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CASE REPORT

Nosocomial cutaneous zygomycosis in a patient with diabetic ketoacidosis

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Summary Zygomycosis is an opportunistic fungal infection with a fulminant course. Varying clinical forms have been described, including cutaneous zygomycosis, which is mainly observed in diabetic and burns patients. We report herein a case of cutaneous zygomycosis of the nose in a 26-year-old female patient with diabetic ketoacidosis, developing secondary to the application of non-elasticized adhesive tape probably contaminated with fungal spores.

Introduction

The incidence of hospital-acquired fungal infections has increased substantially over the past two decades in parallel with medical technological advances. The advent of newer technologies and therapies, such as organ transplantation and the frequent use of chemotherapeutic agents, is resulting in many immunocompromised subjects highly susceptible to fungal infections.[1] Fungal spores, especially those of the zygomycetes, are ubiquitous and cause cutaneous zygomycosis in patients with diabetes, burns, and trauma.[2] The use of contaminated occlusive bandages has also been associated with cutaneous zygomycosis.[3] We report herein a case of cutaneous zygomycosis of the nose in a patient with diabetic ketoacidosis, developing secondary to the application of non-elasticized adhesive tape.

Case report

A 26-year-old female presented to casualty with severe lower abdominal pain of one-day duration and intense thirst of one-week duration. She was mildly tachycardic (116 beats/min) and tachypneic (24 breaths/min), with a low blood pressure (82/56 mmHg), and a body temperature of 38.2 °C. She was severely dehydrated and in a confused state. She had had diabetes mellitus for 3 years with poor glycemic control. It was discovered that she had stopped taking her antidiabetic drugs 10 days before reporting to the hospital. Laboratory examination showed a white blood cell count of 15×10^9/l, hemoglobin A1c (HbA1c) 11.2%, blood glucose 436 mg/dl, blood urea nitrogen 31 mg/dl, serum creatinine 1.5 mg/dl, potassium 5.7 mg/dl, erythrocyte sedimentation rate 37 mm/1-h, and C-reactive protein

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42 mg/l. Her arterial blood gas analysis showed pH 7.1, plasma bicarbonate 16.8 mmol/l, arterial CO_2 pressure 28 mmHg, and arterial O_2 tension 136 mmHg, and her urine was positive for ketones. Transabdominal sonography and a chest X-ray were within normal limits.

She was admitted to the intensive care unit and was kept on intravenous fluids and insulin. Oxygen was provided by a facemask and a Ryle's tube was placed through the right nostril and secured to the nose with adhesive tape (3M™ Micropore surgical tape). On day 3 her consciousness, glucose level, and metabolic status improved, however on day 4 she developed fever. Since the overall general condition of the patient was improving the Ryle's tube was removed on day 5 and an ulcerated area covered with black eschar was noticed on the nose underneath the adhesive tape (Figure 1). The lesions were located exactly in the area where the adhesive tape had been placed.

Surgically excised tissue was sent for bacterial and mycological evaluation. KOH wet mount showed broad, nonseptate hyphae with right-angle branching, characteristic of zygomycetes. A fungal culture was done on Sabouraud's dextrose agar (SDA) with and without cycloheximide and incubated at 25 °C. White cottony colonies appeared within 24 h, which later turned black on SDA without cycloheximide. The isolate was identified as *Rhizopus arrhizus* based on growth at 40 °C and microscopic examination of lactophenol cotton blue wet mounts, which showed unbranched sporangiophores with ridged spores and indistinct rhizoids arising from stolons opposite the sporangiophores. Aerobic and anaerobic cultures for bacterial infection were negative. Two blood specimens collected for fungal and bacteriological culture were sterile. Computed tomography imaging revealed no evidence of extension from the cutaneous lesion to other maxillofacial sites; no other systemic complications arose from the initial lesion.

Based on the above findings, a diagnosis of nosocomial cutaneous zygomycosis was made. Local debridement was performed and amphotericin B (4 mg/kg/day) was administered intravenously for 10 days, along with a strict control of her blood glucose level. The patient recovered well and has maintained good glycemic control (HbA1c 5.8%) with oral antidiabetic treatment.

Discussion

The zygomycetes class of fungi includes three orders: *Mucorales*, *Mortierellales* and *Entomophthorales*. Among these,

Figure 1 (A) Cutaneous zygomycosis involving the nose. (B) KOH wet mount showing broad, nonseptate hyphae with right-angled branching, characteristic of zygomycetes (400×). (C) Growth of *Rhizopus arrhizus* on Sabouraud's dextrose agar. (D) Lactophenol cotton blue mount of *Rhizopus arrhizus* (100×).

fungi belonging to the order *Mucorales* are mainly responsible for infection in humans. Based on clinical presentation and site of infection, zygomycosis can be divided into six clinical categories: (1) rhinocerebral, (2) pulmonary, (3) cutaneous, (4) gastrointestinal, (5) disseminated, and (6) miscellaneous.[4] Cutaneous zygomycosis, comprising about 16% of all cases of zygomycosis, can be primary or secondary, resulting from direct inoculation or systemic dissemination. The various systemic illnesses that can predispose to systemic zygomycosis include diabetes mellitus, leukemia, neutropenia, malnutrition, renal failure, organ transplantation, and immunosuppressive therapy; local risk factors include burns, trauma, and contaminated elasticized surgical dressings.[5] There are two types of primary cutaneous mucormycosis: superficial and gangrenous. Superficial cutaneous mucormycosis is characterized by vesicles or pustules involving the superficial dermis and subcutaneous tissues, whereas the gangrenous form, which develops as the disease progresses, is characterized by ulceration and formation of an eschar.[6] The latter was seen in our patient.

Zygomycosis is a rapidly progressive infection, which may be fatal in a few days if not treated. The predisposition of diabetics to acquire the mucormycosis infection may be related to acidosis and hyperglycemia. Acidosis disrupts iron binding of transferrin, resulting in an increased proportion of unbound iron, which may promote growth of the fungus.[5] Susceptibility of the patients with diabetic ketoacidosis to this infection may also be due to decreased neutrophil chemotaxis and phagocytosis.[7]

In this patient, adhesive tape, which was used to secure the Ryle's tube to the nose, was probably contaminated with fungal spores, although this could not be confirmed by culture. Adhesive tape is a unique piece of medical equipment because it is almost never washed or sterilized after initial opening of the package. In addition, a roll of tape may be used by and for many individuals and thereby become exposed to several patients and clinicians. Moreover, a roll is typically manipulated by doctors, nurses, or other healthcare workers using ungloved hands. A number of reports indicate that necrotizing cutaneous mucormycosis can follow the use of some bandages or adhesive tapes to cover surgical wounds.[8–10]

Isolated cutaneous zygomycosis has a favorable prognosis and a low mortality if diagnosed and treated promptly, as was the case with our patient. However it can be invasive locally and penetrate from the cutaneous and subcutaneous tissues into the adjacent fat, muscle, fascia, and even bone. Secondary vascular invasion may lead to hematogenously disseminated infection of the deep organs leading to a poor prognosis.[5] It is important to stress the need for proper handling of materials that seal tightly on the skin. For every patient a separate roll of tape should be used, and one should think of the feasibility of discarding the outer layer of adhesive tape and using only the inner layer.[10] In order to prevent nosocomial cutaneous zygomycosis, debilitated patients requiring endotracheal intubation/Ryle's tube might benefit from the securing of these with surgical tubing or fabric fastener straps (Velcro) rather than adhesive tape. If these methods are not available, routine skin checks underneath the tape should be meticulously performed at the time of changing the tubes, as this might provide a clue for the early diagnosis of zygomycosis. Rapid diagnosis and early medical and surgical treatment result in a favorable outcome in patients with cutaneous zygomycosis.

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Conflict of interest: No conflict of interest to declare.

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