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Staphylococcus aureus infection of the optic nerve

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Abstract

A 71-year-old woman presented with painful vision loss in the right eye followed by ophthalmoplegia. Magnetic resonance imaging (MRI) demonstrated optic nerve sheath enlargement and enhancement. Biopsy of the optic nerve sheath revealed purulent and necrotic material that was positive for methicillin-sensitive staphylococcus aureus. The patient underwent enucleation of the right eye and was treated with systemic antibiotics with clinical stabilization. Imaging, pathological and treatment aspects of optic nerve sheath abscess are discussed.

Keywords

optic nerve; abscess; staphylococcus aureus

CASE REPORT

A 71-year-old woman reported headache and acute vision loss in her right eye. She had a history of diabetes mellitus with proliferative retinopathy and had uncomplicated nasal septoplasty one month prior to presentation. Review of systems was positive for myalgias, jaw tenderness and weight loss. Visual acuity was reported to be count fingers in the right eye, with a right relative afferent pupillary defect and fundusoscopic changes of diabetic retinopathy. Erythrocyte sedimentation rate was 74 mm/hr. There was concern for giant cell arteritis (GCA) as the cause of acute retrobulbar optic neuropathy and she was treated with

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intravenous corticosteroids while temporal artery biopsy was arranged. When this failed to show evidence of arteritis, oral corticosteroids were gradually discontinued.

Nine days later, while on a steroid taper, the patient's condition worsened with further decline of vision in right eye, new right eye ophthalmoplegia and onset of fever and chills. Temperature was 37.9°C. Neuro-ophthalmologic examination revealed visual acuity of no light perception, right eye, and 20/40, left eye. The right pupil was fixed at 2mm and did not react directly or consensually. Ductions of the right eye were limited to only slight incyclotorsion on attempted downgaze. There was 2 mm of right proptosis and complete right ptosis. Intraocular pressures were normal and symmetric. There was mild injection of the right conjunctiva and the anterior chamber appeared quiet. Ophthalmoscopic examination revealed right optic disc edema with extension of subretinal fluid into the macula and occlusion of the central retinal artery and vein. Left eye and neurological examinations were normal.

Peripheral white blood cell count was elevated at 12,300 cells/ μ L with 76% neutrophils. Cerebrospinal fluid had 480 white blood cells/ μ L (43% neutrophils, 48% lymphocytes), protein of 80 μ g/dL (normal:15–45 μ g/dL) and negative cultures. Ultrasonography demonstrated a heterogeneous subretinal mass communicating with the optic nerve. Magnetic resonance imaging showed diffuse enhancement and enlargement of the optic nerve sheath as well as restricted diffusion (Fig 1). The right cavernous sinus and paranasal sinuses appeared normal. Endoscopy did not reveal paranasal sinus infection.

The patient was empirically started on intravenous vancomycin, cefepime, acyclovir, and voriconazole for a suspected intraocular infection of unknown etiology. Echocardiogram, blood cultures, viral studies, and the remainder of an infectious source workup were negative. Due to worsening of her clinical condition, an anterior orbitotomy was performed. Purulent material was expressed upon incision of the optic nerve sheath. Grain stain showed gram positive cocci.

Over the next 24 hours the patient developed temporal field loss in the left eye and MRI demonstrated new involvement of the optic chiasm (Fig 2).

A decision was made to enucleate the right eye and at the time of surgery the orbit was irrigated with vancomycin and gentamicin. Pathology showed a neutrophilic infiltrate with cellular debris in the optic nerve, peripapillary retina, vitreous, and choroid without evidence of neoplasm or granulomatous inflammation (Fig 3). Final culture results showed growth of methicillin-susceptible *Staphylococcus aureus* (MSSA). Systemic antimicrobial therapy was switched to nafcillin, rifampin and linezolid.

Because of catheter-related bloodstream infection, nafcillin and rifampin were discontinued after 2 months and the patient received oral linezolid for an additional 5 months. Visual acuity in the left eye stabilized at 20/50 with persistence of a temporal visual field deficit. Follow-up MRIs showed resolution of the chiasmal abscess. Eighteen months after her initial diagnosis, the patient was doing well without recurrence of her infection.

While our initial diagnostic concern was GCA, our patient had an alternative explanation for her symptoms and clinical findings in the form of an optic nerve infection. This case reinforces the importance of considering the possibility of GCA mimics for which steroid therapy may be ineffective or detrimental. Patient risk factors such as immune compromise, oncologic history (e.g. paranasal sinus, dental, genitourinary) are features that may heighten suspicion for possible non-GCA diagnoses.

Staphylococcus aureus is an aerobic bacterium that is found in 20–80% of the general population, primarily in the nares (1). *S. aureus* infections are fairly ubiquitous and disseminated infections can result in significant morbidity and mortality (2). Controversy still remains over which isolate, MSSA or methicillin-resistant *S. aureus* (MRSA), is more virulent (3–5). The virulent nature of MSSA was well-demonstrated in our patient as she had rapid spread of infection from the optic nerve to the optic chiasm despite appropriate antimicrobial therapy. Successful treatment was achieved with aggressive use of antibiotics (6, 7) and surgical intervention.

In a retrospective study of 163 patients with brain abscesses, *S. aureus* was the causative agent in 21% (8). An unidentified source of the abscess was common, occurring in 19% of patients. Similarly, a predisposing factor for orbital infections is often not identified (9). We hypothesize that our patient's infection may have been due to transient bacteremia at the time of her nasal septoplasty. This led to seeding of her optic nerve and subsequent abscess formation supported by findings on diffusion-weighted imaging (DWI) (10). Immunosuppression due to her diabetes likely was a contributing factor. Use of corticosteroids prior to antibiotic treatment may have further compromised her immunological response.

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Figure 1.

Infectious optic neuropathy. Coronal T2 (A) and postcontrast T1 fat-suppressed (B) images show thickening and right optic nerve sheath with abnormal enhancement within the right orbit. Axial FLAIR (C) and postcontrast, fat-suppressed (D) scans confirm these findings. Diffusion-weighted imaging (E) with apparent diffusion coefficient map (F) demonstrate restricted diffusion within right optic nerve.

Figure 2. Contrasted coronal (A) and sagittal (B) magnetic resonance imaging demonstrates a presumed chiasmal abscess (arrows).

Figure 3.

Pathology of enucleated eye. A. A cellular infiltrate with cell debris is present in the optic nerve, peripapillary retina, vitreous, choroid and subarachnoid space (hematoxylin & eosin). Inset shows the infiltrate composed of neutrophils and necrotic debris, consistent with an abscess. B. Choroidal abscess is present (hematoxylin & eosin). Inset reveals the abscess contains neutrophils and debris surrounded by plasma cells.