An Update of Pitted Keratolysis: A Review

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Abstract

Pitted keratolysis is a bacterial infection of the soles of the feet or less commonly, the palms of the hands. Pitted keratolysis is easily identified by its shallow, crater-like pits. Collection of specimen using swab may be helpful to identify causative bacteria and skin scraping is often taken to exclude fungal infection. The diagnosis is sometimes made by skin biopsy revealing characteristic histopathological feature of Pitted Keratolysis. Treatment generally consists of hygienic measures, sometimes supplemented by medication and perhaps on oral medication. This review is aimed to consolidate present information about aetiopathogenesis, diagnosis and management of Pitted Keratolysis. It is worth mentioning that Pitted Keratolysis is non-contagious. [Journal of Current and Advance Medical Research 2017;4(1):27-30]

Keywords:  Pitted keratolysis; bacterial infection; non-contagious

Introduction

Pitted keratolysis was first reported in Ceylonese patients in 1910, by Castellani under the term “Keratoma Plantare Sulcatum”, a disease limited to the soles and characterized by small pits which coalesced and formed sulci. In 1930, Acton and McGuire described eight cases of Keratoma Plantare Sulcatum from Bengal1. They stated that the pits were associated with an organism belonging to the actinomycetes group and named it Actinomyces Keratolytica spp. In 1931, Acton and McGuire suggested that Actinomyces Keratolytica was the causative agent. With the advent of electron microscopy and special staining method, histologic criteria for diagnosis of Pitted Keratolysis has been determined as a bacterial infection. Pitted keratolysis is caused by cutaneous infection with micrococcus sedentarius (now renamed as Kytococcus sedentarius)2. Dermatophilus Congolensis and Corynebacterium species3.

The organism Kytococcus sedentarius is a gram-positive staphylococcus-related bacterium; it can be grown on tryptase-soy agar. Dermatophilus conglolensis is an aerobic gram-positive bacillus, with branching and septate filaments. They form rough, b-hemolytic colonies on horse blood agar. Corynebacterium species are gram-positive,
catalase-positive, aerobic or facultatively anaerobic, generally non-motile rods\textsuperscript{4}.

Numerous studies have been carried out in recent years focusing mainly on structural abnormalities, pathogenesis, diagnostic criteria and clinical therapy of Pitted Keratolysis. However, information in some aspect is still lacking. This present review is emphasized to bridge this gap in knowledge and put forward all the available recommendation in concise manner to explore the way for a future plan of management of Pitted Keratolysis with accuracy.

**Pathogenesis**

Under appropriate condition like prolonged occlusion, hyperhidrosis, increase skin surface pH\textsuperscript{3}, these bacteria proliferate and produce proteinase then destroy the stratum corneum, causing pits. D. congolensis liberates keratinase in appropriate substrate. K. sedentarius has been found to produce two keratin-degrading enzymes\textsuperscript{4}. They are protease P1 (30kd) and P2 (50kd). The malodor associated with Pitted keratolysis is presumed to be production of sulfur-compound by products, such as thiols, sulfides and thiosteres\textsuperscript{7}. In 2006, foot odor without pitted skin changes was discovered to be from overgrowth of Bacillus subtilis and specifically an isovaleric acid produced by staphylococcus epidermidis overgrowth, a normal skin flora.

**Clinical Features**

The patients with pitted keratolysis may complain of hyperhidrosis\textsuperscript{8}, sliminess, mal odor and occasionally, soreness, itching and pain while walking. However, the pits normally are asymptomatic. Both sides are equally affected, conspicuous, discrete, shallow and circular pits join together at places to produce large erosion. Irritation is minimal. The lesions are composed of numerous small pits or craters present over the soles .They are coalesce in places to produce irregular erosion or sulci, ranging from 0.5 to 7.0mm in depth. A variant of madly enlarged lesions, called crateriform pitted keratolysis, which affects the entire width of plantar surface of the foot underlying the metatarsophalangeal joints\textsuperscript{9}.

In addition to pits, erythematous to violaceous macules and plaque-like lesions may be present .Sites of involvement are pressure bearing areas such as the ventral aspect of the toe, the ball of foot and the heel, but are also rarely seen on the non-pressure bearing areas of the plantar surface and palms of hands\textsuperscript{10}. Interdigital intertrigo and paronychia may coexist but does not influence the onset or course of the disease. Co-existence of Psoriasis has also been reported.

**Diagnosis**

Skin biopsy reveals characteristic histopathology\textsuperscript{11}. Two types pitted keratolysis can be distinguished histologically; in the superficial or minor type, there is only a small depression due to focal lysis and coccoid bacteria are distributed in groups in some and in chain in others. Whereas in the classical or major type, the organism exhibit dimorphism with septets “ Hyphae” as well as coccoid forms, which extent into the stratum corneum forming more definitive pits. Special stains with either a gram stain or Steiner stain will intensely stain the causative organism. Gram stain of Pitted keratolysis shows gram-positive coccals forms and filaments in the stratum corneum. Steiner stain may also highlight the organisms. Some times the organisms may be obvious on routine H-E sections. Culture studies may also be helpful in some cases to confirm the causative organism.

**Treatment**

Although no studies are published on hygiene, several protective measures for preventing Pitted keratolysis have been recommended over time.

Topical antibiotics are certainly easy to use and are well accepted by patients .Twice-daily applications of erythromycin or clindamycin are effective. The combination topical gel of clindamycin 1% - benzyl peroxide 5% has been found effective in 4 patients\textsuperscript{13} but efficacy required the concurrent use of aluminum chloride hexahydrate solution. Either solution or gel formulations may be used. Topical Mupirocin (Bactroban) also has been effective\textsuperscript{14}. For case resistant to topical antibiotics treatments and /or associated with hyper hidrosis, the use of botulinum toxin injections has been effective\textsuperscript{15}.

**Discussion**

Pitted keratolysis has a worldwide distribution, but is more common among bare footed people living in tropical regions. In a study of 142 homeless men in the Boston area (USA) 20.4% had Pitted keratolysis\textsuperscript{16}. Prevalence rates have ranged from 1.5% in Japan (evaluation of 4,325 industrial workers) to 2.25% in New Zealand (random evaluation of 490 subjects)\textsuperscript{17}. A much higher prevalence of 53% was recorded in volunteer
soldiers in a study conducted in South Vietnam where heat, humidity and boots combine to produce a microenvironment that predisposed to the disease.

Table 1: Recommendation of Pitted Keratosis

- By wearing boots for as short a period as possible
- Wear socks which effectively absorb sweat i.e. cotton and / or wool
- Wear open-toped sandals whenever possible
- Wash feet with soap or antiseptic cleanser twice daily
- Apply antiperspirant to the feet at least twice weekly.
- Don’t wear the same shoes two days in a row-dry them out.
- Do not share foot wear or towel with other
- In 2008, Blaise et al commended that affected patients should wash their socks at a temperature of 60°c to kill the Corynebacterium that may be transferred to the socks from skin scaling
- Antifungal and antibacterial dusting powders have also prevent to be effective weapon against the occurrence of this condition
- In some cases, reducing any associated hyperhidrosis with the application of a roll on antiperspirant 20% aluminum chloride solution, may be help full
- Terrasil (a uniquely effects natural formulate) skin repair protects damaged skin and quickly relieves itch and irritation

Currently, in a study conducted among athletes in Britain25 of 184 examined had Pitted keratolysis. Prevalence rates of Pitted keratolysis have range from 1.5% of 4325 Korean industrial worker to 2.25% (11 of 490 subjects randomly evaluated) in New Zealand19. In addition, 2.6% of 378 Turkish male adolescent and post adolescent boarding school students had pitted keratolysis and in a 2yrs study from Belgium, only 4.8 cases of Pitted keratolysis occurred per 1000 dermatology visits. In a study of 1012 patients from Nigeria50, only 19 (1.8%) had Pitted keratolysis.

However 66 (23.3%) 283 Korean coal miners and 341 (42.5%) paddy field workers in costal South India had Pitted keratolysis due to persistent exposure to moist environment21. No race predilection exists for Pitted keratolysis. It is commonly seen during summer and rainy season.

Pitted keratolysis affect any age but adult males with sweaty feet are most susceptible (97% of the cases). Pitted keratolysis is reported to be more common among bare footed laborers, farmers, marine workers, soldiers and industrial workers wearing occluded shoes for prolonged periods19.

Pitted Keratolysis is mainly caused by Coryneform bacteria, though some other bacteria have also been isolated from the lesion, such as Micrococcus sedentarius, Actinomyces keratolytica and Dermatophilus congolensis. Proteolytic enzyme produced by bacteria which digests the keratin, the tough protein that gives resilience to the skin superficial erosions, are seen on the sole and under the toes in Pitted keratolysis. Both sides are equally affected. Pitted Keratolysis is often associated with excessive sweating of palm and soles (palmplanter hyperhidrosis). Erythrasma and fungal infections of the feet have to be ruled out in cases of Pitted Keratolysis21.

Zaias et al22 observing the erosion of the horney layer of planter surfaces, assigned the condition its current name Pitted Keratolysis. International incidence rates of Pitted keratolysis vary significantly based on environment and occupations. Though any age group, but few cases have been reported in the elderly. Theoretically, both male and females should be affected; most written cases report or studies have involved male patients.

A study of physicians treating Dutch army personnel concluded that preventive measures, topical antibiotic therapy, and adequate treatment of hyperhidrosis are the mainstay methods in the management of patients with pitted keratolysis23. The treatment of Pitted keratolysis also lacks evidence based studies; however, historically, dermatologists find that topical antibiotics are effective, even if the recommendations presented above are not followed.

Conclusion

Pitted keratolysis does not typically impede activity, but it can be unpleasant and embarrassing for patients. Informing them about how to keep their feet dry and how to select breathable foot wear is the initial treatment strategy. Instruct Patients with pitted keratolysis should be advised to visit further in case of unsuccessful therapy. Otherwise, care for pitted keratolysis proceeds on an as-needed basis. Dermatologists can diagnose the condition
with relevant laboratory support and make a treatment plan effective for the individual.

References