

Clinical and epidemiological features of coryneform skin infections at a tertiary hospital

Malcolm Pinto, Ganesh Kamath Hundi¹, Ramesh Marne Bhat¹, Nanda Kishore Bala¹, Sukumar Dandekeri¹, Jacintha Martis¹, Srinath M. Kambil¹

Department of Dermatology, Yenepoya Medical College, Deralakatte, ¹Department of Dermatology, Father Muller Medical College, Mangalore, Karnataka, India

ABSTRACT

Background: Skin infections caused by coryneform bacteria are common dermatological conditions. However, to the best of our knowledge, no studies are available on the clinical characteristics and epidemiological features of this group of disorders as one entity from India and abroad. **Aims:** To study the clinical and epidemiological features of coryneform skin infections **Methods:** A total of 75 patients presenting with clinically distinctive lesions of pitted keratolysis, erythrasma and trichobacteriosis to our hospital were included in the study. Cases were interviewed with particular emphasis on epidemiological features and the various clinical findings were recorded. Investigations like Gram's stain, Wood's light examination, 10% KOH scrapings, were done in selected cases to ascertain the diagnosis. **Results:** Pitted keratolysis was more common in the age group of 31-40 years (40%) with a male preponderance (76.7%), most commonly affecting pressure bearing areas of the soles with malodour (86.7%) and frequent contact with water (58.3%) constituting the most important presenting symptom and provoking factor respectively. Erythrasma affected both male and female patients equally and was more commonly detected in patients with a BMI > 23kg/m² (62.5%) and in diabetics (50%). All patients with trichobacteriosis presented with yellow coloured concretions in the axillae. Bromhidrosis (71.4%) and failure to regularly use an axillary deodorant (71.4%) were the most common presenting symptom and predisposing factor respectively. **Conclusion:** Coryneform skin infections are common dermatological conditions, though epidemiological data are fragmentary. Hyperhidrosis is a common predisposing factor to all three coryneform skin infections. Asymmetrical distribution of pits has been reported in our study. Diabetic status needs to be evaluated in all patients with erythrasma. Woods lamp examination forms an indispensable tool to diagnose erythrasma and trichobacteriosis.

Key words: Erythrasma, hyperhidrosis, pitted keratolysis, trichobacteriosis, woods lamp

INTRODUCTION

The normal human skin is colonized by huge numbers of bacteria that live harmlessly as commensals on its surface and within its follicles. At times, overgrowth of some of these resident organisms may cause minor disease of the skin or its appendages.^[1] Coryneform bacteria are aerobically growing, asporogenous, partially acid fast, gram-positive rods of irregular morphology and account for nearly 50% of the natural skin microflora.^[2,3]

A warm and moist environment under occlusion facilitates increased colonization of these bacteria.^[4] The diseases caused by coryneform bacteria include pitted keratolysis,

erythrasma, and trichobacteriosis (formerly called trichomycosis).

Pitted keratolysis is a superficial infection of the skin clinically characterized by conspicuous, discrete, shallow, punched out pits associated with malodor, and involving pressure-bearing

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

Cite this article as: Pinto M, Hundi GK, Bhat RM, Bala NK, Dandekeri S, Martis J, *et al.* Clinical and epidemiological features of coryneform skin infections at a tertiary hospital. Indian Dermatol Online J 2016;7:168-73.

Access this article online

Website: www.idoj.in

DOI: 10.4103/2229-5178.182351

Quick Response Code:



Address for

correspondence:

Dr. Ganesh Kamath Hundi,
Department of Dermatology, Father Muller Medical College, Mangalore - 575 002, Karnataka, India.
E-mail: drgkamat@gmail.com

areas of the soles and rarely palms.^[5] The cause is usually attributed to a member of *Corynebacterium* species, *Micrococcus sedentarius*, and *Dermatophilus congolensis*. All share a common feature, which enables them to open small tunnels in the stratum corneum. Erythrasma is a superficial, localized, chronic infection attributed to *Corynebacterium minutissimum* affecting major body folds and interdigital regions of the feet characterized by erythematous, brown, scaly patches and maceration, exhibiting coral red fluorescence under Woods light.^[6] Trichobacteriosis is an asymptomatic, superficial infection of the axillary and pubic hairs with the formation of adherent and granular nodules—yellow, black, or red on the hair shaft with disturbances in apo-ecrine sweat production and bacterial proliferation crucial for its development.^[7] From the earliest reported cases of trichomycosis, the causative agent was classified as *Corynebacterium tenuis*. In light of the new taxonomic position of the genus *Corynebacterium*, the causative agent belongs to the so-called group 2 (LD2) (also referred to as the CDC-G/LD group), that corresponds to the *Corynebacterium flavescens* species, and that it is related to the flava variant producing yellow concretions along the hair shaft.

This group of infections does not present with diagnostic difficulties because of its distinctive clinical appearance and odor. However, despite cultural differences among populations, excessive sweating and body malodor are perceived as unpleasant by the vast majority of social groups. It may undergo spontaneous remissions and exacerbations and may last for many years if not treated. Shelley *et al.* reported the coexistence of all the three diseases in the same patient.^[8]

Knowledge of the predisposing factors that promote bacterial growth is essential as their removal ensures effective and long-term treatment. There is paucity of medical literature on clinicoepidemiological aspects of coryneform skin infections such as age and gender predilection, various symptoms of presentation, triggering factors, associations with other dermatological conditions, occupational predisposition, and morphological variants of pitted keratolysis from Coastal Karnataka; hence it was proposed to undertake the present study.

MATERIALS AND METHODS

The patients were selected from the outpatient and inpatient departments of Dermatology of Father Muller Medical College over a period of one year (August 2011–July 2012). All cases of pitted keratolysis, erythrasma, and trichobacteriosis clinically fulfilling the inclusion criteria were included in the study. Patients were interviewed with particular emphasis on triggering factors and findings recorded in the proforma made for the study. The various triggering factors and associations that were enquired about included: Hyperhidrosis, prolonged occlusion with shoes,

barefooted walking, friction, maceration, frequent contact with water (for pitted keratolysis) hyperhidrosis, high body mass index, diabetes (for erythrasma) hyperhidrosis, poor axillary hygiene, and failure to use an axillary deodorant (for trichobacteriosis). Investigations such as Gram's stain, 10% KOH Mount was carried out in selected cases to ascertain the clinical diagnosis.

Inclusion criteria

Diagnosis was based on characteristic clinical features: Crateriform pits (pitted keratolysis), hyperpigmented symmetrically distributed plaques in the flexures or scaly, macerated plaques in the toe webspaces (erythrasma), and concretions along the hair shaft (trichobacteriosis). Grams stain and 10% KOH mount was carried out in cases of interdigital erythrasma and to differentiate it from pigmented variant of Pityriasis versicolor in the axillary region. Patients with fluorescence on woods lamp examination in cases of erythrasma and trichobacteriosis were included.

Exclusion criteria

Conditions producing similar lesions such as tinea pedis, plantar warts, pediculosis, and piedra were excluded by clinical presentation and relevant investigations. Woods lamp examination was used to distinguish interdigital erythrasma from other causes such as eczema and candidiasis in the presence of maceration and scaling.

RESULTS

A total number of 75 cases of coryneform skin infections were included in the study, which comprised of 60 cases (80%) of pitted keratolysis, eight cases (10.7%) of erythrasma, and seven cases (9.3%) of trichobacteriosis.

Pitted keratolysis

The youngest and the oldest patients were 15 years and 64 years old, respectively. The most commonly affected age group was between 21 and 30 years (40%). The age group between 51 and 60 years (3.3%) was least commonly affected. The mean age of patients affected was 29.9 years. Out of the 60 cases, 46 (76.7%) were male patients and 14 (23.3%) were female patients, showing a male preponderance. The duration of pitted keratolysis ranged from 1 month to 5 years with the average being 12.25 months in our study. The involvement of soles was seen in 58 (96.7%) patients. The remaining two patients (3.3%) showed involvement of both palms and soles. Pitted keratolysis was observed to occur most frequently in manual laborers (26.6%). The other occupations affected included students (21.7%), housewives (11.7%), farmers (11.7%), industrial workers (8.3%), fishing workers (8.3%), businessmen (6.7%), and drivers (5%). Out of the 60 patients, 35 patients (58.3%) had frequent contact with water during work, 33 patients (55%) walked bare foot, and

29 patients (48.3%) wore occlusive foot wear. Pressure-bearing areas were more commonly involved, with the involvement of the ball of the feet in 52 patients (86.7%), ventral aspect of the toes in 50 patients (83.3%) and heel in 16 patients (26.7%) with distinct characteristics [Tables 1 and 2] [Figure 1]. Involvement of frictional areas was observed in five patients (8.3%). The distribution of pits was asymmetrical in nine patients (15%). Candidial intertrigo was seen among seven patients (11.7%).

Erythrasma

The youngest patient was 38 years and the eldest was 55 years old. The most commonly affected age group was between 41 and 50 years (62.5%). The mean age of patients affected was 46.9 years. The average duration of erythrasma

was 7 months, with shortest and the longest duration of disease being 3 months and 1 year, respectively. The male to female ratio in this study was 1:1. Axillary involvement was seen in six patients (75%). Left 4th toe webspace was involved in two patients (25%). Erythrasma was seen more frequently among businessmen (50%) and housewives (37.5%). Out of the two patients who had interdigital erythrasma, 1 male patient wore occlusive footwear and the other female patient had history of frequent contact with water. Four patients were diabetics.

Out of the eight patients with erythrasma, four (50%) were overweight, three (37.5%) had normal body mass index (BMI) and one (12.5%) was obese. Woods lamp examination was used to diagnose all cases [Figure 2].

Area of involvement	No. of cases	% of cases
Pressure bearing area		
Ball of the feet	52	86.7
Ventral aspect of the toes	50	83.3
Heel	16	26.7
Non pressure bearing area		
Web	5	8.3
Instep	3	5
Arch	2	3.3
Frictional area		
Toe interface	5	8.3

Pit characteristics	No. of patients	% of patients
Number of pits		
1-50	36	60
50-100	16	26.7
>100	8	13.3
Size of pits (mm)		
<0.5	12	20
0.5-1	32	53.3
>1	16	26.7
Depth of pits (mm)		
<1	10	16.7
1-2	33	55
>2	17	28.3
Margin of pits		
Ill defined	50	83.3
Well defined	10	16.7
Shape of pits		
Irregular	39	65
Circular	21	35
Configuration of pits		
Discrete	47	78.3
Coalesced	13	21.7

Trichobacteriosis

The youngest patient was 25 years and the eldest was 43 years old. The most commonly affected age group was between 31 and 40 years (57.1%). The mean age of patients affected was 35.6 years. Out of the seven cases, six (85.7%) were male and one (14.3%) was female. The male to female ratio in this study was 6:1, showing a male preponderance. The average duration of trichobacteriosis was 11 months. It was more common among farmers (42.9%) and manual laborers (42.9%). Out of the seven patients, five patients (71.4%) reported failure to regularly use axillary deodorant. In this study, all seven



Figure 1: Pitted keratolysis: Symmetrical distribution of coalescent pits sparing the instep of the feet

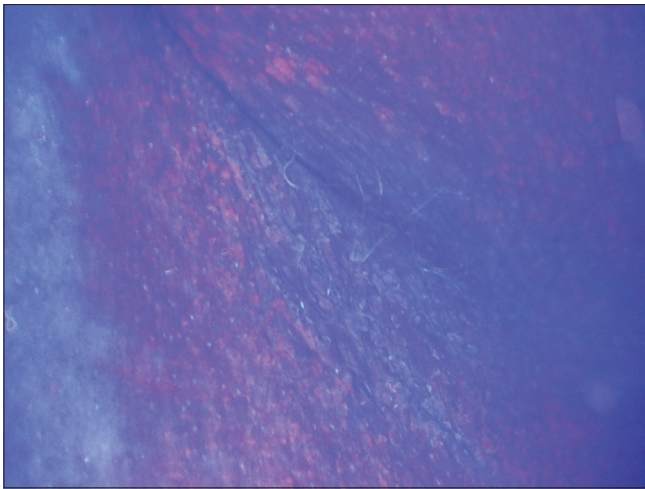


Figure 2: Erythrasma: Woods lamp examination revealing coral red fluorescence in the axilla

patients (100%) presented with yellow concretions on the axillary hair shaft and had yellow fluorescence on Woods light examination [Figure 3].

DISCUSSION

Coryneform skin infections constitute a group of skin infections, which are associated with alterations in the skin microflora under appropriate conditions.

Pitted keratolysis

In our study, majority of the patients with pitted keratolysis were seen in the age group of 21–30 years (40%), followed by 10–20 years (25%) and 31–40 years (15%), respectively. Thus 80% of the cases were in the overall age group of 10–40 years, which corroborates with the findings of Narayani *et al.* where 95.7% of patients and Naik *et al.* where 80% of patients were in the age group of 11–40 years.^[9,10]

Blaise *et al.* reported a higher incidence of pitted keratolysis among male patients (88.7%) similar to our study.^[11] In our study, pitted keratolysis was observed to occur most frequently in manual laborers (26.6%) than among other occupations. The high incidence of pitted keratolysis among students (21%) who wear occlusive foot wear and indulge in sports is explained by the fact that sweating in addition to hyperhydration contribute to the formation of calluses, which provide abundant keratin for corynebacterial growth.^[12] Takama *et al.* reported involvement of pressure-bearing areas in 92.5% and non-pressure-bearing areas in 13.2% of cases in their study. In comparison to our study, a higher involvement of frictional areas (32.1%) has been reported by them.^[13]

The distribution of pits was bilateral in all patients, but asymmetrical in nine patients (15%) in our study. Bilateral involvement was noted in 92.4% of the cases in a previous



Figure 3: Trichobacteriosis: Yellow concretions along the axillary hair

study by Blaise *et al.*^[11] Asymmetrical distribution of pits has not been studied previously.

Malodor was the commonest symptom reported by 86.7% of cases in the present study. Takama *et al.*^[13] and Blaise *et al.*^[11] have reported the incidence of malodor to be 88.7% and 60%, respectively, in their studies. A significantly lower incidence of malodor (36%) has been reported in a previous study by Naik *et al.*^[10]

Hyperhidrosis was the second commonest presenting symptom reported by 65% of cases in the present study. In previous studies, hyperhidrosis was evident in 96.2% of cases by Takama *et al.*^[13] and 70% of cases by Naik *et al.*^[10]

Erythrasma

In our study, the most commonly affected age group was between 41 and 50 years (62.5%). Morales-Trujillo *et al.*, in their study on interdigital erythrasma found that the age of the patients affected ranged from 13 to 78 years with a mean age of 43.5 years. They reported a female preponderance (83.3%) in their study.^[14] Inci *et al.* in their study, found an increased prevalence of interdigital erythrasma among men.^[15] In our study, the most common site of erythrasma was the axillary

region (75%). One female patient presented with involvement of bilateral axillae, inframammary, cubital, and inguinal regions. Left 4th toe webspace interdigital space was involved in two patients (25%).

In a study on interdigital erythrasma, Morales-Trujillo *et al.* have reported 91% of patients with fourth interdigital space involvement.^[14]

Inci *et al.* have reported involvement of the fourth interdigital space in 63.2% of the cases with interdigital erythrasma. A significant difference was found in favor of erythrasma in the fourth interdigital space in their study ($P < 0.001$).^[15]

Our data pertaining to the association of diabetes and overweight status of a patient in relation to erythrasma were statistically insignificant due to the small sample size ($P > 0.05$).

No statistically significant association between erythrasma and diabetes or obesity was observed in their series by Morales-Trujillo *et al.*^[14]

Trichobacteriosis

The greater frequency of occurrence of trichobacteriosis among males, in spite of there being no differences in the rates of infection with respect to gender, can be explained by the fact that women generally tend to shave their axillary hair.^[16] It was most commonly seen among farmers (42.9%) and manual laborers (42.9%) in our study. In our study, all seven patients (100%) presented with axillary hair shaft involvement. Hair shafts of any other region were not involved. In addition to axillae, involvement of pubic and intergluteal hair in two cases and involvement of eyebrows in one case has been documented by Bonifaz *et al.*^[16] Involvement of eyebrows has been explained by dissemination from axillary region by means of auto-inoculation. In this study, all seven patients (100%) presented with yellow concretions on the axillary hair shaft. The rubra and nigra variants of trichobacteriosis were not observed in our study.

In a study done by Bonifaz *et al.*, *flava* was the principal variant of trichobacteriosis in 98.2% cases followed by the *rubra* variant which was seen in 1.8% cases.^[16]

CORYNEBACTERIAL TRIAD

The coexistence of these three corynebacterial diseases has been documented in the literature. In our study, none of the patients had the simultaneous presence of the other coryneform skin infections. Pitted keratolysis associated with erythrasma and trichobacteriosis, referred to as corynebacterial triad, was observed in one case each by Blaise *et al.*^[11] and

Naik *et al.*^[10] and in two cases by Bonifaz *et al.*^[16] The only common base for the triad remains the fact that coryneform bacteria are implicated in their causation. The uniqueness of the causative organisms of this triad being: The pathogen in erythrasma grows abundantly in the stratum corneum, in trichobacteriosis remarkably adheres to the hair, and in pitted keratolysis liberates proteolytic enzymes which digest keratin. Among the components of the triad, erythrasma was the only condition of concern to the patient and the other two were discovered by inspection in a previous study by Shelley and Shelley.^[8]

CONCLUSION

Our clinicoepidemiological study of coryneform skin infections in a tertiary hospital in Coastal Karnataka found pitted keratolysis to be the most common coryneform skin infection. Pitted keratolysis was commonest in the age group of 31–40 years with a male preponderance, most commonly affecting pressure-bearing areas of the soles of the feet. Erythrasma affected both male and female patients equally and was more commonly detected in patients with a BMI > 23 kg/m² and in diabetics. Involvement of the axillary region was the most common presenting feature. We observed yellow concretions in the axilla of all patients with trichobacteriosis with bromhidrosis being the most common presenting symptom. No patients showed the simultaneous presence of all three coryneform skin infections. The relative small sample size, lack of microbiological correlation in the form of methods such as culture and treatment correlation are the major limitations of this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Hay RJ, Adriaans BM. Bacterial infections. Burns T, Breathnach S, Cox N, Griffiths C, editors. Rook's Textbook of Dermatology. 8th ed. Oxford: Wiley-Blackwell; 2010. p. 30.37-30.40.
- Kaźmierczak AK, Szarapińska-Kwaszewska JK, Szewczyk EM. Opportunistic coryneform organisms-residents of human skin. Pol J Microbiol 2005;54:27-35.
- Lee PL, Lemos B, O'Brien SH, English JC 3rd, Zirwas MJ. Cutaneous diphtheroid infection and review of other cutaneous Gram-positive Bacillus infections. Cutis 2007;79:371-7.
- Hartmann AA. The influence of various factors on the human resident skin flora. Semin Dermatol 1990;9:305-8.
- Zaias N. Pitted and ringed keratolysis. A review and update. J Am Acad Dermatol 1982;7:787-91.
- Golledge CL, Phillips G. *Corynebacterium minutissimum* infection. J Infect 1991;23:73-6.

7. Freeman RG, McBride ME, Knox JM. Pathogenesis of trichomycosis axillaris. *Arch Dermatol* 1969;100:90-5.
8. Shelley WB, Shelley ED. Coexistent erythrasma, trichomycosis axillaris, and pitted keratolysis: An overlooked corynebacterial triad. *J Am Acad Dermatol* 1982;7:752-7.
9. Narayani K, Gopinathan T, Ipe PT. Pitted keratolysis. *Indian J Dermatol Venereol Leprol* 1981;47:151-4.
10. Naik CL, Singh G. Clinico epidemiological study of pitted keratolysis. *Indian J Dermatol* 2007;52:35-8.
11. Blaise G, Nikkels AF, Hermanns-Lê T, Nikkels-Tassoudji N, Piérard GE. Corynebacterium-associated skin infections. *Int J Dermatol* 2008;47:884-90.
12. Ramsey ML. Pitted keratolysis: A common infection of active feet. *Phys Sportsmed* 1996;24:51-6.
13. Takama H, Tamada Y, Yano K, Nitta Y, Ikeya T. Pitted keratolysis: Clinical manifestations in 53 cases. *Br J Dermatol* 1997;137:282-5.
14. Morales-Trujillo ML, Arenas R, Arroyo S. Interdigital erythrasma: Clinical, epidemiologic, and microbiologic findings. *Actas Dermosifiliogr* 2008;99:469-73.
15. Inci M, Serarslan G, Ozer B, Inan MU, Evirgen O, Erkaslan Alagoz G, *et al.* The prevalence of interdigital erythrasma in southern region of Turkey. *J Eur Acad Dermatol Venereol* 2012;26:1372-6.
16. Bonifaz A, Vázquez-González D, Fierro L, Araiza J, Ponce RM. Trichomycosis (trichobacteriosis): Clinical and microbiological experience with 56 cases. *Int J Trichology* 2013;5:12-6.