Clinical case in community pharmacy: pitted keratolysis

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"The male customer, 30 years old, visited the pharmacy store complaining of a foul odor coming from his feet. Upon self-examination, he noticed small cracks under both of his feet"

What is pitted keratolysis?[1-3]

Pitted keratolysis, also known as malodorous feet with pits, is a skin condition caused by infection with gram-positive bacteria, including *Corynebacterium* spp., *Kytococcus sedentarius*, *Dermatophilus congolensis*, and *Streptomyces* spp. which are normal inhabitants of human skin. These bacteria proliferate in moist conditions, leading to the development of lesions on the skin. The increased growth of bacteria produces enzymes (proteases) that break down the upper layer of the skin (Stratum corneum), resulting in pits. These pits are often found in areas that bear weight, such as the soles and heels of the feet (Figure 1). Patients typically do not experience itching or pain, but they may have a characteristic foul odor emanating from their feet, caused by sulfur-containing compounds produced by the bacteria, such as thiols, sulfides, and thioesters.

The lesions typically appear as pits ranging in size 1-5 millimeters on the upper surface of the feet, soles, or toes. Some pits may have a yellow or brown coloration due to the accumulation of skin debris. This condition can have a significant impact on the patient's mental well-being, leading to a lack of self-confidence and limitations in interacting with others.

Figure 1 The lesions of pitted keratolysis[4]

What are factors that contribute to the development of pitted keratolysis?[5-7]

Factors that contribute to the development of pitted keratolysis include:

˚ Moist conditions or excessive sweating (hyperhidrosis), which promote the growth of bacteria on the skin.

˚ Wearing socks and shoes that do not allow adequate air circulation and wearing them for prolonged periods. This is often seen in individuals who wear closed or poorly ventilated footwear, such as boots, closed-toe shoes, or athletic shoes, and is commonly found in occupations such as military personnel, police officers, runners, athletes, fishermen, farmers, and industrial workers.

˚ Failure to maintain cleanliness of socks and shoes, or wearing the same pair of socks repeatedly for several days.

˚ Other factors such as stress, which can lead to increased sweating, deficiencies in certain nutrients like zinc, individuals with compromised immune systems or on immunosuppressive medication, patients with diabetes or obesity, and consumption of certain pungent-smelling foods.

How pitted keratolysis is diagnosed?[5-6]

Diagnosing pitted keratolysis can be done by community pharmacists through medical history taking and observing the characteristics of the lesions along with the location and odor of foot. In severe cases, uncertain diagnosis, or unresponsive treatment, referral to a specialized physician for further examination and appropriate treatment is recommended, especially in cases that excessive sweating is the underlying cause. Additional treatments such as botulinum toxin injections may be necessary.

From further medical history taking and observing the lesions, it was found that the lesions under the feet appeared as small pits on both sides (Figure 2) and have persisted for several months. There is no pain or itching. Various over-the-counter medications have been purchased, including athlete's foot medication, topical drugs for scabies, Zema® lotion, Zema® cream, oral antibiotics and oral antifungal agents, all of which have been used continuously without improvement. The patient works as a security officer at a bank and regularly wears socks and leather boots, experiencing constant sweating and foot odor, even when not working. This has led to a lack of self-confidence due to the strong foot odor, feeling ostracized by coworkers, and a reluctance to interact closely with others. Consequently, the patient experiences significant distress and sadness. There is no history of drug allergies or any chronic medical conditions. Thus, the patient seeks advice from a pharmacist to address these issues

Figure 2 The lesions of this case

What is the treatment of pitted keratolysis?

Although there isn't extensive information regarding the treatment of pitted keratolysis, and much of the data comes from case reports and small-scale studies without control groups, pitted keratolysis can be effectively treated using medication and certain practices.[1,5-15]

1. **Antibacterial treatment**

   Studies have shown that most patients respond well to topical antimicrobial treatment without the need for oral medication. It's recommended to apply topical antimicrobial

medication to the affected area 1-2 times daily for 2-4 weeks (frequency and duration of treatment depend on severity). Recommended topical antimicrobial medications include:

- clindamycin 1% solution/gel : Clinda® M solution, Clindalin® gel, Clindaman® lotion, Rosil® solution, etc
- erythromycin 2-4% solution/gel (currently not available in Thailand)[9]
- mupirocin 2% cream/ointment : Bactex® ointment, Bacidal® ointment, Bactokil® ointment, etc
- fusidic acid 2% cream/ointment : Germidic® cream, Fucidin® cream, Fucidin® ointment, etc
- benzoyl peroxide 2.5-5% cream/gel : Benzac AC® 2½ water base gel, Benzac AC® 5 water base gel, etc. This medication has antibacterial and keratolytic properties. A study conducted in Thailand, using a randomized controlled trial design, supported the use of benzoyl peroxide 2.5% gel for treating pitted keratolysis. The study was conducted among students of the Royal Thai Naval Academy in Chonburi province, diagnosed with pitted keratolysis, totaling 89 subjects with an average age of 20 years. They were divided into two groups: one receiving benzoyl peroxide 2.5% gel (42 subjects) and the other receiving benzoyl peroxide 5% gel (47 subjects). Both groups applied the medication to both feet once daily before bedtime for 2 weeks. The results indicated that the group receiving benzoyl peroxide 2.5% gel showed comparable efficacy in treatment (reducing foot pits and foot odor) to the group receiving benzoyl peroxide 5% gel, with no significant difference in side effects[10]. Therefore, benzoyl peroxide 2.5% gel can be considered as effective as benzoyl peroxide 5% gel for once-daily application

  Benzoyl peroxide can be combined with other topical antimicrobial agents, such as clindamycin 1% solution/gel, to enhance treatment effectiveness. From case reports in the United States and Croatia, it was found that when benzoyl peroxide 5% was used in combination with clindamycin 1%, applied twice daily, it was effective in treatment and no side effects were observed.[13,14] Administering both medications together may be more effective than using clindamycin alone because benzoyl peroxide has both antibacterial and keratolytic properties, aiding in the absorption of clindamycin into the skin and reducing the risk of clindamycin resistance[14]. However, a study in Korea found that using clindamycin alone was equally effective as using benzoyl peroxide alone and did not differ from using both medications together[16]. Therefore, the decision to use both medications in a pharmacy store should be considered based on appropriateness, such

as the severity and chronicity of the condition, treatment resistance, or the risk of drug resistance.

For patients who do not respond to topical treatment alone, oral antimicrobial medication may be prescribed for 7-10 days. Options include:

- clindamycin 150-300 mg four times daily
- erythromycin 250-500 mg four times daily
- tetracycline 250-500 mg four times daily
- doxycycline 100 mg twice daily
- roxithromycin 150 mg twice daily

2 **Prevention of moisture**

Using aluminum chloride 20% on the feet once or twice daily after cleaning with antiseptic soap can help reduce sweating, especially in individuals with hyperhidrosis. Products containing aluminum chloride available in Thailand, such as Salil® antiperspirant spray, Driclor® antiperspirant solution/roll on, Drysol® antiperspirant solution, etc[9]

3. **Foot hygiene**

Maintaining foot hygiene by washing with soap or antiseptic solution 1-2 times daily, avoiding prolonged use of damp socks and shoes, wearing well-fitting socks and shoes made of breathable materials like cotton, avoiding nylon socks, changing socks frequently, and washing socks at approximately 60 degrees Celsius to kill bacteria are recommended practices.

Adverse events of drug treatment for pitted keratolysis[1,6]

Adverse events from the use of medications to treat pitted keratolysis are minimal and not severe. Possible adverse reactions that may occur topically including irritation, itching, dryness, redness, and stinging of the skin. If severe adverse reactions occur, such as allergic rash, urticaria, or blistering, medication should be discontinued immediately, and medical attention should be sought. Similarly, antiperspirant products containing aluminum chloride may cause allergic reactions, itching, and irritation

Recommendations for medication use and self-care to treat and prevent recurrences of pitted keratolysis[1,6-7]

- Medication use: Pharmacists should advise continuous and regular use of topical antimicrobial medication for 2-4 weeks. Improvement of symptoms and the disappearance of foot odor should gradually occur within 4 weeks. If symptoms do not improve, patients should be advised to consult a physician for further diagnosis and to identify the underlying cause. In

cases where benzoyl peroxide is prescribed, in addition to instructions regarding medication use and potential side effects, patients should also be advised on the risk of bleaching clothes, bed linens, and blankets, which may occur due to contact with the medication.

- Self-care and foot health maintenance: Patients should be advised to clean their feet with soap and antiseptic solution 1-2 times daily. Avoiding the use of inappropriate or moisture-retaining socks and shoes for prolonged periods is essential. For individuals experiencing excessive sweating, products to reduce sweating can be used on the feet 1-2 times daily. Moreover, patients should avoid sharing socks and shoes with others.

Summary and case discussion

Pitted keratolysis can be effectively treated by administering topical antimicrobial medication and providing appropriate foot care advice. For this patient, treatment was provided with topical antimicrobial medication to eliminate the causative bacteria. Clindamycin 1% gel was applied together with benzoyl peroxide 5% gel to the affected foot areas twice daily for 2-4 weeks. Patient was advised to apply either medication first and then wait for 3-5 minutes before applying the other medication. Additionally, he was given advice on appropriate foot care to help prevent recurrence. Considering the rational drug use, it may not be necessary to use both types of medication together. However, due to the thickened skin and relatively deep pits caused by the chronic condition and the use of multiple medications, a keratolytic effect from benzoyl peroxide 5% gel was required. Moreover, combining the medication helped enhance the antimicrobial effect and reduce the risk of bacterial resistance from clindamycin 1% gel. After continuous use for 3 weeks, he showed improvement, with the disappearance of foot lesions and odor. He provided additional information that he had resigned from their job as a safety officer and started working as a fruit vendor because he did not want to wear uniforms, socks and shoes all day due to concerns about recurrence.

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