Pott’s Puffy Tumor in a 12-year-old boy

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Case Records of the Brown University Residency in Emergency Medicine

DR. TIANJIANG YE: A 12-year-old boy with a history of attention deficit hyperactivity disorder and asthma was referred from an outside facility for evaluation of a headache and an abnormal head CT scan. The patient was playing soccer 3 days prior to presentation when he was elbowed by an opposing player in the forehead, just above his left eyebrow. The patient denied any loss of consciousness but subsequently developed intermittent headaches, nausea, and malaise, which became progressively worse over the next few days. A review of systems was negative for visual changes, weakness, numbness, tingling, nuchal rigidity, or vomiting. His mother reported he had an upper respiratory infection approximately 2 weeks prior to presentation, and he continued to have some congestion. The mother also noted swelling above the left supraorbital ridge where he was elbowed, and the patient was brought to an urgent care clinic three days later for evaluation of ongoing headaches and inability to concentrate at school. A CT scan of his brain was obtained at the outside facility and he was noted to have a focal lucency in the left frontal region of his brain consistent for a subdural hematoma. He was transferred to the Hasbro Children’s Hospital ED for further evaluation and management.

At triage, the patient’s blood pressure was 116/71 mm Hg, pulse 106 beats per minute, respiratory rate of 22, temperature of 100.4 F, and pulse oximetry of 100% on room air. The patient appeared well and was cooperative and able to answer questions appropriately. He had a moderate area of focal swelling over his left supraorbital ridge with mild tenderness to palpation. His extraocular movements were intact and painless. Pupils were equal and reactive. His neurological exam, including cranial nerve, sensory, motor, reflex, cerebellar, and gait was normal. His nasal mucosa was moist and he had mild turbinate hypertrophy and tenderness to palpation over his frontal sinus. He did not have any nuchal rigidity or lymphadenopathy. His heart, lung and abdominal exam were unremarkable and his extremities were warm and well perfused. The remainder of the exam was unremarkable.

DR. SARAH GAINES: It is interesting to me that this patient had a CT after such a minor trauma. What are the indications for a head CT after minor head injury or persistent headaches?

DR. STUART SPITALNIC: Headaches in children are not uncommon. The prevalence of at least one major episode of headache increases from 30 to 50% in elementary school-age children to 50 to 82% in adolescents. Migraine is the most common chronic headache in children, while tension headaches tend to predominate in adolescents [1]. CT scan is generally not indicated in the initial work up for these benign causes for headache. However, changes in the quality of headache or additional symptoms such as seizure, can lead to an expansion of the differential diagnosis and neuroimaging.

There are certain clinical findings – prolonged loss of consciousness, persistent vomiting, and an abnormal neurologic exam – which, when present after head injury, require brain imaging. Similarly, the normal child with no risk factors nor exam findings, who was subject to minimal trauma, requires no imaging. While there is no difficulty identifying the seriously injured on initial evaluation, it can be challenging to identify which patients who have experienced non-trivial head trauma can forgo radiologic evaluation. Although clinical judgment does very well predicting which patients require imaging, several clinical guidelines have been developed regarding who does not require a CT scan.

The Pediatric Emergency Care Applied Research Network (PECARN) guidelines have been validated and are often applied to the pediatric population to determine the necessity of imaging. The PECARN guidelines suggest that in children under 2 years, a CT is not required if the Glasgow coma score is 15, there has not been a prolonged (>5 seconds) loss of consciousness (LOC), no palpable skull fracture, and there are no signs of altered mental status including agitation, somnolence or a change in response to verbal communication. In patients 2 years and older, CT may safely be avoided in patients with a GCS of 15 without other signs of altered mental status, no signs of a basilar skull fracture, no vomiting, no loss of consciousness, and no severe headache. [2,3,4,5,6,7,8]

Of note, and to reiterate, the guidelines were designed to assist in determining in which patients CT can be avoided, not those in whom it is required. A significant amount of leeway is given to clinical judgment. Additionally, the guidelines were developed in children presenting within 24 hours of injury. As such, they can only have a limited application to the patient at hand.

DR. DALE STEELE: The patient had a low-grade fever, and swelling over his forehead, but an otherwise normal exam.
Did you review the abnormality on the CT scan with radiology? What were your next steps?

**DR. YE:** On review of the outside CT, it appeared that there was a fluid collection in the left frontal epidural space concerning for either blood or an infection. [Figure 1] We obtained a complete blood count, coagulation studies, basic chemistries, blood cultures, C-reactive protein (CRP), and an erythrocyte sedimentation rate (ESR). Notably, the patient had a white count of 12.3 with left shift, the CRP was 143, and ESR was 36. He underwent an MRI of the brain which showed an erosion of the posterior table of the left frontal bone with associated air and a 2.1 x 0.7 x 2.7 cm fluid collection. [Figure 2] The findings were strongly suggestive of frontal sinusitis complicated by an adjacent subperiosteal abscess of the posterior table of the frontal bone and epidural abscess overlying the left frontal lobe. This finding was consistent with a Pott’s puffy tumor complicated by an epidural abscess.

**DR. THOMAS GERMANO:** Can you discuss the cause of Pott’s Puffy Tumor?

**DR. YE:** Pott’s puffy tumor is a rare clinical entity characterized by a subperiosteal abscess and associated frontal bone osteomyelitis. It was first described in 1768 as a complication of head injury by Sir Percival Pott. [9] Seven years later Pott reported it as a complication of sinusitis and it is now known to be much more commonly associated with untreated frontal sinusitis in pediatric patients. [10] There have been other case reports of this clinical entity as a complication of insect bites, malignancy, and even mastoiditis. [11, 12] Pott’s puffy tumor is most commonly described in the adolescent and preadolescent age group and is extremely rare in children under the age of six. It is also uncommon in adults.

The pathophysiology of this condition relates in part to the anatomy of the frontal sinus. The frontal sinus develops as an extension of the ethmoidal air cells after the sixth year of life and do not fully develop until late adolescence. As sinusitis is the most common precursor to the development of Pott’s puffy tumor, the condition is thought to arise through several mechanisms including retrograde spread of the sinusitis from the diploic veins that drain the sinus as well as direct extension through various anatomical pathways. [12] Bacteria erode through the posterior table of the frontal bone, resulting in intracranial extension and subsequent complications including meningitis, epidural, and subdural abscess. [13] The subperiosteal abscess that is universally present in this condition results in swelling of the forehead giving the condition its “puffy” nature. The low oxygen environment of the sinus predispose to anaerobic organisms, such as fusobacterium and bacteroides species, but infections involving streptococci, hemophilus influenza, staphylococcus, and pseudomonas have also been reported. [10]

**DR. WILLIAM BINDER:** What are the clinical symptoms associated with this disorder and how is it usually diagnosed?

**DR. YE:** The diagnosis of this condition requires a high degree of clinical suspicion. The classic presentation is a child who presents to the ED with a soft, fluctuant swelling of the forehead of several days duration associated with nasal congestion, low-grade fever, and rhinorrhea. They may have had some minor trauma to the head or URI symptoms of subacute duration prior to the onset of presentation. The presence of headache, vomiting, seizure, or focal neurological deficits suggests intracranial complications. Physical exam will often show periorbital swelling or localized swelling and fluctuance of the forehead with a well-delineated mass and tenderness of the frontal sinus. Nasal speculum exam may reveal rhinorrhea with inflamed turbinate. Laboratory testing will generally result in elevated white count and inflammatory markers. Blood cultures should be drawn. A CT scan of the brain should be ordered to visualize opacification of the frontal sinus and defects in the frontal bone.

**Figure 1.** CT of the brain without contrast demonstrates air and fluid collection in the left frontal epidural space.

**Figure 2.** T2 axial image with a 2.1 x 0.7 x 2.7 cm fluid collection in the left frontal sinus, which demonstrates contrast enhancement and restricted diffusion.
It is often possible to see intracranial expansion. A MRI of the brain with contrast will help to further characterize the lesion and allows for preoperative planning.

The treatment of this condition involves broad-spectrum IV antibiotics in addition to surgical management for evacuation of associated abscess and possible removal of the osteomyelitic bone. [14] This condition is a surgical emergency and to this end, neurosurgery and ENT should be consulted for further surgical management. Often, the procedures can be done via a minimally invasive endoscopic sinus approach. [14] Antibiotics should be continued postoperatively for 6-8 weeks. Complications are treated on an individualized basis. Such complications include meningitis, epidural/subdural abscess, cavernous sinus thrombosis, and orbital cellulitis. [10] The morbidity and mortality is high if it is untreated with but prompt recognition and management, the outcome is usually favorable and sequelae is minimal.

DR. OTIS WARREN: What was the clinical course of this patient?

DR. YE: Neurosurgery and ENT were subsequently consulted. The patient was given ceftriaxone, vancomycin, and metronidazole. He was taken to the OR the same day for endoscopic left frontal sinus exploration, ethmoidectomy, and left maxillary antrostomy. He underwent burr hole drainage with irrigation of suction of the epidural space. He was found to have purulent secretions in the ethmoid air cells and associated inflammation with granulation tissues, some of which was removed.

Postoperatively, the patient was admitted to the PICU. The purulent sample grew *streptococcus intermedius* sensitive to ceftriaxone, and a PICC line was placed for long-term antibiotics, which were continued for an additional 4 weeks. He recovered uneventfully and has had no residual neurological deficits.

**FINAL DIAGNOSIS:** Pott’s puffy tumor complicated by subperiosteal abscess and an epidural abscess due to *streptococcus intermedius*.

References


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