International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Fungal Etiology in Diabetic Foot Ulcers: Clinical Mimics, Diagnostic Challenges, and Management Protocols

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Abstract: ***Diabetic foot ulcers are often presumed to be bacterial in origin, yet a growing number of cases reveal underlying fungal infections that resist standard antibiotic treatment. This case report presents a 45-year-old diabetic patient with a Wagner Grade III ulcer, where Candida species were isolated following debridement and confirmed via KOH mount. The patient responded well to antifungal therapy, underscoring the importance of early fungal investigation in non-healing wounds. Recognizing distinct clinical features and timely initiation of antifungal treatment may improve outcomes and reduce surgical interventions.***

Keywords: diabetic foot ulcer, invasive fungal mycoses, KOH, Antifungal therapy, Surgical debridement

1.Background

Fungal Foot infections in diabetics are uncommon but increasingly recognized in chronic, non-healing wounds, especially when bacterial cultures remain negative or wounds fail to improve with standard antibiotic therapy.

Case: We report a 45-year-old female with type II diabetes mellitus who presented with a Wagner Grade III ulcer involving the plantar-medial aspect of the left fore and mid-foot. Clinical examination revealed two adjacent ulcers with deep tissue involvement and tendon exposure. Following surgical debridement, pus culture showed extensive growth of Candida species. KOH mount confirmed budding yeast cells with pseudohyphae. The patient responded favorably to oral fluconazole.

2.Introduction

Diabetic foot ulcers (DFUs) are a significant cause of morbidity among patients with long-standing diabetes mellitus. Although bacterial infections are the most common cause of DFU-associated sepsis, invasive fungal infections—particularly those caused by Candida species—are increasingly being identified in chronic, non-healing ulcers. These infections often remain undiagnosed due to overlapping clinical features with bacterial infections and failure to consider fungal pathogens initially. Here, we present a case of invasive candidal infection in a Wagner Grade III DFU, highlighting the importance of early microbiological diagnosis and targeted antifungal therapy.

3.Case Presentation

A 45-year-old female with type II diabetes mellitus for the past 10 years, managed with oral hypoglycemic agents, presented with a non-healing ulcer on her left foot. Examination revealed a Wagner Grade III diabetic foot ulcer located on the plantar-medial aspect of the fore and mid-foot. Two adjacent ulcers were noted. Superior ulcer was broad and shallow with moist, reddish granulation tissue with presence of pale-yellow slough and serous discharge. It had well-defined margins with l undermining edges. Surrounding skin showing maceration and erythema. Inferior ulcer shows Deep cavity with exposed tendons, Pale devitalized tissue, suggesting ischemia and ongoing infection and Irregular cavity with pockets suggestive of tunneling. Surrounding tissues showing edema and dusky discoloration extending beyond the ulcer margins. Discharge was odorless. Neurological assessment revealed loss of pain sensation in both feet, consistent with diabetic neuropathy. Vascular examination of both lower limbs demonstrated normal pulses, with no clinical evidence of peripheral arterial occlusive disease. Systemic examination was unremarkable. Vital signs: Blood pressure 110/80 mmHg, pulse rate 84/min.

Investigations

- Total leukocyte count: 16, 500/mm^3
- C-reactive protein: elevated
- Renal function tests: normal
- Serological markers: negative
- X-ray of the left foot: No evidence of osteomyelitis

Pus culture and sensitivity (C/S) was sent, and broad-spectrum antibiotics were initiated. The patient underwent Extensive surgical wound debridement under spinal anesthesia. After 3 days, the pus culture ans sensitivity reported extensive growth of Candida species. KOH mount demonstrated budding yeast cells with elongated pseudohyphae, confirming invasive candidal infection.

Treatment

The patient was started on:

- Oral fluconazole 12 mg/kg (800 mg) loading dose
- Followed by 400 mg once daily for two weeks

Antifungal therapy was planned to continue until clear improvement of the ulcer bed was observed.

4.Discussions

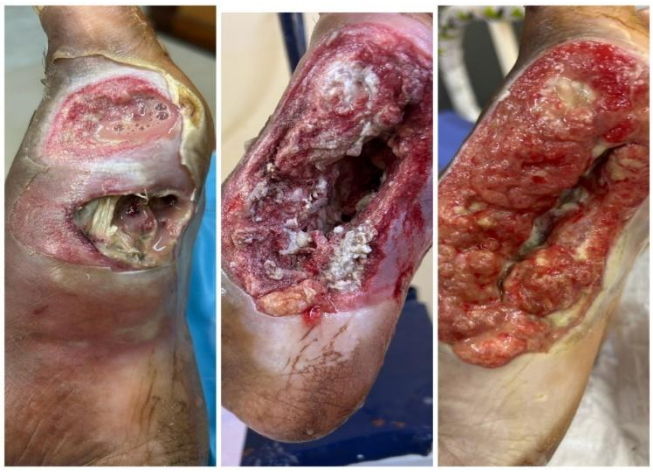
Unlike bacterial DFU, fungal infections show more indolent course, with non-purulent features. Systemic signs are mild with low grade fever or no fever. characteristics of fungal ulcers are pale dusky dry wound bed, minimal pus despite extensive necrosis, failure to improve with broad spectrum antibiotics. Presence of excessive granulation tissue during healing with satellitic nodules.

Pathogenesis

- Immune dysfunction in diabetes is the key factor leading to Impaired neutrophil chemotaxis and phagocytosis. High glucose reduces macrophages and T cell activity. Glycation of proteins interferes with complement function and a poor cytokine response led to decreased fungal clearance.
- Metabolic factors include hyperglycemia promotes fungal proliferation; ketoacidosis predisposes to mucor invasion since fungus thrive in acidic high iron environment.
- Repeated broad spectrum Antibiotics-eliminates bacterial competition leads to fungal overgrowth, particularly predispose to candida species.
- Long standing chronic ulcer - chronic granulation tissue with poor vascularity impairs local immunity, repeated debridements creates entry points for fungus.
- Associated PAOD-Ischemia reduces oxygen supply, decreased neutrophil function creates necrotic tissue which acts as perfect substrate for molds.
- Wound environment -Macerated skin, gaps between toes, moist dressings all promotes superficial colonization in to deeper invasion.
- Fungal factors - The commonest yeast species include candida ablicans, tropicalis, parapsilosis and glabarta. molds include Mucorales, Aspergillus and fusarium.

5.Conclusion

This case highlights the emerging challenge of fungal infections in diabetic foot ulcers, emphasizing the importance of early diagnostic suspicion, especially when ulcers fail to respond to antibiotics. KOH examination and fungal culture remain essential tools for timely diagnosis. Prompt antifungal therapy, combined with surgical debridement and multidisciplinary management, can significantly enhance wound healing and reduce the risk of complications.



Picture I: Shows grade iii diabetic foot ulcer with invasive fungal infection.

Picture II: Immediate post debridement status.

Picture III: After 2 weeks of antifungal therapy, wound showing excessive granulation with satellitic nodules suggestive of fungal etiology

References

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