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# A Rare Case Report of Subdural Empyema as a Severe Intracranial Complication of Maxillary Sinusitis

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***ABSTRACT***

*Subdural empyema is a rare but potentially life-threatening intracranial complication of bacterial sinusitis. This case report described a 34-year-old man who presented with progressive impairment of consciousness following generalized tonic-clonic seizures. The patient had a three-month history of sinusitis and subsequently developed foul-smelling purulent nasal discharge, worsening headache, and high-grade fever. Neurological examination revealed impaired consciousness and nuchal rigidity without focal motor deficits. Laboratory investigations demonstrated leukocytosis, neutrophilia, an elevated neutrophil-to-lymphocyte ratio, reactive thrombocytosis, and mild anemia. Contrast-enhanced head computed tomography revealed a right frontoparietotemporal crescent-shaped subdural collection with peripheral enhancement, cerebral edema, a 0.7-centimeter midline shift, subfalcine herniation, and associated meningoencephalitis. Opacification of multiple paranasal sinuses, including the right maxillary sinus, supported sinusitis as the infectious source. The patient was treated with intravenous broad-spectrum antibiotics, anticonvulsant therapy, corticosteroids, and supportive management. Following multidisciplinary evaluation, conservative treatment was continued without surgical drainage because the patient showed progressive clinical improvement. His consciousness improved, no recurrent seizures occurred, and his headache subsided. The patient was discharged in stable neurological condition. This case highlighted the importance of early recognition, prompt neuroimaging, appropriate antimicrobial therapy, and multidisciplinary management in patients with sinusitis who developed neurological deterioration.*

## 1. INTRODUCTION

Rhinosinusitis is one of the most common inflammatory diseases of the upper respiratory tract encountered in clinical practice and is a major cause of healthcare visits worldwide. It is characterized by inflammation of the nasal and paranasal sinus mucosa and may result from viral, bacterial, or fungal infections, as well as noninfectious factors such as allergies, anatomical abnormalities, and impaired mucociliary function. Most episodes of rhinosinusitis are mild and resolve with symptomatic treatment or antibiotics when indicated (Fokkens et al., 2020). Rhinosinusitis has a substantial global burden. Approximately 6–12% of adults are estimated to experience rhinosinusitis annually, while chronic rhinosinusitis affects approximately 5–12% of the global population. Although advances in antimicrobial therapy have reduced the incidence of severe complications, paranasal sinus infections remain a potential source of infection spreading to adjacent orbital and intracranial structures, particularly when diagnosis is delayed, treatment is inadequate, or predisposing factors are present (Fokkens et al., 2020; Orlandi et al., 2021).

Complications of rhinosinusitis can be classified into local, orbital, and intracranial complications. Orbital complications are more frequently encountered, whereas intracranial complications are relatively uncommon, with an estimated incidence of less than 0.1% among patients with acute bacterial sinusitis. Despite their rarity, intracranial complications are associated with substantial neurological morbidity and may require emergency neurosurgical

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intervention, with a significant risk of mortality even in the era of modern antibiotics and advanced neuroimaging (Eça et al., 2024; Hall & De Jesus, 2024).

The spectrum of intracranial complications secondary to sinusitis includes meningitis, cerebritis, brain abscess, epidural empyema, subdural empyema, dural venous sinus thrombosis, and frontal bone osteomyelitis. Among these conditions, subdural empyema is particularly aggressive because purulent material accumulates within the subdural space, allowing infection to spread rapidly along the cerebral hemispheres. Progressive infection may result in cerebral edema, increased intracranial pressure, seizures, focal neurological deficits, cerebral herniation, and death when diagnosis and treatment are delayed (Hall & De Jesus, 2024; Merck Manual Professional Edition, 2024).

Although mortality from subdural empyema has declined substantially compared with the pre-antibiotic era, the condition remains a neurological and neurosurgical emergency. Clinical outcomes are strongly influenced by the speed of diagnosis, extent of infection, neurological status at presentation, and appropriateness of treatment. Delayed recognition of intracranial infection may increase the risk of permanent neurological disability secondary to mass effect, cerebral ischemia, cortical venous thrombosis, or cerebral herniation (Hall & De Jesus, 2024; Eça et al., 2024).

Most subdural empyemas in adults develop as complications of paranasal sinus infections, particularly frontal sinusitis. The predominance of frontal sinusitis as a source of intracranial infection is related to its close anatomical relationship with the anterior cranial fossa and the presence of a diploic venous system that may facilitate retrograde spread of infection into the intracranial cavity. In contrast, maxillary sinusitis is less frequently reported as the primary source of subdural empyema because of its greater anatomical distance from the intracranial cavity and the more complex pathways required for infection to spread intracranially. Therefore, subdural empyema originating from maxillary sinusitis represents an uncommon clinical manifestation, with much of the available evidence derived from case reports and small case series (Cress et al., 2024).

The management of subdural empyema requires early recognition, prompt neuroimaging, appropriate antimicrobial therapy, and multidisciplinary evaluation. Surgical drainage combined with intravenous antibiotics is generally recommended because it can reduce mass effect, evacuate purulent material, and provide specimens for microbiological examination. However, treatment decisions should be individualized according to the patient's neurological status, extent of infection, clinical response, and multidisciplinary assessment (Hall & De Jesus, 2024; Nathoo et al., 1999). The relative rarity of subdural empyema secondary to maxillary sinusitis means that information regarding its clinical presentation, disease progression, diagnostic characteristics, and management remains limited. Most available evidence concerns intracranial complications originating from frontal sinusitis, while cases associated with maxillary sinusitis remain less frequently reported. Well-documented case reports may therefore contribute to clinical awareness and provide additional information regarding the diagnosis and management of this uncommon but potentially life-threatening complication (Cress et al., 2024; Massimi et al., 2024).

## 2. METHOD

### Case Report

A 34-year-old man was referred to the Emergency Department of Prof. Dr. Margono Soekarjo Regional Hospital, Purwokerto, with progressive impairment of consciousness following recurrent generalized tonic-clonic seizures. Seven days before admission, the patient developed greenish, foul-smelling discharge from the right nostril. Four days later, he developed dizziness and high-grade fever. His neurological condition subsequently deteriorated, with incoherent speech followed by two episodes of generalized tonic-clonic seizures lasting less than five minutes each. The seizures occurred approximately 30 minutes apart and were followed by persistent impairment of consciousness for two days.

On admission, the patient had a Glasgow Coma Scale score of E3V5M6. His vital signs were stable. Neurological examination revealed nuchal rigidity without cranial nerve deficits. Motor strength was 5/5 bilaterally, physiological reflexes were +2 and symmetrical, and pathological reflexes were absent. Laboratory investigations demonstrated leukocytosis of 13,290/mm$^3$, thrombocytosis of 521,000/mm$^3$, neutrophilia of 77.6%, lymphopenia of 14.2%, an elevated neutrophil-to-lymphocyte ratio of 5.46, and mild anemia. These findings supported the presence of a systemic infectious process.

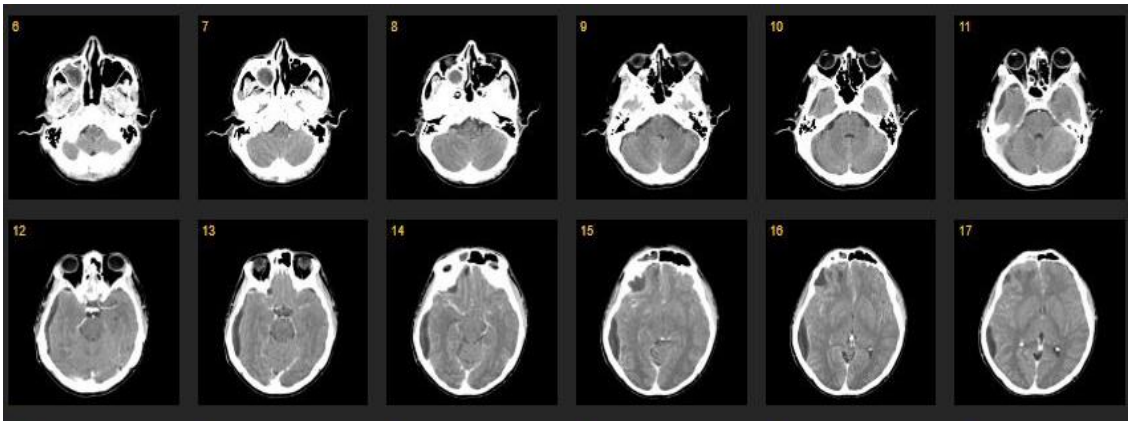


Figure 1. Contrast-enhanced head computed tomography showing a right frontoparietotemporal crescent-shaped subdural collection with peripheral enhancement, accompanied by cerebral edema and mass effect with midline shift. Opacification of the right maxillary sinus was also observed, supporting a sinogenic source of infection.

Contrast-enhanced head computed tomography demonstrated a crescent-shaped hypodense subdural collection in the right frontotemporoparietal region with peripheral enhancement. The lesion was accompanied by cerebral edema and mild mass effect with midline shift. Opacification of the right maxillary sinus supported a sinogenic source of infection. Based on the clinical and radiological findings, the patient was diagnosed with a right frontoparietotemporal subdural empyema associated with right maxillary sinusitis, accompanied by seizures and impaired consciousness. The patient received broad-spectrum intravenous antibiotic therapy, anticonvulsant therapy, corticosteroids, and supportive treatment. The treatment was continued following multidisciplinary evaluation. The Neurosurgery team evaluated the patient and determined that surgical intervention was not indicated because of the adequate clinical response to conservative management. During hospitalization, the patient's clinical condition progressively improved, with improvement in consciousness and no recurrent seizures. The patient was subsequently discharged in a stable condition with plans for continued treatment and outpatient follow-up. The fulltext also documented that microbiological cultures of blood, sinus secretions, and the subdural collection were not performed. Therefore, the causative microorganism could not be definitively identified, and antibiotic therapy was administered empirically. Because the patient did not undergo surgical drainage, no subdural pus specimen was available for microbiological examination. This limitation should be considered when interpreting the microbiological aspect of the diagnosis.

## 3. RESULT AND DISCUSSION

### Result

Following initiation of empirical intravenous broad-spectrum antibiotic therapy, anticonvulsant therapy, corticosteroids, and supportive treatment, the patient's neurological condition progressively improved. His level of consciousness improved to *compos mentis*, and no recurrent seizures were observed during hospitalization. His headache also gradually improved, and no new focal neurological deficits were documented. Following multidisciplinary evaluation, particularly by the Neurosurgery team, surgical drainage was not performed because of the

favorable clinical response to conservative treatment. The patient was subsequently discharged in a stable neurological condition with plans for continued treatment and outpatient follow-up. The favorable clinical response supported the effectiveness of the initial conservative management in this individual patient. However, because microbiological cultures were not obtained and no surgical drainage was performed, microbiological confirmation of the causative organism was unavailable. Therefore, the clinical outcome was assessed primarily on the basis of neurological improvement, absence of recurrent seizures, and overall clinical stability.

**Discussion**

Subdural empyema is a rare but potentially life-threatening intracranial complication of bacterial sinusitis. Although the incidence of intracranial complications has decreased with the widespread availability of antimicrobial therapy, subdural empyema remains a neurological and neurosurgical emergency because infection can spread rapidly through the subdural space and result in cerebral edema, increased intracranial pressure, seizures, neurological deficits, cerebral herniation, and death (Hall & De Jesus, 2024; Eça et al., 2024). The present case was clinically important because the patient developed subdural empyema in the setting of prolonged sinusitis and subsequently presented with progressive neurological deterioration, generalized tonic-clonic seizures, and impaired consciousness. The patient's history of persistent sinusitis followed by purulent nasal discharge, fever, headache, seizures, and impaired consciousness suggested progression from a localized sinonasal infection to an intracranial complication. The presence of nuchal rigidity further supported meningeal involvement. These findings emphasized that neurological deterioration in patients with sinusitis should be considered a potential warning sign of intracranial extension.

Most intracranial complications of sinusitis are associated with frontal sinus disease because of the anatomical proximity of the frontal sinus to the anterior cranial fossa and the presence of valveless diploic veins that can facilitate retrograde spread of infection. In contrast, maxillary sinusitis is less frequently associated with intracranial complications because of its greater anatomical distance from the intracranial compartment. The involvement of the right maxillary sinus in this patient therefore represented an uncommon presentation. The absence of osseous destruction on imaging suggested that direct extension through bone was less likely, although the precise route of intracranial spread could not be established in this case.

The diagnosis was supported by the combination of clinical, laboratory, and radiological findings. The patient demonstrated leukocytosis, neutrophilia, an elevated neutrophil-to-lymphocyte ratio, and thrombocytosis, all of which were compatible with an acute systemic inflammatory response. However, these laboratory abnormalities were nonspecific and could not establish the diagnosis independently. Neuroimaging was therefore essential for identifying the intracranial lesion and determining its extent. Contrast-enhanced head computed tomography demonstrated a crescent-shaped subdural collection in the right frontoparietotemporal region with peripheral enhancement, cerebral edema, mass effect, and midline shift. These findings were compatible with subdural empyema and indicated significant intracranial involvement. The associated opacification of the right maxillary sinus supported a possible sinogenic source. Contrast-enhanced computed tomography was particularly valuable in this case because it provided rapid assessment of the intracranial collection and associated mass effect in a patient presenting with neurological deterioration.

The differential diagnosis included chronic subdural hematoma, epidural empyema, brain abscess, and bacterial meningitis. Chronic subdural hematoma may produce a crescent-shaped extra-axial collection; however, the history of sinusitis, fever, leukocytosis, neutrophilia, nuchal rigidity, and peripheral enhancement favored an infectious process. Epidural empyema was considered less likely because epidural collections are generally more lentiform and do not extend along the cerebral hemisphere in the same manner as subdural collections. Brain abscess was also considered because of the seizures and impaired consciousness, but the primary lesion was located in the subdural space rather than within the brain parenchyma. Bacterial meningitis could explain the fever, headache, and nuchal rigidity but could not adequately explain the large extra-axial collection and associated mass effect.

Management of subdural empyema generally consists of intravenous broad-spectrum antibiotics combined with surgical drainage. Surgical intervention allows evacuation of purulent material, reduction of intracranial mass effect, and acquisition of specimens for microbiological examination (Nathoo et al., 1999; Hall & De Jesus, 2024). In the present case, however, surgical drainage was not performed because the patient demonstrated favorable clinical improvement following empirical antimicrobial and supportive treatment. The decision was made after multidisciplinary evaluation, particularly by the Neurosurgery team. The conservative approach in this case should be interpreted as an individualized management decision rather than evidence that surgery can routinely be avoided in patients with subdural empyema. The patient's improving consciousness, absence of recurrent seizures, and overall neurological stability supported continued medical management. Nevertheless, patients with progressive neurological deterioration, significant mass effect, persistent infection, or failure to respond to antimicrobial therapy may require urgent surgical drainage.

The antimicrobial regimen in this case consisted of broad-spectrum intravenous antibiotics. Because blood cultures, sinus secretion cultures, and cultures of the subdural collection were not obtained, the causative microorganism could not be definitively identified. Consequently, the antibiotic regimen was administered empirically based on the clinical presentation and presumed polymicrobial origin of the infection. The absence of microbiological confirmation represents an important limitation because antibiotic therapy could not subsequently be tailored according to pathogen identification and antimicrobial susceptibility testing.

The patient's favorable clinical response was characterized by improvement in consciousness, absence of recurrent seizures, reduction in headache, and stable neurological status at discharge. This outcome suggested that early recognition and prompt initiation of antimicrobial therapy may have contributed to preventing further neurological deterioration. However, the outcome of a single case cannot establish the efficacy or superiority of conservative treatment over surgical management. An important clinical lesson from this case is that sinusitis should not always be regarded as a benign or self-limiting condition. Progressive headache, persistent fever, purulent nasal discharge, seizures, impaired consciousness, or signs of meningeal irritation should prompt consideration of intracranial complications and early neuroimaging. Timely recognition is particularly important because neurological deterioration may progress rapidly once an intracranial collection has developed.

## 4. CONCLUSION

Subdural empyema is a rare but potentially life-threatening intracranial complication of sinusitis that requires early recognition and prompt management. In this case, the combination of progressive neurological deterioration, generalized tonic-clonic seizures, impaired consciousness, and nuchal rigidity in a patient with a history of sinusitis raised suspicion of an intracranial infectious complication. Contrast-enhanced head computed tomography was essential for establishing the diagnosis and demonstrated a right frontoparietotemporal subdural collection with cerebral edema, mass effect, and midline shift, with associated paranasal sinus involvement. Early administration of empirical intravenous antibiotics and multidisciplinary evaluation resulted in clinical improvement without surgical drainage in this individual patient. However, this favorable outcome should not be interpreted as evidence that conservative management can routinely replace surgical drainage, which remains an important component of treatment for subdural empyema.

Clinicians should maintain a high index of suspicion for intracranial complications in patients with sinusitis who develop progressive headache, fever, seizures, impaired consciousness, or signs of meningeal irritation. Prompt neuroimaging and early multidisciplinary assessment involving neurology, neurosurgery, and otorhinolaryngology are recommended to facilitate timely diagnosis and appropriate treatment decisions. When microbiological specimens are available, culture and antimicrobial susceptibility testing should be performed to guide targeted antibiotic therapy. Further accumulation of well-documented cases may help clarify the

clinical characteristics and optimal management of subdural empyema associated with less common sinonasal sources such as maxillary sinusitis.

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