Over the counter antifungal spray causing frostbite: Case study

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ABSTRACT
There are many over-the-counter (OTC) patients may seek when treating tinea pedis. There are very few side effects from topical medications since many are sprays, lotions and or creams. Frostbite from OTC antifungal medication is a rare but possible adverse reaction that we should be aware of. We present a case study of a patient who developed frostbite after using an over the counter Miconazole nitrate powder spray for a tinea pedis. The patient presented with pain, numbness, and discoloration of the affected area, which required immediate treatment. This case highlights the importance of careful consideration of potential side effects of OTC medications, even those considered safe and effective, and the need for prompt recognition and management of adverse reactions. By educating patients about the proper use of OTC medications and advise them to seek medical attention if any unusual symptoms arise, we can prevent further iatrogenic damage especially in high risk diabetic patients.

Introduction

Dermatophytes are the primary causative organisms of tinea pedis. The most common types of dermatophytes that cause this infection are Trichophyton rubrum and Trichophyton mentagrophytes (roseus). These fungi can also cause other types of fungal infections, such as jock itch and ringworm. Additionally, tinea pedis can also be caused by yeasts and molds, such as Candida albicans and Scytalidium dimidiatum.1 This involves a combination of factors, including the presence of the causative organism, the host’s susceptibility to infection, and environmental factors. The causative organism must be present in sufficient numbers to cause an infection, and the host’s immune system must be compromised in some way to allow the organism to take hold. Environmental factors such as warm, moist environments also play a role in the development of tinea pedis. Alidudin et al collected data from 199 participants in the United Kingdom, including demographic information, health status, lifestyle factors, and symptoms related to tinea pedis.7 They found that nearly half of the participants reported having tinea pedis symptoms in the past year, and that the condition was more common among men, those who frequently wore closed-toe shoes, and those who engaged in physical activity. They also conducted qualitative interviews with a subset of participants and found that many were unaware of the risk factors and symptoms of tinea pedis, and that there was a lack of information and resources available for prevention and treatment.4

The pathology of tinea pedis involves a series of complex interactions between the host’s immune system and the causative organism.2,5 Once the organism enters the skin, it begins to grow and spread, leading to the characteristic symptoms of tinea pedis. The first stage of the infection involves the colonization of the skin by the fungus, which may go unnoticed in some individuals. As the infection progresses, the fungus begins to invade the deeper layers of the skin, causing inflammation, itching, and burning.3 The second stage of the infection involves the growth of the fungus into a mature mycelium, which produces a range of enzymes and toxins that contribute to the pathogenesis of the infection. These enzymes and toxins can cause damage to the skin and exacerbate the inflammatory response, leading to the formation of blisters, cracks, and fissures in the affected area.2,9 The final stage of the infection involves the spread of the fungus to other parts of the body, such as the toenails or hands, and the development of secondary bacterial infections. If left untreated, tinea pedis can lead to more serious complications, such as cellulitis or osteomyelitis, which can be life-threatening in some cases.2–10

Tinea pedis diagnosed clinically and treated effectively and early resolves with no issues.2–10 Our case demonstrates a patient with tinea pedis who was treated early on and resulted in further harm of the skin due to the over-the-counter product causing a frostbite.

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These authors offer evidence and practice to avoid frostbite from products that treat tinea pedis.
Case report

A 67-year-old female with a past medical history of hypertension, diabetes, and sleep apnea presented with itching burning sensation along with scaling and erythema between the toes of bilateral feet along with scaly dry skin. Patient past surgical history was unremarkable. Her recent A1C was 6.6. She had no known drugs allergies, and was taking hydrochlorothiazide, losartan, and metformin as prescribed by her primary care physician. Patient denies any recent changes in activity. Patient stated she had no prior issues to bilateral feet.

On physical exam one can appreciate an unremarkable vascular, neurological, and musculoskeletal examination. Upon examination of the skin one does note erythema, scaly dry skin, with fissures noted plantar bilaterally along with maceration noted in all interdigital toe spaces bilaterally. At this time the patient had elected to proceed with over-the-counter topical medication to combat tinea pedis as she wanted to avoid any oral medications. The patient was informed on many OTC products and use of them. We instructed the patient to keep at least 6 inches away and not more than 3 seconds of spray. She planned to return in 6 weeks.

About three weeks patient called to be seen due to unexpected changes noted on the dorsal aspect of her skin that has not changed for about two and half weeks and is painful. The patient was seen immediately due to concern of a blister on the dorsal aspect of her left foot. Patient’s vitals were unremarkable, and she denied any fever, chills, shortness of breath and or chest pain. Patient did bring in the OTC product she has been using. Lotrimin powder spray, and patient had expressed she followed the directions written on the label. On physical examination one appreciates decrease in erythema and improvement of bilateral fissures and scaling along with improvement of maceration to all interdigital spaces bilaterally. One does not a blister on the dorsal aspect of the base of the third toe with erythema and fluid filled (Fig. 1). Upon closer examination it measured approximately 1 and a half cm in diameter overlying the proximal aspect of the phalanx of the third digit left foot. The discoloration is consistent with a burn/frostbite. We were able to evacuate the fluid under aseptic betadine technique with a number 27 gauge needle and resulted in clear serous fluid (Fig. 2). No further signs of clinical infection were noted. Upon further inspection of the Lotrimin powder spray label, no warning for burn and or frostbite is mentioned, but one chemical listed is isobutane which is notorious for causing frostbite (Figs. 3 and 4).

The patient was informed on her findings and stop use of any product containing isobutane. The patient was given a prescription for miconazole powder agent to continue to use powder product for her tinea pedis.
Patient called in a week and noted improvement and then returned at 6 months. Upon physical examination at the 6-month mark one can appreciate resolved tinea pedis with no maceration between interdigital spaces along with no scaly or fissures noted.

**Discussion**

OTC may offer a safer and more affordable alternative to conventional antifungal medications, particularly for individuals who are unable to tolerate or prefer to avoid oral-based treatments.\(^1\) Antifungals containing imidazoles like clotrimazole, econazole, ketoconazole, miconazole, isoconazole, tioconazole, and sulconazole are highly effective in treatment of tinea pedis and rarely cause any side effects. There is few literature discussed and or documented on frostbite/burns caused by OTC sprays.\(^{11-14}\)

A case report by Kurosaki et al described an 81-year-old man who developed a necrotic ulcer on his external genitalia after using an OTC antifungal aerosol for more than 3 seconds and consuming a full bottle in a day, hoping to cure faster. The patient was treated with wound cleaning and therapy with silver sulfadiazine cream, oral tranilast, and trafenirin spray, and underwent surgical debridement and skin grafting. Kurosaki et al highlighted the potential harm caused by the butane and propane propellants in the aerosol, which can cause cold burns due to their low boiling points.\(^{12}\) The report referenced experiments which showed that spraying aerosol for 6 s can reach -40 C, and the manufacturer’s instruction suggest that skin can drop by 20 C with just 1 second of spraying.\(^{12}\) It was noted that animal models have shown that cold burns occur when skin is cooled below 10 C. This related to our case since the ingredient of isobutane a similar chemical structure as butane since both are hydrocarbon gases and belonged to a family of compounds known as alkanes.
Another case report by Camp et al. described two teenage females who sprayed their skin with deodorant spray for 20–30 s from 1 cm to achieve an anesthetic effect. The spray contained butane and propane.13 The first patient developed a non-healing wound on her forearm and required a split skin graft after two weeks of treatment. The second patient’s wounds were treated conservatively.13 This case also related to our case due to the fact an OTC product contained butane a chemical known to reach -40 C.12 Their goal was to inform other providers on the risk of chemical sprays found in OTC product for the body. Our case a patient endured a frostbite burn from the chemical spray which could be avoided.

Conclusion

Tinea Pedis may be difficult to treat due to fungal spores. There are many OTC products that work different for each individual. Physicians should be aware of the OTC products, especially sprays with butane, isobutane and propane to prevent iatrogenic harm, which can lead to burns especially in high-risk diabetic patients. This case illustrated Tinea Pedis treated with an OTC spray which led to an iatrogenic burn. Immediate treatment and recognition of the burn was critical to ensure no further harm from OTC product. Patient education about the proper use of OTC medications and their ingredients can prevent an iatrogenic burn/frostbite.

Informed patient consent

Complete informed consent was obtained from the patient for the publication of this study and accompanying images.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References