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Case Study

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From Hyperglycemia to Fungal Invasion: A Case of Mucormycosis in Uncontrolled Diabetes

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A B S T R A C T

Mucormycosis is a rare, rapidly progressive, and often fatal opportunistic fungal infection predominantly affecting immunocompromised individuals, particularly those with uncontrolled diabetes mellitus. Hyperglycemia and metabolic acidosis contribute to impaired host immunity and increased free iron availability, thereby creating a favorable environment for the proliferation of fungi belonging to the order Mucorales. Rhino-orbital and rhino-orbito-cerebral forms are the most common clinical presentations, characterized by angioinvasion, tissue necrosis, and rapid disease progression. Early diagnosis and prompt multidisciplinary management are crucial for improving survival outcomes. This case report describes a 50-year-old male with poorly controlled diabetes mellitus who presented with facial swelling, periorbital edema, and progressive vision loss. Radiological evaluation suggested rhino-orbital mucormycosis with pulmonary involvement. Microbiological investigations played a pivotal role in establishing the diagnosis. Direct microscopic examination of nasal biopsy using potassium hydroxide (KOH) mount revealed broad, ribbon-like, aseptate hyphae. Fungal culture on Sabouraud Dextrose Agar (SDA) confirmed the presence of Mucorales, and Lactophenol Cotton Blue staining demonstrated characteristic sporangiophores and rhizoids. Despite aggressive antifungal therapy, metabolic stabilization, and supportive care, the patient succumbed to advanced disease progression. This case underscores the critical importance of integrating clinical, radiological, and microbiological findings for early and accurate diagnosis. It further highlights the necessity of strict glycemic control and vigilant monitoring in diabetic patients to reduce the risk of invasive fungal infections such as mucormycosis.

Learning

The complex relationship between uncontrolled diabetes and mucormycosis, underscoring the necessity of increased clinical attention.

Introduction

The potentially fatal invasive fungal infection known as mucormycosis is more common in diabetic individuals, whether or not they also have other underlying medical problems such solid organ transplants or hematological malignancies.[1] Primary disease, usually an airborne infection, is linked to the clinical development of sinusitis, rhinocerebral mucormycosis, or pulmonary infection and is started in the upper or lower airways.[2] Patients with immunocompromised conditions, such as diabetes, are more likely to have the common form of this infection in the rhinomaxillary region.[3] The most common complications were associated with nephrotoxicity and prolonged hospitalization due to IV antifungal therapy.[4]Thus, the key to lowering the death

rate is early detection of this potentially fatal illness and timely treatment

Case Report

History

A 50 year old male patient was admitted to ENT department at Gadag Institute of Medical Sciences & Training Hospital on 15th June 2024. He was farmer by profession and a native of Shirhatti, Gadag district. He presented with facial swelling associated with pain since 4 days. He also complained of difficulty in opening right eye associated with watering and discharge. The patient gave chronic history of gradual loss of vision in right eye since 2 years. Patient is also a known case of uncontrolled type 2 Diabetes mellitus under medication (Tab. Glimepiride 2mg BD, Tab. Pioglitazone hydrochloride 100mg + Tab. Metformin 500mg BD) since 3 years. Patient gave history of occasional alcohol consumption since 4 years and tobacco chewing since 10 years. Patient is not a known case of hypertension, asthma, epilepsy and food/drug allergy.

Examination

On examination, patient was conscious, co-operative & oriented. Vitals recorded: Pulse rate of 99 bpm, blood pressure of 110/60 mm Hg and SpO2 of 90% at room air. Diffuse swelling was noted over right cheek and right infraorbital region. The swelling was tender and soft in consistency. Perception of light was absent in right eye. Crusting and blood clots were noted in right nostril. A whitish patch, measuring 3x2cm, was noted over the right side of hard palate. Examination showed intact facial nerve. On ophthalmic examination, periorbital edema was noted in right eye and periorbital tenderness was present over superior, lateral and infraorbital region. Patient was unable to open right eye due to induration and edema. Fundoscopy suggested glaucomatous optic atrophy.

Blood & Urine Investigations

CBC showed leucocytosis (18530 cells/cumm) and reduced RBC count (3.91 million/cumm). LFT showed slight increase in Total Bilirubin (1.3 mg/dL) and Alkaline Phosphatase of 294IU/L. GRBS remained steadily raised and was repeated every 2nd hourly. Renal function tests were massively deranged; Serum creatinine of 8.06mg/dL. Serum uric acid of 9.8 mg/dL and Blood urea of 162.6 mg/dL. Serum sodium (118 mmol/L) and serum chloride (90mmol/L) were deranged initially, which readjusted within normal limits the following day. The patient's CRP level was 31.44mg/dL. Biochemistry studies on patient's urine showed traces of albumin and abundant sugar (++++). Urine microscopy showed granular casts. ABG consistently indicated metabolic acidosis and was repeated every 6th hourly.

Imaging

CT skull showed bony erosions on the medial wall of right maxillary sinus. Soft tissue edema with surgical emphysema was noted in the right premaxillary and infratemporal fossa. Also, a tiny focus of air was present in the extraconal space at inferior aspect in right orbit. CT chest showed multiple well-defined areas of central ground glass opacity with surrounding thick rim of dense consolidation seen in the posterior segments of bilateral upper lobe and superior segment of right lower lobe-suggestive of "reverse halo" sign. MR-Brain, Orbit, PNS and Neck without contrast showed mucosal thickening in right maxillary, bilateral ethmoid sinuses and right nasal turbinates with areas of T2 hyperintensity. Right optic nerve was mildly thickened and showed T2 hyperintensity. Also, right sided periorbital edema and superficial soft tissue edema were noted in the temporal fossa. Imaging findings were in favour of an infective etiology like Mucormycosis.

Microbiological Investigation

Biopsy from inferior turbinate of right nostril was sent to Microbiology laboratory for performing bacterial culture and susceptibility and KOH mount. Bacterial culture showed no growth after 48 hours of aerobic incubation. KOH mount revealed broad, hyaline, aseptate branching fungal elements resembling fungi belonging to the order Mucorales. Culture on SDA slant (at room temperature) showed tube-filing, cottony (white to grey) growth, which started to turn black on further incubation. Fungal culture/Slide culture was performed. LPCB (LactoPhenolCottonBlue) was performed on fungal growth on incubated SDA slant and slide culture. Slide culture showed cottony growth which turned brown on subsequent incubation. LPCB showed aseptate, unbranched sporangiophores that arise opposite rhizoides at the nodes, and each sporangiophore supported a round spore filled sporangium which is black in colour.

Figure.1 Showing blackish crusts inside the nostrils and periorbital edema

Figure.2 CT Skull showing bony erosions on the medial wall of right maxillary sinus

Figure.3 CT Chest showing "Reverse halo sign"

Figure.4 KOH mount showing broad, hyaline, aseptate branching fungal elements

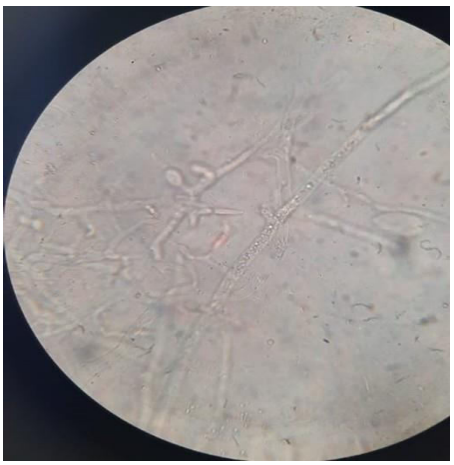

Figure.5 SDA slant showing cottony (white to grey) growth

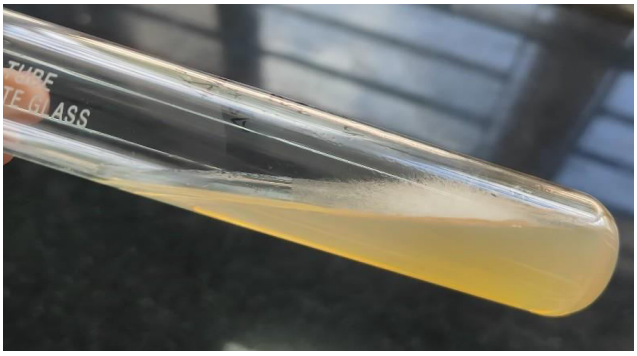

Figure.6 SDA mount showing tube-filing, cottony (white to grey) growth, which started to turn black on further incubation.

Figure.7 Slide culture showing cottony growth

Figure.8 Slide culture cottony growth which turned brown on subsequent incubation.

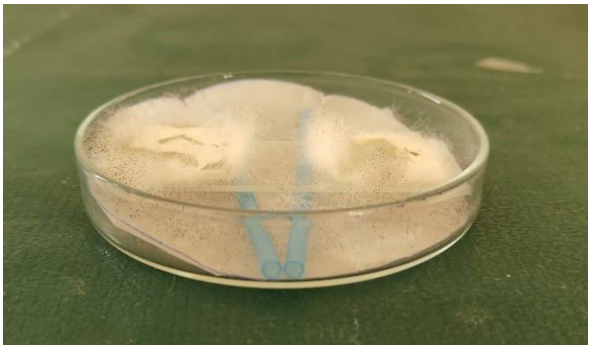

Figure.8 LPCB mount showing aseptate, unbranched sporangiophores

Figure.9 LPCB mount showing aseptate, unbranched sporangiophores that arise opposite rhizoides at the nodes, and each sporangiophore supported a round spore filled sporangium which is black in colour. Stolons connected the group of rhizoids with each other**.**

Stolons connected the group of rhizoids with each other. Throat swab culture showed isolation of Candida spp. after 48 hours of aerobic incubation. Blood culture of the patient showed no growth after 7 days of aerobic incubation.

Impression: Rhino-orbital and pulmonary mucormycosis with uncontrolled type 2 Diabetes mellitus with acute kidney injury with metabolic acidosis

Treatment Provided

The patient was started on Inj Piptaz 5.5gm IV TID, Inj Amikacin IV OD. Inj Pan 40mg IV OD, Inj Tramadol 50mg IV BD, Inj Emeset 4mg IV BD, Betadine mouth gargle, Inj Insulin (according to sugars), IV fluids, Moxiflox eye drops 8th hourly, Lacrigel eyedrops 4th hourly and lip taping at night. The following day (16th June 2024), patient was takenover by General Medicine department in view of deranged RFT and consistently high GRBS. 13 ampules of Sodium bicarbonate in 1-pint normal saline was given overnight for 6 hours in view of metabolic acidosis. Patient underwent haemodialysis of 1.5 litres in view of deteriorating RFT on 18th June 2024. Patient was later intubated and mechanical ventilation was provided the same day, in view of Respiratory distress and tachypnoea (5 ampules of Vecuronium in 50 mL normal saline at the rate of 3mL/hour was provided for the same). Inj Midazolam IV at 5mL/hr was also administered. The worsening renal status of the patient made administration of the drug of choice, Amphotericin B almost impractical.

Later that day (18th June 2024) at 2:30pm, patient succumbed to death, primary cause of death being Cardiac arrest.

Discussion

This case highlights the aggressive and life-threatening nature of mucormycosis, especially in the context of uncontrolled diabetes mellitus. Hyperglycemia and metabolic acidosis contribute significantly to the pathogenesis by impairing immune responses and creating an environment conducive to fungal proliferation. The patient's delayed presentation, coupled with severe metabolic derangements and advanced disease, posed significant diagnostic and therapeutic challenges. Despite prompt treatment and supportive care, the disease progression underscores the importance of early recognition and intervention. This case reinforces the critical need for strict glycemic control and regular monitoring in diabetic patients to prevent opportunistic infections like mucormycosis.

In conclusion, Mucormycosis remains a devastating opportunistic infection with high mortality, particularly

in immunocompromised individuals. This case underscores the necessity of early diagnosis, aggressive management, and a multidisciplinary approach to improve outcomes. It also highlights the importance of patient education on glycemic control and early symptom recognition. Clinicians must maintain a high index of suspicion for mucormycosis in high-risk populations to ensure timely and effective treatment.

Author Contributions

Anjana Benoy: Investigation, formal analysis, writing—original draft. Akshata Uppar: Validation, methodology, writing—reviewing. Mahesh C. Baragundi:—Formal analysis, writing—review and editing. Arun Ingale: Investigation, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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