CLINICAL VIGNETTE

Brain Abscess as a Complication of Acute Rhinosinusitis: A Case Report

Alice E. Agzarian, M.D., Anita Y. Agzarian, M.D.,
and Laura M. Cashin, D.O.

Case Report

A 47-year-old male smoker, who was previously in good health, presented to the emergency room (ER) with complaints of nasal congestion and sinus pressure for 4 weeks. He reported fevers, chills and a nonproductive cough but was afebrile on presentation. His examination was remarkable for left maxillary and frontal sinus tenderness, pharyngeal exudates and boggy erythematous nasal mucosa. He was started on levofloxacin 500mg/day, prednisone 50mg/day, and given instructions on the use of nasal saline irrigation, guaifenesin, and ibuprofen. Despite appropriate treatment, he returned to the ER 3 days later with continued nasal congestion and sinus tenderness and a marked change in his mental status with "inappropriate hollering." He was febrile with a temperature of 101.5 °F. His blood pressure was 125/85 mmHg, his heart rate was 89 beats/min, and his respiratory rate was 16 breaths/minute. He was arousable and responded to all questioning with "ah…shoot." He had dry mucous membranes, frontal and maxillary sinus tenderness, boggy and erythematous turbinates and persistent pharyngeal exudates.

Neurologic examination revealed slight decrease in strength of the right upper and lower extremities and bilateral positive plantar reflexes. His white blood cell count was 17,800 with 83% neutrophils. Urine toxicology screen was negative. Blood cultures were ordered. CT scan of the head without IV contrast in the emergency department revealed nearly complete opacification of the paranasal sinuses with multiple air-fluid levels and hyperdense material in the left sphenoid sinus. The orbits were normal. There was a region of cortical irregularity of the inner table adjacent to the left frontal lobe with heterogeneity of the gray and white matter of that lobe consistent with an infectious process. He was started on empirical ceftriaxone, acyclovir and dexamethasone, and admitted to the intensive care unit (ICU) for further management.

Acute Rhinosinusitis

Acute infectious rhinosinusitis, viral and/or bacterial, is a very common illness in a primary care practice. This infection is responsible for millions of office visits every year and is the fifth most common illness for which a physician will prescribe antibiotics. The direct cost of diagnosis and treatment is about $5.8 billion per year while indirect costs include absenteeism at work and school, diminished productivity, and impairment of quality of life. The result is about 73 million days yearly of restricted activity. Approximately 87% of the 1 billion yearly viral upper respiratory tract infections in the United States result in acute viral rhinosinusitis, and 0.5% to 2% go on to bacterial infection.[1-5]

Acute rhinosinusitis is defined as "symptomatic inflammation of the mucosa of the nasal and paranasal sinuses lasting less than 4 weeks in duration[1]." Cardinal symptoms include "purulent rhinorrhea and either facial pressure or nasal obstruction of less than 4 weeks' duration[1]." Signs on physical examination may include fever, nasal mucosal swelling, nasal crusts, nasal and pharyngeal discharge, failure of transillumination of the maxillary sinuses, and sinus facial tenderness.[1,6]

Most cases of sinusitis result from viral infections. Patients with mild to moderate symptoms usually improve without antibiotic treatment. After about 10 days of symptoms, acute bacterial sinusitis may be suspected, but approximately 40% to 60% of these cases are self-limited and will resolve spontaneously. However, antibiotic therapy for acute bacterial sinusitis has been shown to shorten the duration of symptoms and may increase the rate of cure. Initially, the symptoms of acute viral and bacterial rhinosinusitis can be the same--it can be difficult to determine if a patient has a bacterial infection. Patients with moderate to severe symptoms, or those who are immunocompromised, or who have significant comorbidities, or whose condition worsens after 5 days, should be considered for antibiotic treatment within the first 10 days. A variety of adjunctive over-the-counter medications have been used for sympto-

matic treatment, including antihistamines, topical and oral decongestants, saline irrigation, topical steroids, anti-tussives, analgesics, mucolytics and antipyretics. However, these have not been shown to decrease the duration of illness. If the illness lasts more than 10 days, or if a patient starts to improve and then worsens (this is called "double worsening"), then this may indicate a bacterial cause.

The clinician may opt for antibiotic therapy and additional diagnostic testing. Patients are generally treated empirically without actual cultures, as routine swabs from the nasal cavity are not very reliable. If cultures are deemed necessary for antibiotic selection (such as in a nonresponder), endoscopic culture can be obtained. The most common bacterial pathogens are *Streptococcus pneumonia*, *Haemophilus influenza*, and *Moraxella catarrhalis*, but other Streptococcal species, *Staphylococcus aureus*, anaerobes and other bacteria are occasionally found. First-line antibiotic treatment for acute uncomplicated sinusitis includes amoxicillin or, in cases of penicillin allergy, trimethoprim/sulfamethoxizole, doxycycline or a macrolide antibiotic. Amoxicillin is not effective against betalactamase producing *H influenza* and *M catarrhalis*.

For patients with more serious infections, significant comorbidities, a greater likelihood to have a resistant organism (e.g. recent antibiotic use, child in day-care facility, smoker, etc.) or for treatment failures, antibiotics should be chosen for a broader spectrum of coverage, such as amoxicillin/clavulanate, a fluoroquinolone, a second or third-generation cephalosporin or clindamycin. Patients should be followed to monitor response to treatment, and failure to improve or a worsening of symptoms indicates a need for reassessment of treatment, exclusion of other causes of illness, and search for complications. Complications of acute bacterial sinusitis are rare. Signs and symptoms include decreased visual acuity, diplopia, proptosis, headache, periorbital erythema or edema, and altered mental status.[1-6]

Complications of sinusitis

Suppurative complications of sinusitis are infrequent but they still occur (about 1 in 1000 to 1 in 10,000). These include orbital cellulitis, osteitis "meningitis, intracranial abscess, subdural empyema, epidural abscess, and cavernous sinus thrombosis[7]." About 10% of intracranial infections have a sinus source-usually the frontal, ethmoid and sphenoid sinuses. Men, particularly in their 20's and 30's, have a higher risk than women. Brain abscess complicating sinusitis develops after the spread of infection by direct extension or via thrombophlebitis of connecting venous channels. Causative bacteria include *microaerophillic and anaerobic streptococci*, other anaerobes (such as Bacteroides, fusobacterium) and, less often, *Haemophilus influenza type B, Staphylococcus aureus, and Enterobacter*. Infections can be polymicrobial.[1-4,7-12]

Diagnosis

Early diagnosis and treatment of brain abscess are essential to minimize residual neurologic deficits which may include seizures and hemiparesis. There can be a delay in making the diagnosis of brain abscess because of its infrequent occurrence and nonspecific clinical presentation. Important features include headache (the most common symptom in 70%), altered mental status (about 65%), focal neurologic deficits (about 65%, and these depend on the location of the abscess lesion), fever (about 50%) and seizures (25% to 35%), papilledema (less than 25%), nausea and vomiting (about 40%), and nuchal rigidity (about 25%). A sudden worsening of headache may indicate rupture of a brain abscess.[7,10-14]

The usual laboratory evaluations with CBC, chemistry panel, sedimentation rate, C-reactive protein, and blood cultures should be obtained but may not be helpful in diagnosis of brain abscess. When this complication is suspected, imaging studies are required. With the availability of imaging testing, the mortality of brain abscess complicating sinusitis has dropped from about 66% to between 2% and 7%. Rupture of a brain abscess into the ventricular system is associated with a mortality of up to 80%. CT scan with contrast and, especially, the more specific MRI scan with gadolinium are indicated emergently to plan treatment. There is a characteristic appearance of brain abscess lesion on MRI scan with a central area and ring enhancement representing the capsule. Samples obtained from CT-guided aspiration or surgery should be sent for bacterial, fungal, mycobacterial cultures, gram stain and pathology.[7,10,11,15-17]

Treatment

In the ICU, our patient was treated with intravenous

ceftriaxone and metronidazole. Dexamethasone was continued and he received a loading dose of fosphenytoin. MRI brain scan with and without contrast confirmed the diffuse paranasal sinus disease and the irregularity of the cortical inner table adjacent to the left frontal lobe. In the left frontal lobe there was a small area with loss of the normal gray-white matter differentiation with some surrounding contrast enhancement-suggesting abscess formation and consistent with possible extension from frontal sinus disease. He underwent surgical treatment with bifrontal craniotomy with washout and debridement and bilateral frontal sinus obliteration/cranialization. Intraoperative cultures grew *Streptococcus intermedius* (viridians group). Intravenous treatment with ceftriaxone for a total of 6 weeks was planned. The patient improved and was transferred to the regular ward on the fourth hospital day. He was discharged home off anticonvulsants on the ninth hospital day to complete his course of antibiotic treatment. He had no neurologic sequelae.

Sinusitis-associated brain abscess is initially treated with a third-generation cephalosporin and metronidazole. Antibiotic choice is modified when the causative organism and its susceptibility are identified. Treatment is generally required for about 6 weeks but recommendations vary (e.g. 2 weeks of intravenous followed by 4 weeks of oral antibiotics; 6 to 8 weeks of intravenous antibiotics only). Neurosurgical drainage (aspiration via stereotactic techniques or surgical excision) is usually required for diagnostic and therapeutic purposes. Concurrent sinus surgery is also important to eradicate the source of infection. Anticonvulsants should be administered prophylactically because seizures can occur in 25% to 50% of cases during hospitalization-the duration of treatment is uncertain, and close neurologic follow-up is advisable. Steroids may be indicated to decrease brain edema and treat impending cerebral herniation. Careful follow-up with serial (perhaps weekly) CT or MRI scans is important.[7,8,10,11,16]

Conclusion

As primary care physicians, we are accustomed to seeing numerous patients with acute rhinosinusitis in our practices. Usually patients with mild illness improve with general supportive measures. Sicker or at-risk patients may benefit from antibiotic treatment on initial presentation. Patients with acute rhinosinusitis should be followed closely and advised to report persistent, worsening or unusual symptoms to determine if antibiotic treatment is indicated and to monitor for possible complications. Fortunately the complication of brain abscess is relatively infrequent, but the clinician must have a high index of suspicion because of its often nonspecific clinical presentation. CT imaging is indicated if complications of sinusitis are suspected. MRI scan is more specific than CT for brain abscess. Prompt treatment with empiric intravenous antibiotics, antiseizure medication and possibly steroids are needed, as well as neurosurgical consultation.

REFERENCES

1. **Hwang P.** A 51-Year-Old Woman With Acute Onset of Facial Pressure, Rhinorrhea, and Tooth Pain. Review of Acute Rhinosinusitis. *JAMA.* May 6, 2009. Available at **http://jama.ama-assn.org/cgi/content/full/301/17/1798.** Accessed August 8, 2009.
2. **Ah-See K, Evans A.** Clinical Review. Sinusitis and Its Management. *BMJ.* February 17, 2007. Available at **http://www.bmj.com/cgi/content/full/334/7589/358**. Accessed August 8, 2009.
3. **Brook, I.** Acute and Chronic Bacterial Sinusitis. *Infectious Disease Clinics of North America.* June 2007. Available at **http://www.mdconsult.com/das/article/body/153154566-5/jorg=journal&source=MI&sp=19...** Accessed August 8, 2009.
4. **Falagas ME, Giannopoulou KP, Vardakas KZ, Dimopoulos G, Karageorgopoulos DE.** Comparison of antibiotics with placebo for treatment of acute sinusitis: a meta-analysis of randomised controlled trials. *Lancet Infect Dis.* 2008 Sep;8(9):543-52.
5. **Rosenfeld R, Andes D, Bhattacharyya N.** Clinical practice guideline: Adult Sinusitis. *Otolaryngology-Head and Neck Surgery*. September 2007. Available at **http://www.sciencedirect.com/science2009e?_ob=ArticleURL&_udi=B6WP4-4PHPPTK-1&_use...** Accessed August 8, 2009.
6. **Piccirillo J**. Acute Bacterial Sinusitis. *NEJM.* August 26, 2004. Available at **http://content.nejm.org/cgi/content/full/351/9/902.** Accessed August 8, 2009.
7. **Osborn MK, Steinberg JP.** Subdural empyema and other suppurative complications of paranasal sinusitis. *Lancet Infect Dis.* 2007 Jan;7(1):62-7.
8. **Ziai WC, Lewin JJ 3rd.** Update in the diagnosis and management of central nervous system infections. *Neurol Clin.* 2008 May;26(2):427-68, viii.
9. **Brook I.** Microbiology of intracranial abscesses and their associated sinusitis. *Arch Otolaryngol Head Neck Surg.*2005 Nov;131(11): 1017-9.
10. **Gallagher RM, Gross CW, Phillips CD**. Suppurative intracranial complications of sinusitis. *Laryngoscope.* 1998 Nov;108(11 Pt 1):1635-42.

11. **Mathisen GE, Johnson JP**. Brain abscess. *Clin Infect Dis.* 1997 Oct;25(4):763-79; quiz 780-1.
12. **Tattevin P, Bruneel F, Clair B, Lellouche F, de Broucker T, Chevret S, Bédos JP, Wolff M, Régnier B.** Bacterial brain abscesses: a retrospective study of 94 patients admitted to an intensive care unit (1980 to 1999). *Am J Med.* 2003 Aug 1;115(2):143-6.
13. **Brook I.** Brain Abscess. *eMedicine*. June 26, 2008. Available at **http://emedicine.medscape.com/article/212946-overview.** Accessed August 8, 2009.
14. **Seydoux C, Francioli P.** Bacterial brain abscesses:factors influencing mortality and sequelae. *Clin Infect Dis.* 1992 Sep;15(3):394-401.
15. **Younis RT, Anand VK, Davidson B.** The role of computed tomography and magnetic resonance imaging in patients with sinusitis with complications. *Laryngoscope* 2002 Feb;112(2):224-9.
16. **Cavusoglu H, Kaya RA, Türkmenoglu ON, Colak I, Aydin Y**. Brain abscess: analysis of results in a series of 51 patients with a combined surgical and medical approach during an 11-year period. *Neurosurg Focus.* 2008;24(6):E9.
17. **Levy RM.** Brain abscess and subdural empyema. *Curr Opin Neurol*. 1994 Jun;7(3):223-8.

Submitted on November 11, 2009.