Orbital Cellulitis

Ophthalmic signs most frequently seen with orbital cellulitis are limited ocular motility, proptosis, chemosis, and conjunctival hyperemia (see Figure 4). Fever and leukocytosis are also suggestive of an orbital infection. Vision loss and an afferent pupillary defect may occur due to severe orbital congestion and optic nerve involvement. Exposure keratopathy may also contribute to diminished vision because of disruption of corneal integrity, microbial keratitis, and stromal opacification. Delayed management may result in significant morbidity, including orbital apex syndrome (internal and external ophthalmoplegia, blepharoptosis, diminished corneal sensation, and vision loss) and blindness. Cavernous sinus thrombosis, cranial nerve palsies, meningitis, intracranial abscess formation, and even death can occur without prompt aggressive treatment.

Etiology

As with preseptal cellulitis, infectious orbital cellulitis generally occurs by extension of sinus disease, penetrating trauma, or from infected adjacent structures. Underlying ocular infections—including those associated with aqueous drainage device procedures, scleral buckles, or fulminant endophthalmitis—are less common causes of orbital cellulitis. Orbital infections may have an odontogenic origin, including severe dental caries or a recent dental procedure. Orbital cellulitis secondary to hematogenous dissemination has been reported, particularly in newborns.

In addition to the most common infectious causes of periorbital cellulitis reviewed in this module, a host of unusual infections should be included in the differential diagnosis of patients with periorbital inflammation. Rare infections with clinical involvement of the ocular adnexa include Lyme disease, Rocky Mountain spotted fever, and infectious mononucleosis. Cutaneous palpebral anthrax has drawn attention as fears of biologic warfare and terrorism have become more prevalent.

Noninfectious causes of orbital inflammation and proptosis (eg, thyroid-related ophthalmopathy, orbital pseudotumor, and lymphoma) should be considered in both adults and children (Table 4). In pediatric patients, rhabdomyosarcoma, leukemia, metastatic neuroblastoma, and histiocytic disorders should be included in the differential diagnosis. Advanced necrotic retinoblastoma with anterior segment involvement may also present with clinical findings similar to infectious orbital cellulitis.

Orbital Cellulitis Secondary to Bacterial Sinusitis

More than 90% of all orbital infections are the result of underlying sinus disease. Although sinusitis occurs more frequently in the adult population, orbital cellulitis secondary to sinus disease is seen more commonly in young adults and children. Orbital complications are the most common type of problem arising from acute ethmoid sinusitis. In some communities, a seasonal incidence can be identified, with up to two-thirds of patients with sinusitis and orbital disease presenting from November to March in the United States.

Bacteria that cause sinus infections are the same organisms typically isolated from orbital infections. In children under 8 or 9 years old, a single organism is usually the cause of acute infections. S aureus and S pneumoniae are the most commonly encountered causative organisms in young children. Anaerobic infections are less common in the pediatric age group.

The bacteriology of sinus infections in adolescents and adults is more complex, frequently involving 2 to 5 organisms. Aerobic organisms including Streptococcus and Staphylococcus species as well as Moraxella catarrhalis can occur along with anaerobes such as Peptostreptococcus (commonly seen in dental infections), Fusobacterium, and Bacteroides species. The Streptococcus milleri group (S intermedius, S constellatus, and S anginosus) is often associated with abscess formation. H influenzae type B (Hib) infections have diminished markedly since the early 1990s with widespread use of a capsular polysaccharide vaccine. Pseudomonas aeruginosa and fungal organisms (invasive aspergillosis or mucormycosis) occur more commonly in immunocompromised hosts. Group A Streptococcus may rarely cause necrotizing infections involving the periorbital region, and as with mucormycosis these infections may demonstrate rapid clinical deterioration. Recent reports have heightened concern regarding potentially aggressive community-associated and hospital-associated methicillin-resistant S aureus (MRSA) infections, which may also result in devastating visual consequences (see the section in this module on MRSA infections).

Laboratory Studies

The laboratory evaluation of patients with orbital cellulitis should include a white blood cell count, which will usually demonstrate leukocytosis. Blood cultures should be obtained before initiating antibiotic therapy, although they are positive in less than one-third of patients under 4 years old and in less than 5% of adult patients. Intranasal swabs of purulent material from an infected sinus performed under direct visualization may provide useful material. A lumbar puncture is indicated if there is any concern regarding central nervous system involvement (lethargy, neck rigidity, cranial nerve palsy, headache), but it must be performed only when the possibility of elevated intracranial pressure has been excluded.

Imaging Studies

An orbital CT scan is critical in the evaluation of any patient suspected of having orbital cellulitis. Thin axial and coronal cuts, without contrast, that include the orbits, paranasal sinuses, and frontal lobes are essential (see Figure 5). Initial CT scanning is recommended in any patient with proptosis, ophthalmoplegia, deteriorating visual acuity, color vision loss, an afferent pupillary defect, bilateral periorbital edema, or if there is no clinical improvement in an apparent preseptal infection following 36 to 48 hours of antibiotic therapy. Additionally, failure of a confirmed orbital infection to improve on the appropriate antibiotic regimen should prompt consideration of a repeat CT scan. MRI with fat saturation and gadolinium contrast is reserved for patients suspected of having an intracranial complication such as cavernous sinus disease or an aggressive fungal infection. In the setting of neurologic involvement, it is important to request that neuroimaging studies include the head and not just the orbits and sinuses.

Similarly, the ordering physician should be aware that head studies (ie, “head CT”) alone typically do not provide adequate detail of the orbits.

Medical Management

All children and most adults with orbital cellulitis should be admitted to the hospital for intravenous antibiotics (see Figure 5 and Table 3). A multidisciplinary approach that may involve an ophthalmologist, oculofacial/orbital surgeon, otolaryngologist, pediatrician, infectious disease specialist, and possibly a neurosurgeon is frequently necessary during the course of the patient’s hospital admission.

Empiric drug therapy should be directed against the most frequently occurring sinus pathogens (outlined above). Broad-spectrum cephalosporins such as cefuroxime, cefotaxime, or ceftriaxone along with metronidazole or clindamycin for anaerobic coverage are a frequently used combination therapy. Vancomycin is reserved for patients with MRSA, necrotizing infections, inadequate response of empiric therapy, or if warranted based on culture and sensitivity results (see sections in this module on MRSA infections and future horizons). Nasal decongestant (ephedrine 0.5% or oxymetazoline) nose drops should be administered 3 times daily in the head-back, nostril-up position. After hospital discharge, oral antibiotics (such as amoxicillin-clavulanate) are continued for an additional 1 to 3 weeks.

Surgical Management

Although most periorbital infections respond adequately to medical therapy, early surgical drainage of the involved sinus may be indicated if orbital signs progress despite intravenous antibiotic therapy or if an orbital abscess is present. Abscesses usually form in the subperiosteal space of the orbit adjacent to the infected sinus but occasionally occur within the orbital soft tissue or in the preaponeurotic space (see Figures 2 and 6). An abscess may cause ocular dystopia, limited motility, and severe vision loss. CT findings of a medial subperiosteal abscess include a convex mass adjacent to the lamina papyracea with lateral displacement of the medial rectus (Figure 6). In some patients, a serous exudate or granulation tissue (phlegmon) may simulate an abscess.

Children (under age 9) with an isolated medial or inferior subperiosteal abscess generally have a favorable response to antibiotic therapy. In the absence of vision loss or severe proptosis, a trial of medical therapy may be attempted for up to 48 hours. Adolescents, adults, or any patient with decreased visual acuity and an afferent pupillary defect due to optic nerve compromise from orbital inflammation should undergo urgent sinus and orbital drainage. Superior subperiosteal abscesses of the orbital roof, often secondary to frontal sinusitis, are considered more dangerous because of their potential for intracranial spread and brain abscess formation (Figure 7). Thus, a subperiosteal abscess along the orbital roof typically requires surgical intervention. In addition, accidental and surgical trauma may predispose a patient to orbital cellulitis. Subperiosteal abscesses not secondary to sinus disease may require management that is more aggressive, including early surgical intervention, foreign body removal, long-term intravenous antibiotic therapy, and oral surgery. S aureus is most commonly responsible for orbital cellulitis secondary to trauma. The work-up for this group of patients is similar to that

described for nontraumatic orbital cellulitis; however, an open wound or draining fistula may provide an additional culture source. A broad-spectrum cephalosporin is usually appropriate empiric antibiotic therapy. Immunocompromised patients may also benefit from a more intensive, multidisciplinary treatment approach.

Functional endoscopic sinus surgery is considered by many to be the modality of choice for chronic sinusitis. It is generally a safe and effective means of acute surgical drainage of the maxillary and ethmoid sinuses. Since sinus surgery in an acutely infected patient is more technically challenging due to increased vascularity, poor visualization, and the potential increased risk of producing adhesions and stenosis of the frontal recess, the main surgical objective is to drain the sinus and obtain material for culture.

If an orbital abscess requires drainage, an experienced orbital surgeon can generally evacuate the abscess under direct visualization at the time of sinus surgery. A transcaruncular conjunctival incision is the optimal approach to a subperiosteal abscess of the medial orbit. This approach provides visualization of the entire medial orbital wall as well as the medial aspects of the orbital roof and floor. Minimal morbidity is associated with transcaruncular surgery, as a skin incision is avoided and all of the dissection is extraperiosteal. Subperiosteal abscesses of the orbital floor are less common and can be evacuated by a standard transconjunctival approach through the lower eyelid (Figure 8). A superior orbit subperiosteal abscess may require a transcutaneous, eyelid-crease incision and dissection in a suborbicular plane to reach the superior periorbita (see Figure 7). Subperiosteal abscesses along the orbital roof typically require intraoperative placement of a small drain that can be removed 1 to 3 days postoperatively.

Orbital Cellulitis Secondary to Fungal Sinusitis

Mucormycosis or phycomycosis is an aggressive fungal infection that typically occurs in diabetics, immunocompromised individuals, or patients on chronic corticosteroid therapy. These invasive sinus infections may extend into the orbit or nasal cavity, causing a thrombosing vasculitis and tissue necrosis. Significant proptosis and/or an orbital apex syndrome are frequently present. Multidisciplinary support is essential. Biopsy of involved tissue in the nasopharynx by an otolaryngologist will demonstrate nonseptate branching hyphae that stain well with hematoxylin-eosin. These fungal organisms belong to the class Phycomycetes, genus Mucor or Rhizopus. Resection of involved necrotic tissues with local and systemic administration of amphotericin B is the treatment of choice. Primary exenteration is reserved for patients with fulminant orbital involvement and little chance of globe salvage. The fungus Aspergillus can also present in immunocompromised individuals with acute, fulminant sino-orbital disease and clinical findings similar to mucormycosis. Histopathologic evaluation shows septate branching hyphae on Gomori methenamine-silver staining with angioinvasion and tissue necrosis. Management consists of radical surgical excision of involved tissue and administration of amphotericin B, flucytosine, and/or rifampin.

An increasingly recognized sinus disorder, allergic fungal sinusitis (AFS) or allergic aspergillosis sinusitis also occurs in immunocompetent patients with a history of atopic disease, nasal

polyposis, and chronic sinusitis. It is estimated that up to 15% of patients with AFS have orbital findings including proptosis, ptosis, and diplopia. The diagnosis of AFS is based on laboratory studies, characteristic neuroimaging findings, and histopathology. Functional endoscopic sinus surgery with evacuation of the allergic mucin and aggressive aeration of the involved sinuses is followed by topical and systemic corticosteroid treatment. The role of immunotherapy has not been definitively established.

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