A Rare Case of Aspergillosis of Cranial Bone Flap in an Immunocompromised Patient: A Case Report

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Fungal infections of cranial bone flaps are rare but potentially life-threatening complications in immunocompromised patients undergoing neurosurgery. *Aspergillus niger*, though less common than other *Aspergillus species* in clinical settings, can cause severe opportunistic infections.

We report a case of a 60-year-old immunocompromised female who developed an *Aspergillus niger* (*A. niger*) infection of the cranial bone flap three months after pterional craniotomy for aneurysm clipping. The patient presented with a chronic discharging sinus at the surgical site. Diagnostic imaging revealed an epidural collection, and microbiological examination confirmed *A. niger* infection.

Treatment involved surgical debridement with bone flap removal and long-term voriconazole therapy. The patient showed clinical improvement over 4-5 weeks and remained infection-free at 12-month follow-up.

This case highlights the importance of considering fungal pathogens in delayed post-neurosurgical infections, especially in immunocompromised patients. Prompt diagnosis and aggressive management with combined surgical and antifungal therapy are crucial for favourable outcomes.

Introduction

Cranial bone flap infections following neurosurgical procedures are uncommon but significant complications, with reported incidence rates ranging from 1% to 11% [1]. These infections pose challenges in immunocompromised patients, where opportunistic pathogens can lead to severe outcomes [2]. While bacterial infections are more frequently encountered, fungal infections, though rare, can result in substantial morbidity and mortality [3].

Aspergillus species are ubiquitous environmental fungi known to cause opportunistic infections in immunocompromised hosts [4]. Among these, *Aspergillus fumigatus* is the most commonly isolated species in clinical settings. *Aspergillus niger*, while less frequently encountered, has been implicated in various invasive fungal infections [5]. However, its involvement in cranial bone flap infections is exceptionally rare and poorly documented in the literature.

We present a case of *Aspergillus niger* infection in a cranial bone flap of an immunocompromised patient who underwent neurosurgery for a ruptured intracranial aneurysm. This report aims to highlight the diagnostic challenges, management strategies, and potential implications for neurosurgical practices in high-risk patients.

Case Presentation

Patient History and Initial Procedure

A 60-year-old female patient with a history of type 2 diabetes mellitus, chronic kidney disease stage 3, and rheumatoid arthritis presented with a ruptured right internal carotid artery posterior communicating artery (PCOM) aneurysm. The patient had been on long-term oral corticosteroids (prednisone 10 mg daily) for rheumatoid arthritis management.

Preoperative laboratory tests revealed an HbA1c of 7.8%, fasting glucose of 165 mg/dL, and serum creatinine of 1.7 mg/dL with an estimated GFR of 42 mL/min/1.73m2. These values indicated that the patient's diabetes was poorly controlled at the time of surgery, and her renal function was consistent with her known chronic kidney disease.

On December 10, 2021, the patient underwent a right pterional craniotomy and aneurysm clipping. The surgical procedure followed standard aseptic techniques, including perioperative antibiotic prophylaxis with cefazolin, as recommended by current guidelines [6]. An autologous bone flap was used and secured. The dura was closed, and the surgical site was irrigated with gentamicin-containing saline before closure, a practice supported by some studies for infection prevention [7].

Post-operative Course and Infection Presentation

The immediate post-operative period was uneventful, with the patient discharged after seven days showing normal wound healing and no neurological deficits. However, approximately three months post-surgery, the patient was readmitted with complaints of a chronic ulcer at the surgical site, which had progressed to a discharging sinus over two weeks. The patient reported no fever or neurological symptoms. Physical examination revealed local inflammation and purulent discharge from the wound.

Diagnostic Workup

Laboratory investigations showed the following results as depicted in Table 1.

Table 1: Laboratory investigations

Complete Blood Count (CBC) with differential		
White Blood Cell (WBC) count		11,500 cells/µL
	Neutrophils	75%
	Lymphocytes	15%
	Monocyte	8%
	Eosinophils	1%
	Basophils	1%
Haematocrit		33%
Red Blood Cell (RBC) count		3.8 x 106 cells/µL
Haemoglobin		11.2 g/dL
Platelet count		280,000 /µL
Comprehensive Metabolic Panel		
Sodium		138 mEq/L
Potassium		4.2 mEq/L
Chloride		102 mEq/L
Bicarbonate		24 mEq/L
Blood Urea Nitrogen (BUN)		28 mg/dL
Creatinine		1.9 mg/dL
Glucose		185 mg/dL
Calcium		9.2 mg/dL
Magnesium		2.1 mg/dL
Phosphorus		3.8 mg/dL
Liver function tests		
	ALT	35 U/L
	AST	32 U/L
	ALP	95 U/L
	Total bilirubin	0.8 mg/dL
	Albumin	3.5 g/dL
Coagulation studies		
Prothrombin Time (PT)		12.5 seconds
International Normalized Ratio (INR)		1.1
Activated Partial Thromboplastin Time (aPTT)		32 seconds
Inflammatory markers		
C-reactive protein (CRP)		75 mg/L (normal <5 mg/L)
Erythrocyte sedimentation rate (ESR)		65 mm/hr (normal <20 mm/hr)

Blood cultures for both bacterial and fungal pathogens were obtained upon readmission, demonstrating our high index of suspicion for a fungal infection given the patient's immunocompromised status and the nature of the wound. While bacterial cultures remained negative after 5 days of incubation, fungal blood cultures were initially negative but later showed growth of *Aspergillus niger* after 14 days of incubation. This positive fungal blood culture result confirmed systemic fungal infection, which is relatively uncommon but not unprecedented in cases of invasive aspergillosis. The extended incubation time required for fungal growth highlights the importance of maintaining fungal cultures for an adequate duration in suspected cases of opportunistic fungal infections.

Contrast-enhanced computed tomography (CT) of the brain revealed a hypodense collection in the epidural space adjacent to the bone flap, with mild enhancement of the surrounding dura. There was no evidence of cerebral abscess or intraparenchymal involvement.

Surgical Intervention and Microbiological Findings

The patient underwent wound re-exploration. Intraoperatively, a significant amount of purulent material was observed in the epidural space. The bone flap was removed, and extensive debridement of the surrounding soft tissues was performed. Samples were sent for microbiological analysis.

Direct microscopic examination using 10% potassium hydroxide (KOH) mount revealed non-pigmented septate hyphae, 3-5 µm in diameter, with characteristic dichotomous branching at 45° angles, suggestive of Aspergillus species [8]. Cultures on Sabouraud Dextrose Agar (SDA) with chloramphenicol yielded dark black colonies with a powdery texture after 48 hours of incubation at 25°C and 37°C. Lactophenol cotton blue (LPCB) mount of these colonies revealed conidiophores with biseriate phialides covering the entire vesicle, forming radiate heads characteristic of Aspergillus niger [9].

Treatment and Outcome

Based on the microbiological findings, the patient was started on oral voriconazole (loading dose of 400 mg twice daily on day 1, followed by 200 mg twice daily), as recommended for invasive aspergillosis [10]. The surgical site was managed with regular dressing changes and close monitoring.

The patient showed gradual clinical improvement over 4-5 weeks of antifungal therapy. Follow-up CT imaging at 4 weeks demonstrated resolution of the epidural collection, and wound healing progressed satisfactorily. Inflammatory markers returned to normal levels by week 6 of treatment.

The patient was discharged with instructions to continue oral voriconazole for a total of 12 weeks, with regular outpatient follow-up. At the 6-month and 12-month follow-up visits, the patient remained asymptomatic with no signs of infection recurrence. Repeat CT scans showed no evidence of intracranial infection or inflammation.

Discussion

This case highlights the rare occurrence of *Aspergillus niger* infection in a cranial bone flap following neurosurgery in an immunocompromised patient. While *Aspergillus species* are known opportunistic pathogens in immunocompromised hosts, *A. niger* is less frequently isolated from clinical specimens compared to *A. fumigatus* [11].

The pathogenesis of this infection remains speculative. Given the absence of pulmonary symptoms and normal lung imaging, hematogenous spread seems unlikely. We hypothesize that the infection may have resulted from intraoperative contamination or post-surgical wound colonization, facilitated by the patient's immunocompromised state due to chronic corticosteroid use, diabetes, and chronic kidney disease [12].

A review of literature revealed only a handful of reported cases of *Aspergillus* bone flap infections, with *A. fumigatus* being the predominant species [13, 14]. To our knowledge, this is one of the few reported cases of *A. niger* infection in a cranial bone flap. The indolent nature of the infection, presenting three months post-surgery, is consistent with the typically slow progression of fungal infections in immunocompromised hosts [15].

Diagnosis of fungal bone flap infections can be challenging due to their indolent nature and non-specific clinical presentation. In this case, the chronic ulcer progressing to a discharging sinus

was the key clinical indicator. Prompt microbiological investigation was crucial for accurate diagnosis and appropriate management [16].

The treatment of *Aspergillus* infections in the central nervous system typically involves a combination of surgical debridement and antifungal therapy. Voriconazole is considered the first-line agent for invasive aspergillosis due to its superior CNS penetration and improved outcomes compared to amphotericin B [17]. In our case, the patient responded well to surgical debridement followed by prolonged voriconazole therapy, consistent with current treatment guidelines [18].

This case underscores the importance of maintaining a high index of suspicion for fungal infections in immunocompromised patients undergoing neurosurgical procedures. It also highlights the value of routine microbiological screening of bone flaps and surgical sites in high-risk patients [19].

Conclusion

Aspergillus niger infection of a cranial bone flap is a rare but potentially serious complication in immunocompromised patients undergoing neurosurgery. Early recognition, prompt microbiological diagnosis, and appropriate antifungal therapy are crucial for successful management. This case emphasizes the need for vigilant post-operative monitoring and consideration of fungal pathogens in the differential diagnosis of delayed wound healing or infection in neurosurgical patients, particularly those with compromised immune systems.

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Ethical considerations: This case report is based solely on anonymized laboratory data without involving direct patient interaction or intervention. No identifiable patient information is included, ensuring compliance with ethical guidelines and does not require formal ethical clearance as it involves retrospective data analysis.

Highlights:

•Bone flap infection is a relatively rare yet concerning craniotomy complication.

• Fungal brain abscesses in immunosuppressed patients are associated with high morbidity and mortality. Hence, prompt diagnosis and initiation of treatment is necessary to improve the prognosis of the patients.

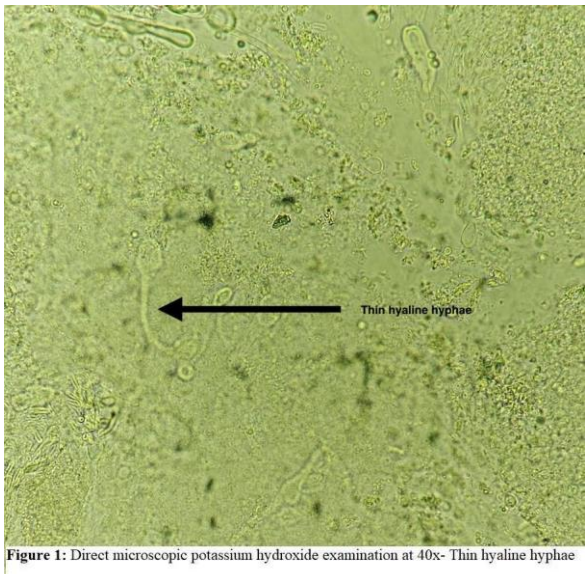

Figure 1: Direct microscopic potassium hydroxide examination at 40x- Thin hyaline hyphae

Figure 2: Sabouraud Dextrose agar - Dark black colony

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