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Emergency Radiology

Frontal sinusitis complicated by a brain abscess and subdural empyema

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ABSTRACT

A 49-year-old male was brought to the Emergency Department after being found unresponsive. The patient had multiple seizures and was intubated in the prehospital setting. A computed tomography scan showed bilateral paranasal sinus disease, and magnetic resonance imaging showed a right frontal abscess and subdural empyema. Neurosurgery took the patient to the operating room, performed a craniotomy, and drained a large amount of purulent fluid. He was subsequently discharged for acute rehabilitation. Clinicians should consider complicated frontal sinusitis, especially in the undifferentiated patient presenting with neurologic deficits and signs or symptoms of sinus disease.

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Introduction

This case demonstrates a subdural empyema and right frontal brain abscess as a result of direct extension of infection from the right frontal sinus. Intracranial extension of acute or chronic sinusitis is a known complication and has a reported incidence of 3.7% to 11% in hospitalized patients [1]. Commonly, intracranial complications are seen in the first 2 decades of life as this age group is most prone to sinus disease [2]. While the clinical incidence is low, physicians must have a high index of suspicion for intracranial infections in the presence of focal neurologic symptoms and sinus disease. Early diagnosis and treatment is essential, as these infections have the potential for devastating neurologic disability. Emergency medicine

literature is limited on this topic which was previously referred to as “Pott’s Puffy Tumor” [3].

Case Report

A 49-year-old male was brought to the Emergency Department (ED) after being found unresponsive on the bathroom floor by his wife. He was last seen acting normally the previous evening. He arrived at the ED intubated and unresponsive. Emergency Medical Services responders reported that the patient suffered multiple seizures prior to arrival. The wife reports a recent history of upper respiratory symptoms. The patient has no recent or distant history of sinus disease or trauma. He was

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Fig. 1 – Computed tomography scan of the head without contrast demonstrating vasogenic edema of the right frontal lobe with a leftward midline shift.

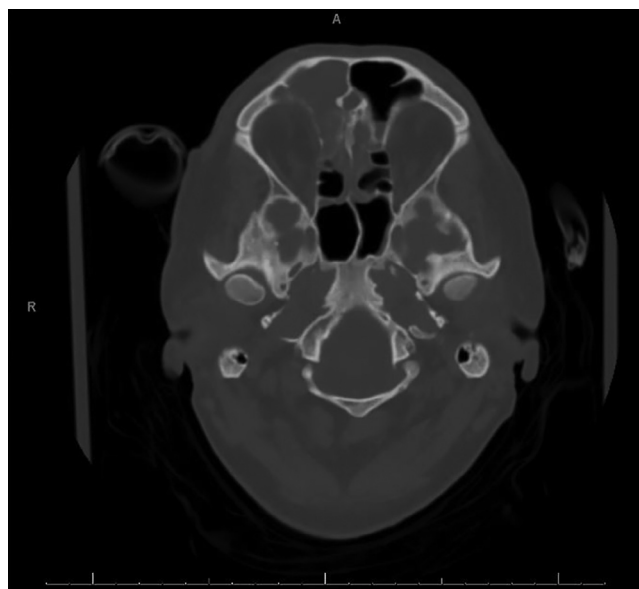


Fig. 2 – Bone windows from computed tomography of head demonstrating sinus disease, right greater than left.

given rocuronium prehospital for intubation. Initial vital signs were BP 166/83 mm Hg, HR 60 bpm, oral temperature 96.7°F, and oxygen saturation 98% on a ventilator; his Glasgow Coma Scale on arrival was 3T. On physical exam the patient was found to have pinpoint pupils. The remainder of the exam was limited due to the prehospital administration of paralytics. Initial laboratory data revealed a white blood count of 20.1 thou/mm³ (normal, 4.0-10.5 thou/mm³) with 4% bands, a lactate of 3.0 mmol/L (normal, 0.5-2.2 mmol/L), troponin of 1.69 ng/mL (normal <0.04 ng/mL), arterial blood gas revealed a pH of 7.31, pCO₂ of 45, pO₂ of 77, and HCO₃ of 22. His urine drug screen was positive for tetrahydrocannabinol.

An unenhanced computed tomography (CT) scan of the brain with axial 2.5 mm sections was obtained that demonstrated vasogenic edema of the right frontal lobe with a leftward midline shift (Fig. 1). Bilateral paranasal sinus disease was also noted (Fig. 2). A magnetic resonance imaging scan was recommended by radiology. This was ordered with and without contrast and generated T1 and T2 images in multiple planes. The images revealed a multilobulated 4 mm right front lesion communicating with the right frontal sinus consistent with a right frontal abscess and right subdural empyema (Fig. 3). Contrast-enhanced images demonstrate the relationship of the abscess to the sinus in the axial (Fig. 4) and sagittal planes (Fig. 5). The patient was subsequently loaded with 750 mg of levetiracetam and 1 g of fosphenytoin, and admitted to the neuroscience intensive care unit for further management.

The Neurosurgery and Infectious Disease departments were consulted on an emergent basis and evaluated the patient. Neurosurgery took the patient to the operating room, performed a craniotomy, and drained a large amount of purulent fluid. The right frontal sinus was exenterated. Antibiotics were not given prior to surgical drainage and a culture was ordered per the request of the Infectious Disease specialist. Cultures were obtained during the operative procedure and the patient was

transferred back to the neuroscience intensive care unit. He was started on 2 g of ceftriaxone, 500 mg of metronidazole, and 1.5 g of vancomycin. He remained intubated until hospital day 8 and was transferred to the general medical floor on hospital day 9. Cultures did not grow a predominating organism. His hospital stay was complicated by a left calf deep vein thrombosis, which was treated with systemic anticoagulation. With

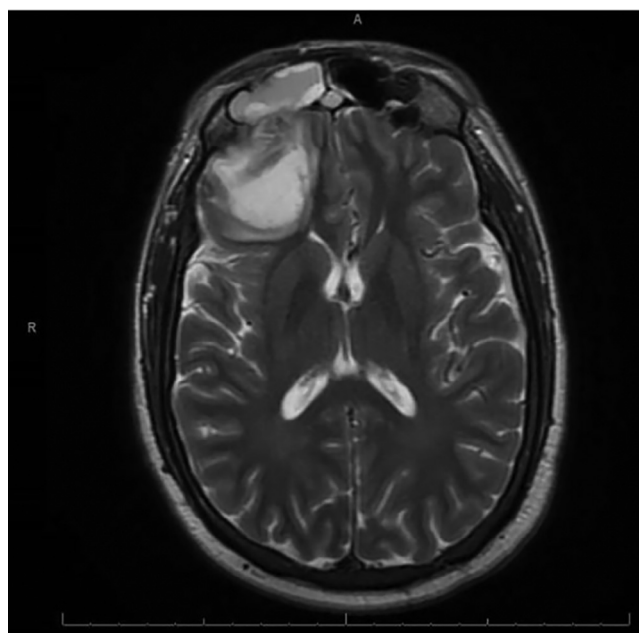


Fig. 3 – Magnetic resonance imaging showing 4 mm right front lesion communicating with the right frontal sinus consistent with a right frontal abscess and right subdural empyema.

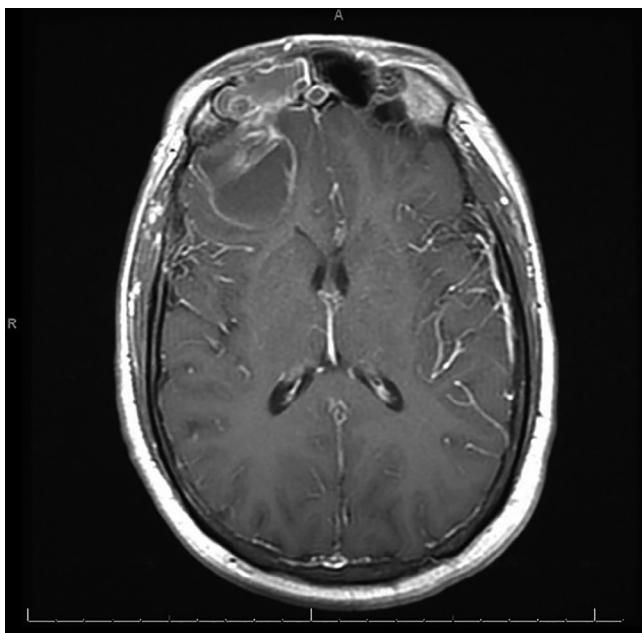


Fig. 4 – Contrasted magnetic resonance imaging noting the relationship of the abscess to the right frontal sinus.

regard to the patient's neurologic sequelae, he exhibited moderate encephalopathy and a mild left-sided hemiparesis with hemiataxia. He was discharged on hospital day 13 to acute rehabilitation for continued care.

Discussion

The central nervous system (CNS) is incapable of mounting a large immune response, thus permitting rapid spread of

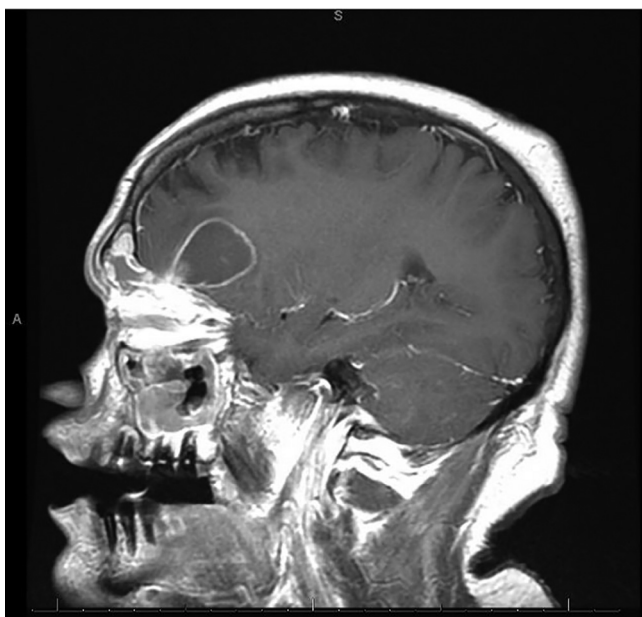


Fig. 5 – Contrasted magnetic resonance imaging noting the circumscription of the abscess.

infection and extensive tissue damage, potentially leaving the patient with long-lasting, severe neurologic deficits. While modern antibiotic therapy has proven effective in treating sinus disease, long-term disease that is untreated, or incompletely treated, predisposes a patient to intracranial extension of infection. Intracranial complications include the formation of a brain abscess, subdural empyema, meningitis, cavernous sinus thrombosis, epidural abscess, or osteomyelitis [2]. These complications can occur as a single entity or in any combination.

Pott's Puffy Tumor is classically associated with frontal bone osteomyelitis. Etiologies include trauma and a frontal brain abscess [3]. In this case, our patient suffered from both a subdural empyema and a brain abscess extending from frontal sinusitis. Subdural empyemas are reported to be the most common complication, forming in 20% of complicated sinus disease and affecting males in their 20s [2]. Most often, CNS complications are the result of retrograde thrombophlebitis of the dipole veins via frontal, ethmoidal, or sphenoidal sinus disease [1,4]. Direct extension, as in this case, is much less common, but can be due to destruction of the brain's outer table by osteomyelitis or due to high-velocity injury creating traumatic communication between the sinuses and intracranial space.

The clinical presentation of these patients can be highly variable making diagnosis difficult. In our patient, he presented with abrupt mental status change and was unresponsive on arrival. No family was present initially and therefore the history was extremely limited. Common signs and symptoms of complicated Pott's Puffy Tumor include fever, headache, seizures, papilledema, or new neurologic deficits [4,5]. The initial presentation may be confused with other, more common disease processes such as an acute cerebrovascular accident. As it relates to frontal sinusitis with CNS complications, subdural empyemas are associated with rapid clinical deterioration accompanied by profound secondary neurologic deficits, while a brain abscess is associated with a more indolent and slowly progressive course. The difference is primarily due to the ability of the infection to rapidly spread in the subdural space, causing extensive mass effect on the brain. It is mentioned in one case report that intracranial infections coexist with orbital complications in up to 45% of cases [4]. Consequently, patients presenting with a history of sinus disease and new orbital complaints should have intracranial infection ruled out.

Initial work up and management of these patients is dictated by clinical presentation. A secure airway should be established quickly in unresponsive patients or those presenting with significant neurologic deficits. Evaluation includes routine blood chemistries to assess for other causes of a patient's symptoms. If any intracranial complication is suspected, evaluation by laboratory results is not enough. Appropriate imaging is paramount to early identification and treatment. A CT scan, with or without contrast, is suitable to identify most cases of sinusitis and associated intracranial processes. If the CT is inconclusive in the setting of a high level of clinical suspicion, then magnetic resonance imaging is recommended for confirmation [6]. Lumbar puncture is indicated only in patients where a mass lesion has been ruled out and a diagnosis has not been established.

Treatment should include broad-spectrum antibiotics aimed at pathogens that commonly colonize the upper respiratory tract including staphylococcus, streptococcus, and anaerobes [7]. In the case of rare intracranial complications, anaerobes and anaerobic streptococci are the most common causative bacterial pathogens [6]. However, in up to 20% of cases, no organism is isolated [1]. Appropriate antibiotic therapy should be tailored to positive culture results and continued for 6 weeks [6]. In addition, approximately 40% of patients will suffer from seizures during the initial stage of illness. The early administration of anticonvulsants is recommended and should be continued for 12 to 18 months or any duration specified by neurology or neurosurgery consultation [1]. In the case of intracranial abscesses, emergent surgical drainage is often needed, allowing for the collection of intra-operative cultures [7].

Although rare, clinicians must have a high index of suspicion for intracranial complications, especially in the undifferentiated patient presenting as unresponsive or with neurologic deficits accompanied by signs of sinus disease on CT scan. Evaluation and treatment should focus on a thorough physical exam, prompt imaging, and early initiation of broad spectrum antibiotics and anticonvulsants as indicated. Proper management from the ED includes early involvement of consultants, including Neurosurgery and Infectious Disease.

REFERENCES

- [1] Dolan RW, Chowdhury K. Diagnosis and treatment of intracranial complications of paranasal sinus infections. *J Oral Maxillofac Surg* 1995;53:1080–7.
- [2] Roche M, Humphreys H, Smyth E, Phillips J, Cunney R, McNamara E, et al. A twelve-year review of central nervous system bacterial abscesses; presentation and aetiology. *Clin Microbiol Infect* 2003;9:803–9.
- [3] Ciobanu AM, Roșca T, Vlădescu CT, Tihoan C, Popa MC, Boer MC, et al. Frontal epidural empyema (pott's puffy tumor) associated with mycoplasma and depression. *Rom J Morphol Embryol* 2014;55(3 Suppl):1203–7.
- [4] Osborn MK, Steinberg JP. Subdural empyema and other suppurative complications of paranasal sinusitis. *Lancet Infect Dis* 2007;7:62–7.
- [5] Williams SP, Wilkie MD. *BMJ Case Rep*. In: Potts puffy tumour: an unforgettable complication of frontal sinusitis. 2014. <<http://doi.org/10.1136/bcr-2014-204061>>.
- [6] Alvis Miranda H, Castellar-Leones SM, Elzain MA, Moscote-Salazar LR. Brain abscess: current management. *J Neurosci Rural Pract* 2013;4:S67–81.
- [7] Nathoo N, Nadvi SS, Narotam PK, et al. Brain abscess: management and outcome analysis of a computed tomography era experience with 973 patients. *World Neurosurg* 2011;75:716–26. discussion 612–617.