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CASE REPORT

A necrotic patch on the elbow of a child

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Introduction

We report the case of a 5-year-old boy presenting with a necrotic patch on his elbow while being admitted to paediatric intensive care due to multiorgan failure. Histopathological examination revealed epidermal ischaemia and dermal necrosis with collections of broad pauciseptate, ribbon-like hyphae. A culture of the skin biopsy confirmed a diagnosis of cutaneous mucormycosis. This was treated with repeated surgical debridement and antifungal therapy.

Case report

A 5-year-old boy with an undiagnosed cause of fulminant liver failure was transferred to the Pediatric Intensive Care Unit at King's College Hospital (KCH), London. On admission, he was in multiorgan failure. Prior to transfer he had received an 8-day course of high-dose intravenous corticosteroids. Three days after admission to KCH, two small black lesions were noted on his right arm at the site of a venous cannula. The lesions expanded rapidly over the next 24 hours. By day 4 of admission there was a 4×5 cm indurated, necrotic plaque with central blistering (Figure 1). Skin biopsies were taken for histopathology and culture. Blood cultures and beta-D-glucan were negative. The blood glucose level was normal. Histology of the biopsy showed dermal necrosis and collections of broad, pauciseptate hyphae branching at 90 degrees in the dermis and subcutis (Figure 2). The clinical findings, histology and microscopy were consistent with a diagnosis of cutaneous mucormycosis. The patient required urgent hepatic support and, despite concerns about immunosuppression and the risk of dissemination, underwent a living donor liver transplant from his father. The post-transplantation immunosuppression regimen consisted of tacrolimus and intravenous corticosteroids. Culture of the skin biopsy subsequently grew *Rhizopus arrhizus* (Figure 3), confirming the clinical diagnosis of mucormycosis. The patient's *Rhizopus* species was sensitive to amphotericin B and isavuconazole, but resistant to itraconazole, voriconazole and posaconazole. The patient was treated with surgical debridement and intravenous AmBisome® and isavuconazole. Initially the skin and soft tissue infection extended, and he underwent further debridement followed by AmBisome® irrigation under a vac dressing (vacuum-assisted closure). On this treatment there was slow but complete resolution of the mucormycosis, and full healing of the debrided wound. The patient was discharged after a five-month admission. His liver transplant remains functional under a maintenance immunosuppressive regimen of tacrolimus and prednisolone.

Discussion

Mucormycosis is a vasotropic fungal infection caused by fungi of the Mucorales order, typically *Rhizopus* and *Mucor* genera. The most common sites of infection are the sinuses, lungs and skin (Petrikkos et al, 2012). The angiophilic growth pattern of these fungi results in blood vessel invasion, thrombosis and ischaemia with tissue necrosis being the characteristic clinical feature of mucormycosis (Petrikkos et al, 2012). Leading risk factors for infection by mucor organisms are poorly controlled diabetes (40%), haematological malignancy (33%) and solid organ transplantation (14%) (Jeong et al, 2019).

Cutaneous mucormycosis results from direct inoculation of fungal spores into the skin from trauma, particularly with injuries contaminated by soil. The infection can also be transmitted from contaminated dressings and by injections. The angioinvasive property of these fungi can lead to haematological dissemination (Spellberg et al, 2005). Immunocompromise is the over-arching hazard and our patient had received high-dose corticosteroids and was in multiorgan failure, which precipitated localised infection.

Mucormycosis is diagnosed following clinical assessment and studies of lesional tissue - microscopy, histopathology and culture. Clinically, cutaneous mucormycosis presents

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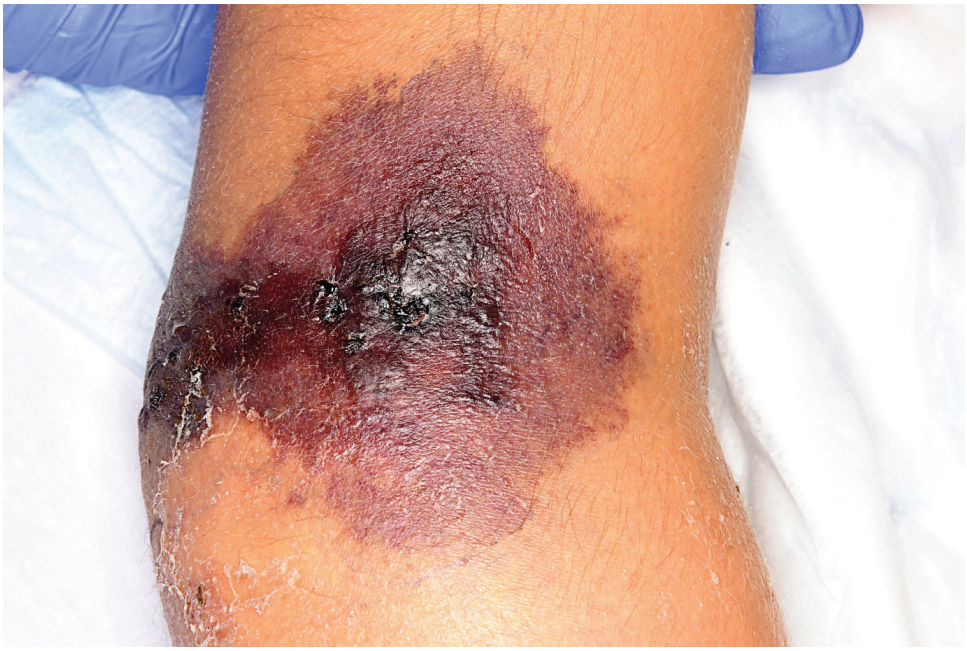

Figure 1. 4×5 cm indurated, necrotic plaque on the right arm.

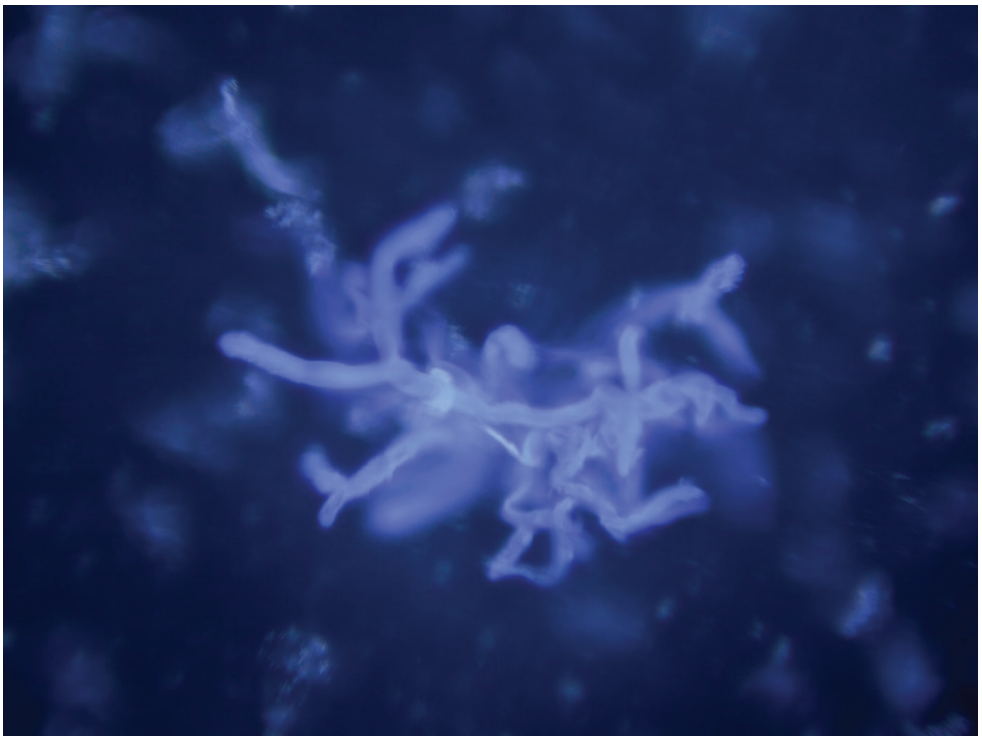

Figure 2. Calcofluor-white stain demonstrating broad, pauciseptate, ribbon-like hyphae branching at approximately 90 degrees.

as a necrotic eschar with surrounding induration and erythema (Petrikkos et al, 2012). Local invasion occurs rapidly and can progress to necrotising fasciitis. Microscopy of a skin biopsy reveals wide, non-pigmented, ribbon-like hyphae with no or few septations and right-angle branching. Histopathology demonstrates the presence of hyphae in vessel walls with accompanying ischaemia and necrosis. A positive culture confirms the diagnosis, however, false negatives are seen in up to 50% of cases (Skiada et al, 2020).

The prognosis of mucormycosis is poor with a mortality rate of just under 50% (Jeong et al, 2019). Successful treatment of mucormycosis involves early diagnosis, urgent surgical

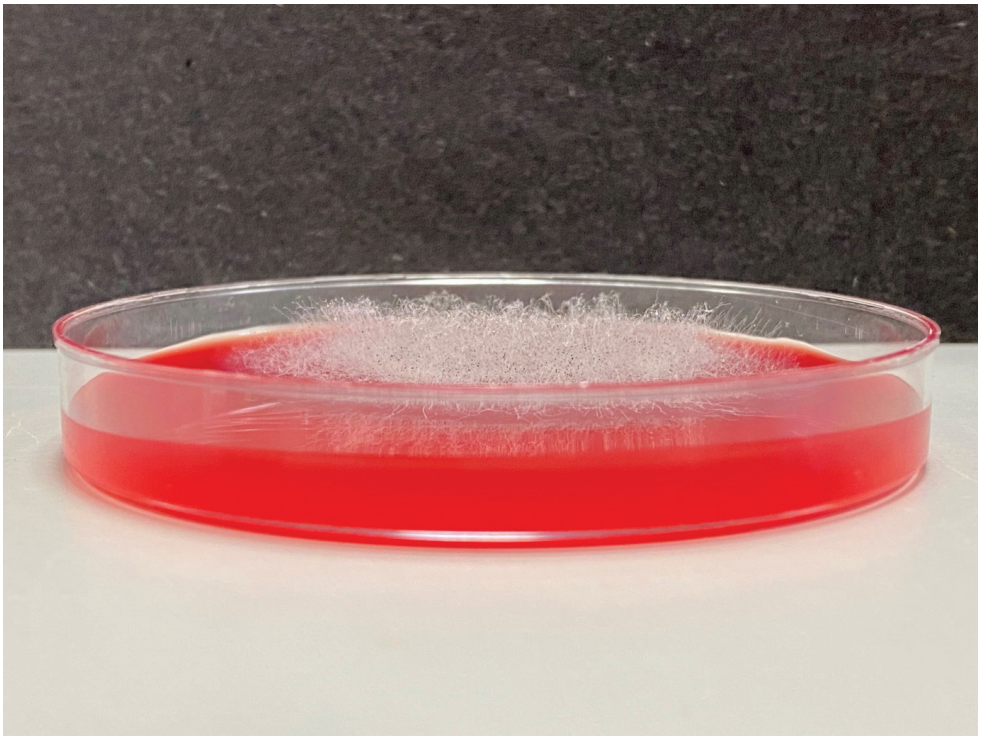

Figure 3. Culture of *Rhizopus arrhizus*.

debridement and treatment with antifungal therapies (prolonged treatment in cases of disseminated infection) (Spellberg et al, 2005). A delay in treatment can lead to a 2-fold increase in mortality (Chamilos et al, 2008). Our patient had cutaneous mucormycosis treated with debridement and dual antifungal therapy of AmBisome® and isavuconazole. Debridement was limited initially, but ultimately extensive debridement was necessary.

Key points

- Mucormycosis is an angioinvasive fungal infection which can progress rapidly and can lead to disseminated disease.
- Key risk factors for mucormycosis include: poorly controlled diabetes, solid organ transplantation, haematological malignancy and severe immunosuppression (present in this case).
- Diagnosis of mucormycosis is made on clinical assessment in combination with microscopy, histopathology and culture.
- Urgent surgical debridement is essential to the successful treatment of cutaneous mucormycosis.
- In addition to surgical debridement, antifungal therapy (typically AmBisome®) is required.

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Availability of Data and Materials

All data generated or analysed during this study are included in this published article.

Author Contributions
WW, AV, MP and DC were responsible for the design of work, drafting and revision of content. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate
Informed consent was signed by the participant.

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Conflict of Interest
The authors have no conflicts of interest to declare.

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