

# Skull Osteomyelitis with Brain Abscess from Uncommon Sources: A Case Series

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## Abstract

Sinusitis and scalp furunculosis are prevalent infections encountered in clinical settings. Typically, these conditions resolve without intervention or necessitate minimal treatment. However, their proximity to the skull and intracranial structures underscores the potential for severe intracranial sequelae if management is inadequate or neglected. These infections exacerbating Skull Osteomyelitis are rare; their further spread causes brain abscesses, which are still rarer. Herein, we present two cases exemplifying skull bone osteomyelitis and brain abscess secondary to insufficient treatment of sinusitis and scalp furunculosis.

**Keywords:** Scalp furunculosis, skull osteomyelitis, brain abscess, atypical brain abscess, atypical Skull Osteomyelitis.

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## INTRODUCTION

Infections involving the brain, meninges, and skull bone share an intricate interconnection owing to their direct anatomical links. The rich arterial supply to soft tissues and the Heversian canal is a formidable barrier against infection dissemination. While sinusitis and scalp furunculosis typically manifest as benign ailments, specific risk factors such as extremes of age, diabetes, immunocompromised status, and inadequate treatment heighten the susceptibility to invasive infections culminating in intracranial osteomyelitis and cerebral parenchymal involvement.<sup>[1-3]</sup> Herein, we present two cases delineating skull bone osteomyelitis and brain abscess stemming from frontal sinusitis and furunculosis.

## CASE DESCRIPTIONS:

### Case 1:

A 40-year-old man, afflicted by diabetes and hypertension, presented to the emergency department with a two-month history of fever and right frontotemporal headache. Cutaneous abscesses were evident on the leg, gluteal region, and scalp, all of which had received prior antibiotic therapy [Figure 1]. Signs of Meningeal irritation were absent. Laboratory findings revealed a hemoglobin level of 12.3 gm/dl, a total leukocyte count of 12000/mm<sup>3</sup>, and an erythrocyte sedimentation rate of 24 mm/hour. MRI of the head unveiled a heterogeneous enhancing lesion in the right temporal and parietal areas with concomitant bone involvement, indicative of parietal bone osteomyelitis and cerebritis [Figure 2A and 2B]. Cerebrospinal fluid examination exhibited 10 lymphocytes and a protein level of 65 mg/dl, with negative microscopy and culture results. Electroencephalogram findings were within normal limits.

The patient underwent a two-week course of meropenem, vancomycin, and metronidazole in the hospital, followed by six weeks of outpatient therapy. Surgical intervention was deemed unnecessary. Subsequent follow-up after 10 weeks revealed complete recovery.

### Case 2:

A 13-year-old boy with a history of recurrent sinusitis presented to the emergency department with left orbital cellulitis and a month-long fever. Empirical treatment with meropenem and vancomycin at a primary health center led to the resolution of fever and orbital cellulitis within a week, and treatment was discontinued. However, after a 10-day interval, he developed headache and swelling over the left frontal region. Clinical examination revealed bone softness in the left frontal area alongside meningeal signs. Laboratory investigations indicated a total leukocyte count of 5800/mm<sup>3</sup>, with normal findings on cerebrospinal fluid examination. MRI of the head disclosed bifrontal and ethmoidal sinusitis, accompanied by bilateral frontal bone osteomyelitis and an epidural abscess. [Figure 3A and 3B]. Notably, soft swelling in the left frontal area raised suspicion of Pott's Puffy tumor. Subsequent surgical intervention entailed debridement of the affected region and evacuation of 15 ml pus. Meningeal biopsy unveiled nonspecific inflammation,

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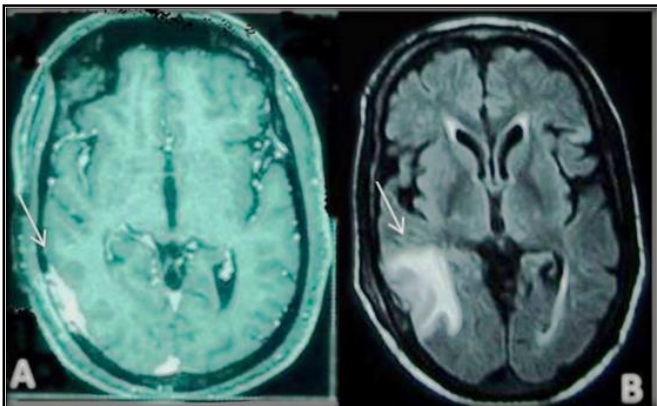
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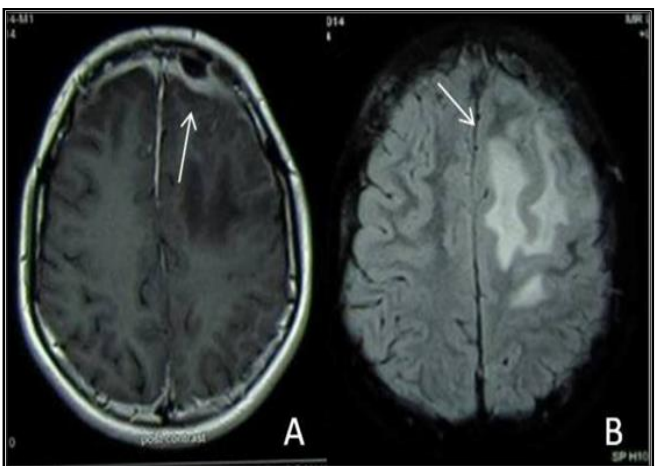
with sterile cultures obtained from cerebrospinal fluid, pus, and blood specimens. The patient underwent an eight-week regimen of meropenem, vancomycin, and metronidazole, culminating in complete recovery upon eight weeks of follow-up.



**Figure 1: multiple healed furuncles on the gluteal area**



**Figure 2: A: Contrast-enhanced Magnetic Resonance Imaging of the head showing enhancement of right parietal bone and adjacent parenchyma. (arrow). B: MRI Head FLAIR (Fluid attenuated Inversion Recovery) image showing hyperintensity in right parietal bone and adjacent parenchyma. (arrow)**



**Figure 3: A: Contrast-enhanced Magnetic Resonance Imaging of the head showing enhancement of left frontal bone and adjacent parenchyma. (arrow). B: MRI Head FLAIR (Fluid attenuated Inversion Recovery) image showing cerebritis of the left frontal area. (arrow)**

## DISCUSSION

Acute osteomyelitis encompasses an infection that permeates the bones, implicating the periosteum, bony cortex, and medullary cavity.<sup>[1,3,4]</sup> Concurrently, furuncles of the scalp and scalp ulcers present as recurrent foci of infection, escalating in severity if left unaddressed. Both cases elucidate the involvement of the skull bone and brain parenchyma stemming from an exogenous infection origin, a rare phenomenon.<sup>[4]</sup> While the first case conjectures dissemination from a healed scalp furuncle or hematogenous spread from the gluteal region, the latter implicates an infected frontal sinus. Despite the resolution of furuncles upon presentation, manifestations of central nervous system involvement had already manifested. Both of our patients did not have any arterio-venous shunts or congenital cardiac disease.

Sinus inflammation typically follows a self-limiting trajectory; however, clinical vigilance is warranted under specific circumstances. Persistent symptoms beyond ten days, severe manifestations such as high fever, purulent nasal discharge, or facial pain persisting for several consecutive days, or the worsening of symptoms following an initial period of improvement (“double-sickening”). Post-viral upper respiratory tract infection signifies a need for intervention.<sup>[5]</sup> The significance of treating the primary source of infection is underscored by the atypical disease progression observed in the second case, where a mere week of antibiotic therapy failed to suffice. Host-related factors, encompassing diabetes mellitus, malnutrition, younger age, malignancy, and immunocompromised states, significantly modulate disease course, compromising bone vascularity and favoring infection propagation.<sup>[6,7]</sup> Mandible, frontal, temporal, maxilla, nasal bone, and skull base are commonly involved.<sup>[8]</sup> Osteomyelitis, marked by fever, malaise, and localized pain, harbors the potential for formidable complications if untreated, including facial cellulitis and cerebral abscess.<sup>[9,10]</sup> Disease onset is typically explained by the introduction of pathogens into the vascular channels of the skull bone, with concurrent cellulitis exacerbating tissue necrosis and fostering bacterial proliferation. The intracranial extension is facilitated via emissary and diploic veins, with patients often presenting with subperiosteal abscesses and soft tissue swelling. Radiological modalities, notably Contrast-enhanced MRI, afford superior soft tissue and medullary bone assessment, expediting diagnosis and subsequent intervention. Microbiological evaluation, encompassing fungal culture, often yields inconclusive results, with streptococci, staphylococci, and anaerobes representing primary pathogens.

Both cases were partially treated, which may be the cause of the sterile culture. Empirical antibiotic therapy, typically comprising third-generation cephalosporins, metronidazole, and vancomycin, supplemented by meropenem as an alternative, remains pivotal pending culture and sensitivity results.<sup>[11]</sup> Continuation of antibiotic therapy for six to eight weeks is recommended, with surgical intervention reserved for select cases.<sup>[12]</sup> After receiving eight weeks of antibiotic therapy, both cases herein achieved complete recovery without sequelae.

## CONCLUSION

Though rare, intracranial complications stemming from sinus and

skin infections mandate expeditious diagnostic and therapeutic interventions to forestall adverse outcomes. The sensitivity of MRI in delineating bone and soft tissue changes underscores its indispensability, with combined antibiotic and surgical interventions yielding optimal outcomes. Our case series aims to increase physician awareness about Skull osteomyelitis with brain abscess by emphasizing the potentially devastating complications and multimodal treatment approach involving Neurologists, Neurosurgeons, ENT specialists, Skull base surgeons, and Infectious disease experts.

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### Conflicts of interest

There are no conflicts of interest.

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