



# Pott's Puffy tumor: The role of ultrasound, computed tomography and magnetic resonance imaging in diagnosis

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## ABSTRACT

Pott's Puffy tumor is a rare disorder which is characterized by frontal osteomyelitis and subperiosteal abscess as a complication of sinusitis. Nowadays we have forgotten this entity under the broad spectrum antibiotherapies for sinusitis. We reported an adolescent with chronic sinusitis suffered from forehead swelling and headache. He was performed ultrasound, computed tomography, magnetic resonance imaging for accurate diagnosis. Early diagnosis with appropriate imaging is necessary in order to avoid more severe complications, such as subdural empyema, septic thrombosis of the dural sinuses. Emergency physicians should remember Pott's puffy tumor in differential diagnosis in patients presenting with forehead swelling and headache. Imaging modalities have an important role for the right diagnosis and guidance of the surgery. The thing that make this report special is the ultrasonographic images that are so rare reported in the literature. To our knowledge there are two reports which emphasized the sonographic findings of this entity.

**Keywords:** computed tomography, magnetic resonance imaging, ultrasonography, Pott Puffy tumor, sinusitis

## INTRODUCTION

Pott's Puffy tumor (PPT) is a rare complication of mostly acute sinusitis and trauma and also acupuncture, insect bite, intranasal cocaine use, fungal infection, prior cranioplasty and infected frontal sinus mucocele as noted in the literature (1,2).

It has been reported that it is characterized by subperiosteal abscess and osteomyelitis of frontal bone. It is an uncommon presentation of acute sinusitis in all ages especially adolescents (3, 4). Imaging modalities have an important role for the right diagnosis and guidance of the surgery. Through the important findings in ultrasound (US), it should be used as the initial imaging modality. We reported an adolescent with PPT and all three imaging modality findings here; US, computed tomography (CT) and magnetic resonance imaging (MRI). We emphasize on the role of ultrasound contributing to the early diagnosis of Pott's puffy tumor. Subsequently CT scan and MRI were performed and confirmed the sonographic findings. We also present postoperative CT images. Treatment is the combination of antibiotherapy and surgery.

## CASE REPORT

A 14-year-old boy applied for two months history of headache and swelling of his forehead for a week. His forehead swelling was tender, warm and erythematous. His laboratory values were no suspicious of infection. For diagnosis, US, CT (64 slices, multi-detector CT) and MRI (1.5 T, Siemens, Erlangen, Germany) were performed. Firstly, US was applied to understand the nature of swelling. Sonography was performed using an HDI 3000 scanner (ATL-Philips Medical Systems, Bothell, WA) with a broadband 7 MHz linear-array transducer. Sonography of the swelling in the frontal region revealed discontinuity of frontal bone and a hypoechoic subcutaneous mass consistent with subperiosteal abscess (Figure 1a). Color dopler ultrasonography revealed the significant vascularity in the peripheral of the subperiosteal abscess (Figure 1b).

Contrast enhanced CT was performed to confirm the bone defect and abscess. CT revealed pansinusitis, epidural and subperiosteal abscess in frontal area, frontal bone osteomyelitis (Figure 2a-c). To see clearly if there was any brain parenchyma involvement which may be overlooked by CT, patient underwent contrast enhanced MRI. The erosion and destruction of frontal bone on the right, soft tissue and epidural abscesses with their rim enhancements were demonstrated on MRI (Figure 2d) and no parenchymal involvement was there. With those imaging and clinical findings, the diagnosis was PPT, a rare complication of sinusitis today, thanks to broad-spectrum antimicrobial coverage.

The patient was recommended surgery for abscesses and underwent surgery by otorhinolaryngology and neurosurgery at the same session. Right frontal bone and sinus anterior wall destruction were seen. Abscesses were drained from frontal sinus. Then neurosurgery team attended the operation. Craniotomy was performed to left frontal side and epidural abscess was drained. At the end of the operation, frontal sinus was obliterated with the fat from the left groin. After a week from the operation, CT was performed to check. The fat density was clearly seen in the frontal sinus (Figure 3). Microbiologic culture results were negative under the previous antibiotic treatment. Pathology result was active chronic inflammation.

## DISCUSSION

PPT was first described by Sir Percivall Pott in 1775 as a result of trauma and frontal sinusitis. It is a surgical emergency. It generally occurs in young adolescents (4,5) as in our case. Young children and adults were also reported in the literature (6). Clinical findings are fluctuant swelling of scalp, headache, periorbital edema, fever. It is considered that the ways for the infection to spread are venous way from the frontal sinus through the diploic veins (7) or direct way as a result of trauma or malignancy (4). Although it affects mostly teenagers, there

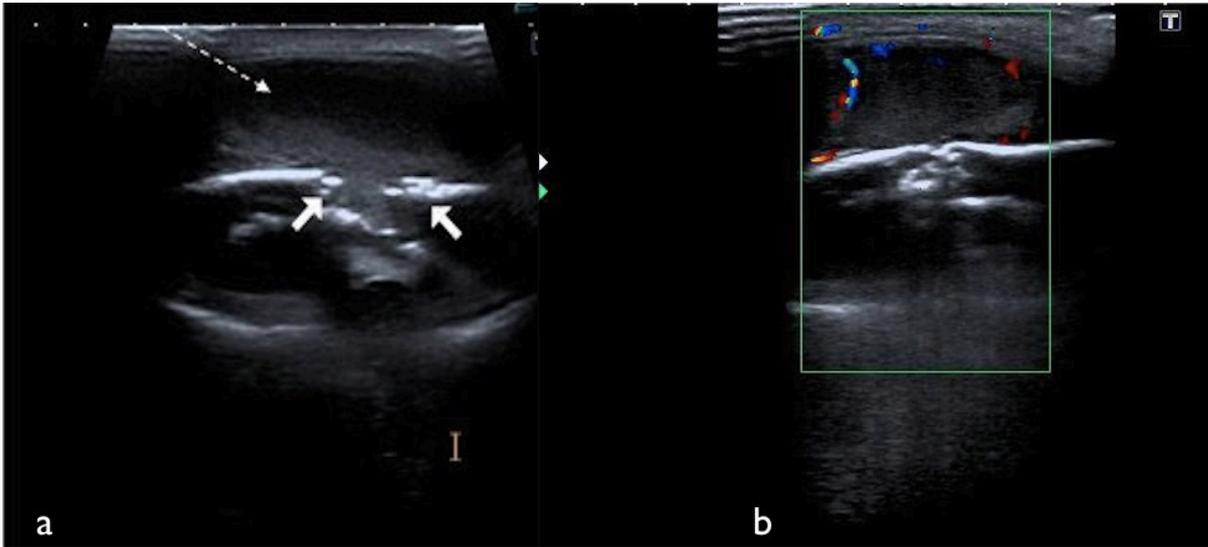
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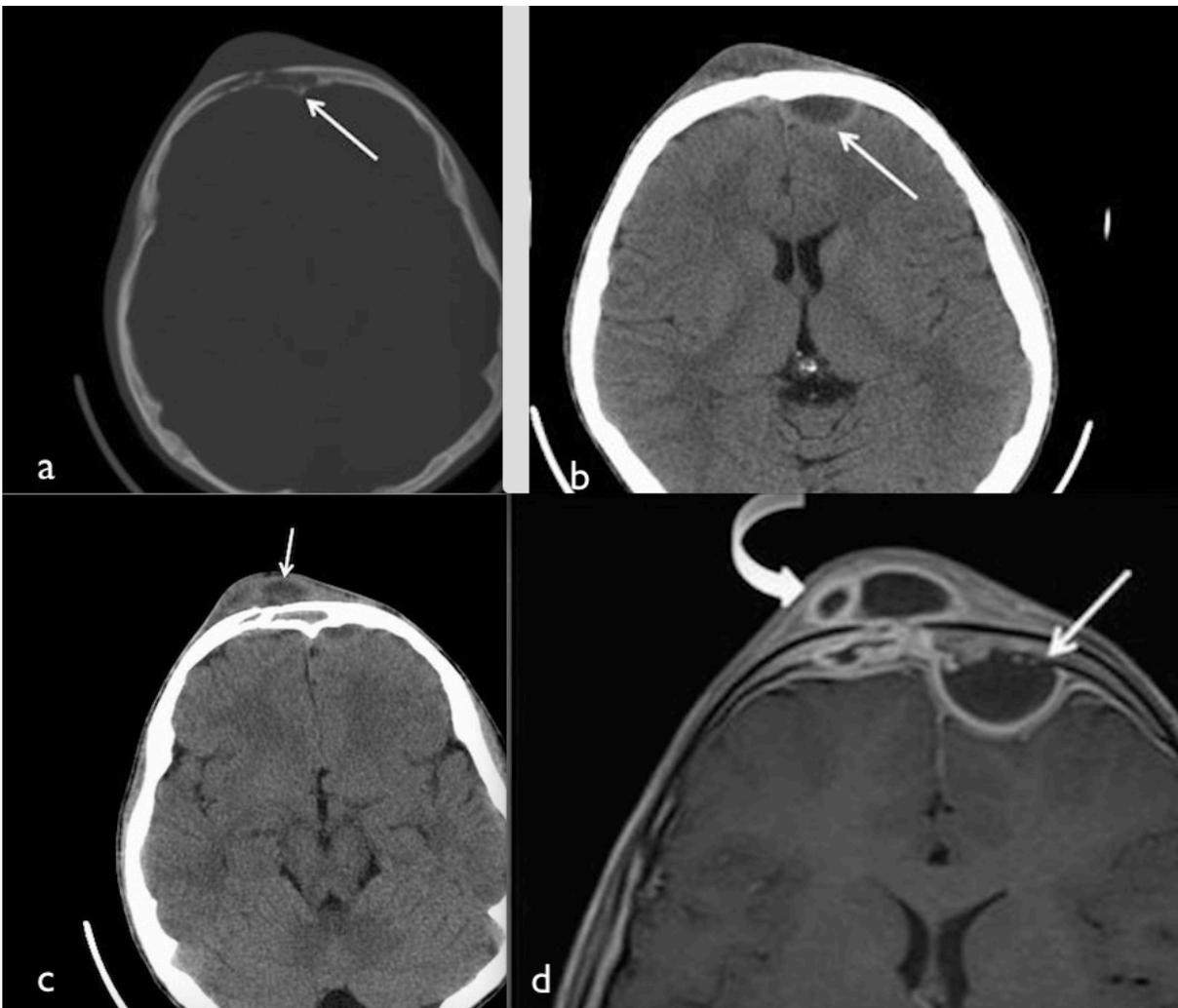
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**Figure 1.** *a.* Fourteen year-old boy, transverse sonogram of his frontal swelling revealed the subperiosteal abscess (arrows) and discontinuity of frontal bone (dashed arrow). *b.* Color dopler US image; the significant vascularity in the peripheral of the subperiosteal abscess



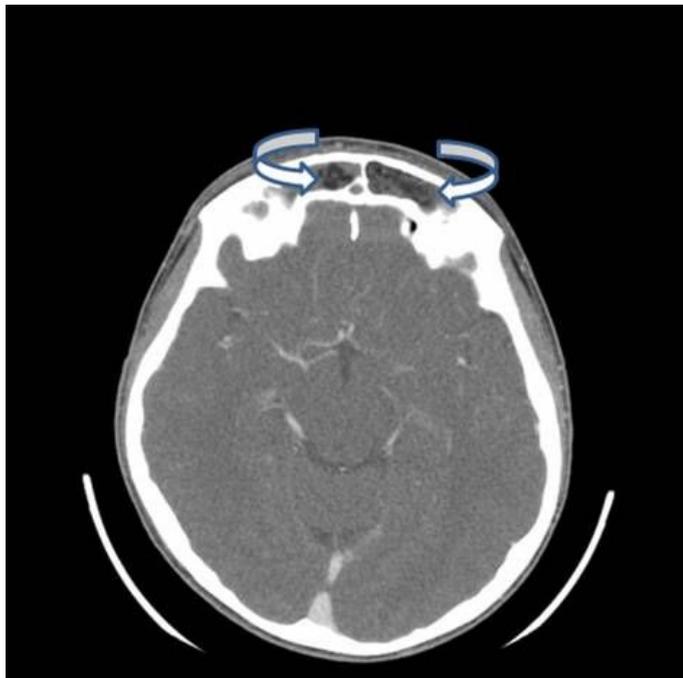
**Figure 2.** Axial CT images *A:* Frontal bone defect due to osteomyelitis (arrow) *B:* Hypodense crescent like lesion consisted with epidural abscess (arrow) *C:* Subgaleal hypodense lesion represents subperiosteal abscess (arrow) *D:* Axial contrast-enhanced MRI demonstrates both subperiosteal (curved arrow) and epidural abscess (straight arrow) with their rim enhancements

have been cases reported in patients aged from 7 to 83-year-old (8).

The responsible pathogens are *Streptococcus* sp., *Staphylococcus* sp. and anaerobes and *Hemophilus influenzae* (7). Nowadays we have forgotten this entity under the broad

spectrum antibiotic therapies for sinusitis. Microbiology result was negative for the reported patient, probably due to previous antibiotic treatment.

Epidural abscesses, subdural empyema, brain abscesses and cortical vein thromboses are possible complications. Early



**Figure 3.** Axial postoperative CT; hypodense fat tissue (curved arrow) in the frontal sinus from groin

diagnosis is based on clinical examination, and appropriate imaging, and is critical to prevent complications (4). Radiologic examination of the brain is mandatory (6). The diagnosis of PPT can be supposed by US, the sonographic findings can be confirmed by CT scan. Contrast-enhanced CT scan is regarded as the most adequate study to confirm the diagnosis, although magnetic resonance imaging (MRI), technetium-99m scan, and gallium-67 scanning have been reported as supportive investigations. For the determination of osteomyelitis, however, contrast-enhanced CT is preferred, as CT scan is

superior to MRI in its superior depiction of bony detail. Ultrasound played a crucial role in the diagnosis by showing a subperiosteal abscess associated with erosion of the frontal bone. This imaging finding asks for further CT to evaluate for the presence of intracranial complications as well as to confirm the diagnosis. The disorders in differential diagnosis of forehead swelling and headache are soft tissue infections, cellulitis, haematomas, neoplasms (3) and Pott's Puffy tumor. Terui et al. (9) described a case of PPT caused by chronic sinusitis resulting in sinocutaneous fistula. Eugene et al. present a case of non-Hodgkin's lymphoma of the frontal sinus presenting as Pott's puffy tumour (10).

The treatment consists of medical and surgical therapy. Surgery can be performed open neurosurgical procedure just like in our patient. Intravenous antibiotherapy is an important pillar of the management and it may cause negative cultures. In addition to prompt surgical intervention intravenous antibiotics must be initiated.

As a result early diagnosis with appropriate imaging is necessary in order to avoid more severe complications, such as subdural empyema, and septic thrombosis of the dural sinuses. Emergency physicians should maintain PPT in differential diagnosis in patients presenting with forehead swelling and headache. US is the first choice for diagnosis. It is so difficult to differentiate them according to their clinical and laboratory values. So imaging methods have an important role in the diagnosis. Contrast enhanced CT is good at showing bone defect, sinusitis, associated complications. However, while CT is superior in bone defects, MRI is better to demonstrate clearly any brain involvement. CT is accepted as the most common study that is applied for the diagnosis and MRI is considered as a supportive method. US makes us suspicious about a problem that must be confirmed by CT. In the literature US findings of Pott's Puffy tumor was rarely adverted. In this presentation we also mentioned sonographic images in addition to CT and MRI findings.

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