 to 2 weeks before orbital injury to as late as 5 weeks after orbital injury. Clinical characteristics of the study population are summarized in Table 1.

Two patients developed an orbital abscess that required surgical drainage. One patient underwent an orbital exploration that failed to reveal an abscess and subsequently underwent endonasal maxillary antrostomy with drainage, followed by rapid improvement in orbital signs. One patient improved on IV antibiotics alone and underwent orbital fracture repair with an absorbable plate at a later stage.

## Case Reports

### Case 1

A 4.5-year-old boy was referred with left periorbital swelling. He had a 1-week history of upper respiratory tract infection for which he had been treated with oral antibiotics. Five days before admission, he fell and struck his eye with a bicycle handle. His mother noted that the lower eyelid was swollen and the skin abraded, but the skin was not bruised or reddened, suggesting the possibility of subcutaneous emphysema. Over 2 days before admission, he developed progressive inferior periorbital swelling with pain. Clinical examination disclosed marked periorbital redness and swelling, with no voluntary eyelid opening. Visual acuity (VA) was at least counting fingers, but no proper evaluation of ocular motility or pupillary response could be made due to marked pain, swelling, and chemosis (Fig 1A). Computed tomography of the orbits disclosed 2 separate masses in the left inferior lateral orbit displacing the globe superiorly, with bilaterally opaque ethmoidal and max-

illary sinuses left more than right (Fig 1B, C) and a small relatively undisplaced orbital floor fracture (Fig 1C). He underwent an exploratory orbitotomy (swinging lower eyelid incision) that revealed 2 intraorbital abscesses. Gram stain showed polymorphonuclear cells (+3) with no evidence of microorganisms. No organisms grew on aerobic or anaerobic culture. Postoperatively, he showed marked and rapid improvement with IV ceftriaxone, vancomycin (because of penicillin allergy), and oral prednisolone syrup that was started on day 3. Visual acuity and ocular motility had returned to normal in the course of 3 days. Surgical drainage of the sinuses was not performed at the time of orbitotomy.

### Case 2

A 25-year-old male was referred with a diagnosis of right orbital floor fracture after a surfboard injury; clinical examination disclosed VA of 20/20 and normal ocular examination results, including ocular motility. A CT scan of his orbits and paranasal sinuses showed a small midorbital floor fracture, with clear maxillary and ethmoidal sinuses. The patient was treated conservatively, and no antibiotic treatment was prescribed. Five weeks later, he returned with marked right periorbital pain, redness, swelling, and a temperature of 38.3° C (Fig 2A). There was a history of a nonspecific upper respiratory tract infection for the past week with forceful nose blowing 1 day before admission. On clinical examination, he had periorbital swelling and redness, VA of 20/60, and painful restriction of ocular motility in all directions of gaze. A complete blood count showed an increased leucocyte count of  $20 \times 10^3$ , with a predominance of neutrophils. A repeat CT scan of the orbits showed air in the inferior lateral orbit on the right side (Fig 2B) and orbital floor fracture and opaque maxillary and ethmoidal sinuses on the right side (Fig 2C). The patient was diagnosed with acute orbital cellulitis and began treatment with IV ceftriaxone, metronidazole, and flucloxacillin. Swelling and ocular motility limitations deteriorated over the following hours, despite antibiotic therapy. He underwent a right orbital exploration via a swinging lower eyelid incision that revealed no orbital abscess; the lateral canthotomy and cantholysis were left unsutured. An endonasal maxillary antrostomy was performed with drainage of purulent material under pressure. Postoperatively, the patient showed marked improvement, with decreased pain, increased extraocular motility, and normal VA. Blood cultures were negative, and gram stain from the maxillary sinus pus showed marked granulocytosis with no microorganisms. No organisms grew on anaerobic or aerobic cultures.

Table 1. Clinical Characteristics of 4 Patients with Orbital Blowout Fracture and Sinusitis Who Developed Orbital Cellulitis with or without Orbital Abscess

Case	Age (yrs)	Gender	Side	Fracture	Injury	Sinusitis Duration (Days)	Days to Trauma*	Antibiotics†	Days to Cellulitis‡	Surgery
1	4.5	M	L	Floor	Bicycle handle	14	-7	Y	5	Abscess drainage
2§	25	M	R	Floor	Surfboard	7	35	N	1	Orbit and sinus
3	58	F	R	Floor + medial wall	Assault	4	5	Y	2	Fracture repair¶
4§	31	M	R	Floor	Fall	7	-2	Y	2	Abscess drainage

F = female; L = left; M = male; N = no; R = right; Y = yes.

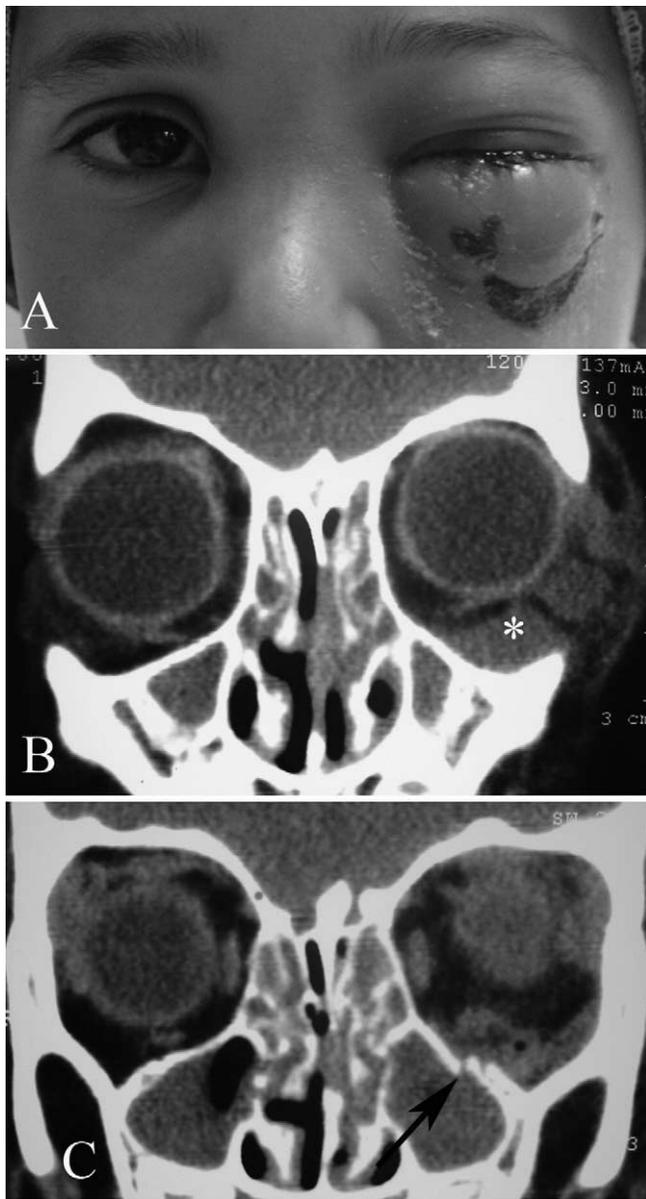
\*From upper respiratory tract infection to orbital trauma.

†Whether patients received an oral antibiotic immediately after orbital fracture.

‡From orbital trauma to orbital cellulitis.

§Patients developed orbital cellulitis after vigorous nose blowing.

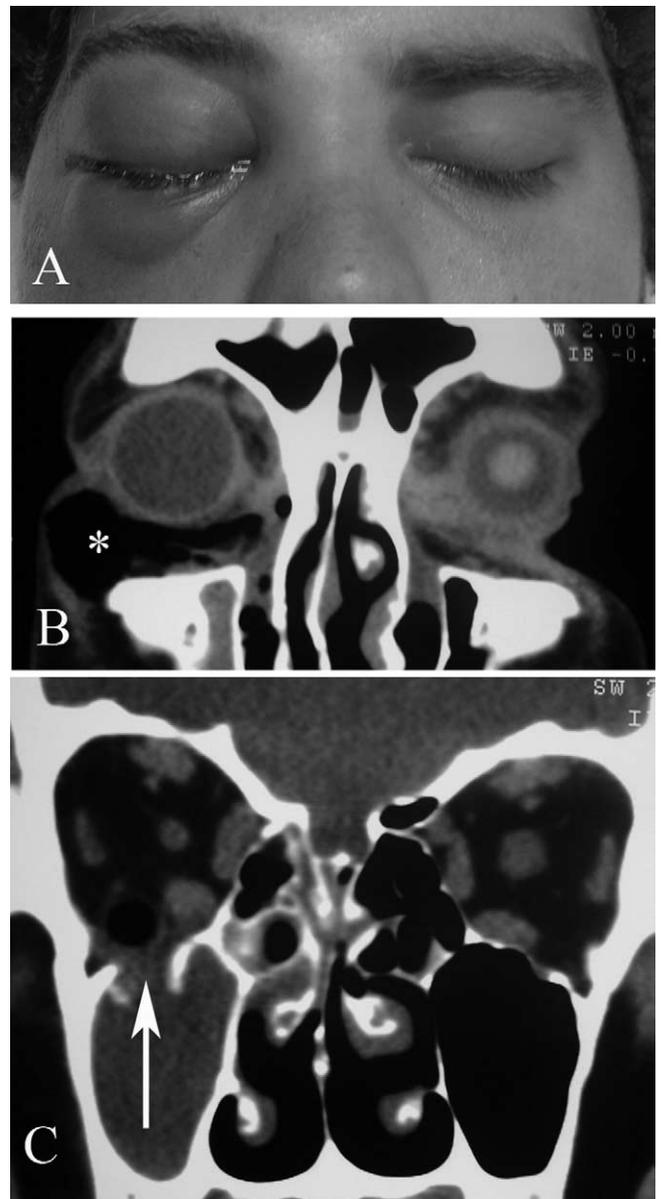
¶Patient underwent delayed fracture repair after orbital cellulitis had resolved.



**Figure 1.** A, A 4.5-year-old boy presenting with left peri-orbital swelling, redness, and pain 5 days after sustaining mild orbital injury with a bicycle handle. Two weeks before admission, he had been treated with oral antibiotics for upper respiratory tract infection. B, Computed tomography scans of the orbits and paranasal sinuses, coronal section, disclosing air and 2 distinct masses in the inferior lateral aspect of the left orbit (asterisk). C, A more posterior section shows a small linear orbital floor fracture on the left side (arrow). Note marked opacification in the ethmoid and maxillary sinuses, left more than right. Explorative orbitotomy revealed 2 distinct orbital abscesses in the inferior lateral left orbit. The patient improved after orbital abscess drainage and IV antibiotics.

### Case 3

A 58-year-old woman presented with a right orbital floor and medial wall fracture 3 days after an assault. She had VAs of 20/20 bilaterally, right infraorbital anaesthesia, and limitation of upgaze. Computed tomography scans revealed a right orbital floor and medial wall fracture. There was a moderate amount of blood in the right maxillary sinus, but the remaining sinuses were clear. She



**Figure 2.** A, A 25-year-old male with acute onset of right peri-orbital pain, swelling, and redness that occurred after vigorous nose blowing. Five weeks before admission, he sustained a right orbital floor fracture due to a surfboard injury; surgery was not performed to correct the fracture. B, Computed tomography scan of the orbits, coronal section, showing air in the inferior aspect of the right orbit (asterisk). C, A more posterior section showing a right orbital floor fracture (arrow). Note opacification of the maxillary and ethmoidal sinuses on the right. The patient underwent explorative orbitotomy that revealed no pus in the orbit, as well as endonasal right maxillary antrostomy with drainage of pus. Postoperatively, he showed marked improvement over the course of 2 to 3 days.

was commenced on oral cephalexin, instructed not to blow her nose, and scheduled for fracture repair the following week. Seven days later, she presented with painful proptosis of the right eye (Fig 3). On examination, she was febrile (37.9° C), with signs of peri-orbital inflammation, 2 mm of axial proptosis, and painful limitation of all extraocular movements, and she had an elevated neutrophil count. She gave a history of blowing her nose 2 days prior. A repeat CT scan showed increased opacification of the right



**Figure 3.** A, A 58-year-old woman with right periorbital redness and swelling and a diagnosis of orbital cellulitis. Eight days before admission she was assaulted and developed right orbital floor and medial wall fractures; 2 days before admission, she reported nose blowing. B, Computed tomography of the orbits showing right medial and inferior wall fractures with opaque maxillary and ethmoidal sinuses, right more than left. She showed marked improvement with IV antibiotics alone, and underwent successful orbital fracture repair 2 weeks later.

maxillary and ethmoid sinuses as well as a small amount of right orbital emphysema. A diagnosis of orbital cellulitis was made, and she was commenced on IV cefuroxime and metronidazole. The cellulitis resolved over the next 3 days, and she underwent fracture repair via a swinging eyelid approach with a Lactosorb plate (Lorenz/Biomet, Warsaw, IN) 12 days later. Her postoperative course was uneventful, and there was full resolution of all signs.

#### Case 4

The last patient, a 31-year-old male, sustained blunt right orbital trauma with fracture during the course of upper respiratory tract infection. Soon after the injury, he developed right orbital cellulitis that did not respond to oral antibiotics. Orbital exploration revealed an orbital abscess that grew mixed anaerobic organisms. He had marked improvement within the course of several days on IV antibiotics and after surgical abscess drainage.

#### Discussion

We describe 4 patients who developed acute orbital cellulitis after orbital fracture with coexistent sinusitis. In 1

patient, sinusitis and then orbital cellulitis developed 5 weeks after orbital fracture, with the orbital infection possibly occurring as a result of vigorous nose blowing. All patients required broad-spectrum IV antibiotic treatment, and 2 improved only after surgery to drain an orbital abscess. One patient underwent orbital exploration, but no abscess was found; he also underwent endonasal maxillary antrostomy, which resulted in dramatic improvement. Oral antibiotics given prophylactically in 3 of the patients after the orbital trauma did not seem to prevent cellulitis or abscess formation in these cases.

Orbital cellulitis occurs most commonly as a result of ethmoidal and/or maxillary sinusitis. In the pediatric population, up to 90% with orbital cellulitis have paranasal sinusitis, and nearly half have multiple sinus involvement.<sup>2</sup> Orbital cellulitis has been described after ocular surgery or periocular injection<sup>13-17</sup> and rarely after naso-orbital fractures with preexisting sinusitis.<sup>9</sup> Computed tomography scanning remains the imaging study of choice for localization of sinus infection and grading of orbital inflammation.<sup>5</sup>

Positive blood cultures may be found in up to 33% of children with orbital cellulitis younger than 4 years but in only 5% of adults, and the yield of positive results is variable,<sup>18</sup> with none being found in our previous study of 50 cases.<sup>2</sup> Similarly, routine sinus aspirate usually does not result in a change of management.<sup>19</sup> Only 1 of our 4 patients in this series grew mixed anaerobes in bacterial culture. It is possible that partial antibiotic treatment before surgery prevented growth of the affecting organisms in the other patients. Administration of antibiotics in patients with uncomplicated orbital fractures is controversial. Three of our 4 patients were treated with oral antibiotics at the time of the orbital injury, but this did not prevent cellulitis or abscess formation.

Two of our patients reported vigorous nose blowing before the onset of orbital cellulitis. A similar mechanism has been described in an elderly woman with an upper respiratory tract infection who sustained orbital floor fracture after nose blowing.<sup>8</sup> This was further complicated by orbital emphysema and orbital abscess. Case 2 had a pre-existing orbital fracture due to a surfboard injury 5 weeks before admission. We suspect that within that time scar tissue would have already formed between the orbit and the antrum. It is possible that the vigorous nose blowing disrupted the integrity of this barrier, allowing sinus bacteria to dislodge into the orbit, giving rise to acute orbital cellulitis.

Surgical intervention may be required in cases of orbital cellulitis with compromised optic nerve function or when orbital cellulitis fails to respond to medical management. The main purpose of surgery is to drain any purulent material, release intraorbital pressure, and obtain adequate culture material. Surgery may include orbital decompression with or without subperiosteal abscess drainage and drainage of affected sinuses. Combined endoscopic sinus surgery with transorbital abscess drainage has been proven to be effective in the treatment of orbital cellulitis with subperiosteal abscess with compromised visual function or after failed maximal medical treatment.<sup>20</sup> Two of our patients required surgical abscess drainage, and 1 patient who did not improve with IV antibiotics showed marked improvement only after endonasal maxillary sinus antrostomy and drainage. Surgery is uncommonly required in cases of orbital cellulitis complicating sinusitis. In our previous survey,<sup>2</sup> we found that surgical intervention in nontraumatic orbital cellulitis was common in the pediatric population, with 76% of patients being treated, compared with 55% of adults; sinus surgery was the major surgical treatment in both groups, whereas abscess drainage was performed in 15 patients (29%).

We postulate that in our cases organisms from adjacent infected sinuses entered the orbital cavity via the fracture and disrupted periorbital, with subsequent cellulitis and abscess formation.

Orbital cellulitis after orbital decompression surgery, which is an iatrogenic orbital fracture with disruption of the periorbital, is very rare. It would seem that orbital cellulitis complicating traumatic orbital fractures is equally uncommon, and most commonly occurs when infectious paranasal sinusitis is present at the time of injury and presents within

several weeks of injury. Vigorous nose blowing after blow-out fracture seems to be an additional risk factor. Administration of prophylactic oral antibiotics in cases of orbital fracture, in our patients, did not seem to prevent infection, and should be evaluated in further studies.

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