

<https://doi.org/10.48047/AFJBS.6.15.2024.3091-3096>



African Journal of Biological Sciences

Journal homepage: <http://www.afjbs.com>



Research Paper

Open Access

Mucormycosis of jaws – literature review and current treatment protocols

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Volume 6, Issue 15, Sep 2024

Received: 15 July 2024

Accepted: 25 Aug 2024

Published: 05 Sep 2024

[doi: 10.48047/AFJBS.6.15.2024.3091-3096](https://doi.org/10.48047/AFJBS.6.15.2024.3091-3096)

Abstract

Mucormycosis, a rare but serious fungal infection, has gained attention due to its increasing prevalence in immunocompromised patients, particularly in relation to dental and maxillofacial contexts. This review aims to summarize the current understanding of mucormycosis affecting the jaws, highlighting its pathophysiology, clinical presentation, diagnostic challenges, and treatment protocols. We explore the multifactorial risk factors contributing to its emergence, including diabetes mellitus, immunosuppressive therapies, and recent COVID-19 infections. The review synthesizes existing literature to outline effective management strategies, emphasizing the role of early diagnosis, surgical intervention, and antifungal therapy. Furthermore, we discuss the importance of multidisciplinary approaches in optimizing patient outcomes. This comprehensive overview serves as a resource for clinicians in recognizing, diagnosing, and managing mucormycosis of the jaws.

Keywords

Mucormycosis, Fungal infection, Maxillofacial, Immunocompromised, Clinical presentation, Diagnosis, Treatment protocols, Antifungal therapy, Multidisciplinary approach

Introduction

Mucormycosis is an opportunistic fungal infection caused by members of the Mucorales order, predominantly affecting immunocompromised individuals. Its incidence has notably increased in recent years, particularly among patients with diabetes mellitus, hematological malignancies, and those undergoing immunosuppressive therapies (1, 2). The infection often presents as a rapidly progressive necrotizing process, primarily affecting the sinuses, lungs, and, notably, the maxillofacial region (3).

In the context of the jaws, mucormycosis can manifest as a severe and destructive osteomyelitis, leading to significant morbidity (4). Symptoms may include facial swelling, pain, and the presence of necrotic tissue, making early diagnosis crucial for effective intervention (5). The association of mucormycosis with recent COVID-19 infections has further emphasized the need for vigilance, as these patients exhibit increased susceptibility to fungal infections due to corticosteroid use and underlying comorbidities (6, 7).

Treatment of mucormycosis typically involves a combination of surgical debridement and antifungal therapy, with early intervention being critical for favorable outcomes (8). Despite advances in medical management, the mortality rate remains high, underscoring the importance of understanding the disease's pathophysiology and risk factors (9). This review aims to consolidate current knowledge regarding mucormycosis of the jaws, focusing on its etiology, clinical features, diagnostic strategies, and treatment protocols.

Review

Mucormycosis is a serious fungal infection caused by filamentous fungi belonging to the Mucorales order. This condition predominantly affects immunocompromised individuals, leading to potentially life-threatening consequences. The increasing incidence of mucormycosis, particularly in patients with diabetes, cancer, and those receiving immunosuppressive therapies, has raised concerns in the medical community (1, 2). The maxillofacial region is a critical area of concern, with mucormycosis often manifesting as aggressive osteomyelitis of the jaws (3). This review aims to provide a comprehensive overview of mucormycosis affecting the jaws, including its etiology, clinical features, diagnostic approaches, treatment protocols, and outcomes.

Pathophysiology

Mucormycosis is primarily caused by fungi in the Mucorales class, which includes genera such as *Rhizopus*, *Mucor*, and *Absidia*. These fungi are ubiquitous in the environment, commonly found in soil, decaying organic matter, and even in the nasal secretions of healthy individuals (4). The pathogenicity of these fungi is associated with their ability to invade blood vessels, leading to thrombosis and tissue necrosis (5).

The risk factors for mucormycosis include diabetes mellitus, especially when poorly controlled, hematological malignancies, solid organ transplants, and prolonged use of corticosteroids (6). The incidence of mucormycosis has notably increased during the COVID-19 pandemic, where the use of corticosteroids in treatment protocols has further exacerbated the risk (7).

Clinical Presentation

Mucormycosis affecting the jaws typically presents with a range of symptoms that can be misdiagnosed as dental infections or other oral pathologies. The initial signs may include facial

swelling, pain, and the presence of necrotic tissue in the oral cavity (8). As the disease progresses, patients may experience fever, altered mental status, and systemic infection (9).

The characteristic progression often leads to the involvement of the maxillary sinus, with potential extension to the orbit and brain, resulting in severe complications (10). Radiological examinations, including CT scans, often reveal bony destruction and sinus involvement, which are critical for diagnosis (11).

Diagnostic Challenges

Diagnosing mucormycosis can be challenging due to its nonspecific clinical presentation and the overlap with other conditions. The gold standard for diagnosis remains histopathological examination of tissue samples, which can reveal the characteristic non-septate hyphae of Mucorales (12).

Culture of the organism from clinical samples can also be performed; however, it may not always yield positive results, especially if the sample is not collected appropriately (13). Molecular techniques such as PCR have been explored for faster diagnosis but are not yet widely implemented in clinical practice (14).

Treatment Protocols

Surgical Intervention

Early surgical intervention is crucial in managing mucormycosis of the jaws. Debridement of necrotic tissue is essential to reduce the fungal load and prevent further spread of the infection (15). In severe cases, radical surgical procedures, including resection of affected jaw segments, may be necessary to achieve clear margins (16).

Antifungal Therapy

The mainstay of pharmacological treatment for mucormycosis includes the use of antifungal agents. Amphotericin B remains the cornerstone of treatment, with liposomal formulations preferred due to their reduced nephrotoxicity (17). Posaconazole and isavuconazole are alternative options that may be considered based on patient tolerance and specific clinical scenarios (18).

Combination therapy, involving both surgical and antifungal approaches, has been shown to improve outcomes, particularly in cases with extensive disease (19).

Supportive Care

Supportive care is an integral part of the management of mucormycosis. Correction of underlying predisposing factors, such as glycemic control in diabetic patients, is essential for successful treatment (20). Multidisciplinary teams involving infectious disease specialists, surgeons, and intensivists play a crucial role in optimizing patient outcomes (21).

Outcomes

The outcomes of mucormycosis can vary significantly depending on the timeliness of diagnosis and treatment. Reports suggest that the overall mortality rate for mucormycosis ranges from 30% to 70%, with higher rates observed in patients with delayed diagnosis (22).

Factors influencing prognosis include the extent of the disease at presentation, the underlying health of the patient, and the speed of intervention (23). Long-term complications, including facial deformities and impaired oral function, can also occur, necessitating further reconstructive procedures (24).

Mucormycosis of the jaws presents a significant clinical challenge due to its aggressive nature and the complexity of management strategies. The increasing incidence of this infection, particularly among immunocompromised populations, underscores the need for heightened awareness and timely intervention. The interplay of various risk factors, particularly diabetes mellitus and recent COVID-19 infections, has been shown to exacerbate the likelihood of developing mucormycosis (1, 2).

The clinical implications of mucormycosis are profound. Patients often present with nonspecific symptoms such as facial swelling and pain, which can lead to misdiagnosis and delayed treatment (3). This delay can result in rapid disease progression and increased morbidity. The unique presentations in the maxillofacial region, including necrotic tissue and sinus involvement, necessitate a high index of suspicion among healthcare providers (4).

Early intervention is critical for improving outcomes, as studies have indicated that the mortality rate significantly increases with delayed diagnosis (5). The role of imaging, particularly CT scans, is essential in assessing the extent of the disease and guiding surgical decisions (6). In this regard, a multidisciplinary approach involving otolaryngologists, infectious disease specialists, and dental surgeons can improve management strategies and patient outcomes (7).

The treatment of mucormycosis involves both surgical and antifungal strategies. Surgical debridement is often the first line of treatment and is crucial for removing necrotic tissue, which harbors the fungus and contributes to its spread (8). In some cases, radical resection may be warranted, especially when the disease has advanced significantly (9). However, the extent of surgical intervention required can pose significant challenges, particularly in preserving function and aesthetics in the maxillofacial region (10).

Antifungal therapy, primarily with amphotericin B, remains the cornerstone of treatment. Liposomal formulations are preferred due to their reduced toxicity (11). However, the limited availability of effective antifungal agents and the rising resistance among fungal species complicate treatment protocols (12). Alternatives such as posaconazole and isavuconazole offer some promise, yet their efficacy against mucormycosis is still under investigation (13).

Prognostic factors play a critical role in determining patient outcomes. Studies have identified that the extent of the disease at presentation, the immune status of the patient, and the speed of intervention significantly influence survival rates (14). For instance, patients with poorly controlled diabetes or those undergoing intensive immunosuppressive therapy are at higher risk for unfavorable outcomes (15). Furthermore, the emergence of COVID-19-associated mucormycosis has highlighted the vulnerability of this patient population, necessitating a reevaluation of existing management strategies (16).

Future Directions

Given the increasing incidence of mucormycosis, particularly in the context of the COVID-19 pandemic, future research should focus on improving diagnostic modalities and therapeutic options. Advances in molecular diagnostics may facilitate quicker identification of mucormycosis, allowing for earlier and more targeted interventions (17). Moreover, the

development of new antifungal agents and combination therapies could enhance treatment efficacy and reduce mortality rates (18).

Public health initiatives aimed at educating both healthcare providers and patients about the risk factors and early signs of mucormycosis are essential. Enhanced surveillance systems to track the incidence of mucormycosis in at-risk populations could also inform better clinical practices and resource allocation (19).

Conclusion

Mucormycosis of the jaws remains a formidable challenge in clinical practice. Early recognition, aggressive surgical management, and appropriate antifungal therapy are crucial for improving patient outcomes. As the landscape of mucormycosis evolves, particularly in light of global health crises, ongoing research, and education are vital to mitigating the impact of this devastating infection.

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