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Original Research Article

To identify the role of occlusive clothing (undergarments) in the maintenance of fungal infection in treatment resistant, recurrent and persistent tinea cruris: A pilot study at tertiary care hospital

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ABSTRACT

Background: Chronic and recurrent dermatophytoses are very common in tropical countries like India. Among many patho-mechanisms implicated, the role of changing lifestyle and clothing patterns is highly suggestive. Our study was done to identify whether the dermatophytes could be cultured from undergarments of the patients and also to find out the persistence of fungi after conventional washing techniques.

Materials and Methods: It was a cross-sectional study carried on patients attending out-patient department of Department of skin and VD of Jhalawar Medical College with samples size of 50. KOH examination of recurrent and chronic tinea cruris patients was done followed by culture of skin scraping from advancing margin of tinea, samples of unwashed and washed undergarment pieces, followed by species identification by using lactophenol cotton blue stain.

Results: Males outnumbered females (28 M:22F). Maximum cases belonged to age group of 21 -30 years (27/50); most of the patients opted for tight synthetic undergarments (26/50). Samples of 44 patients were KOH positive. Fungal elements were cultured from 28/50 samples from skin scraping, 22/50 from unwashed undergarments, 15/30 from washed undergarments. Most common species identified was Trichophyton mentagrophytes.

Discussion: Recurrent and chronic tinea infections are becoming causes of increasing financial burden and impaired quality of life of affected patients. Although culture is not a very sensitive method to confirm dermatophytic infections, yet fungal elements can sustain in undergarments of patients affected by chronic and recurrent tinea cruris which may lead to non-response to standard dose and schedule of antifungal agents.

Conclusion: Dermatophytes may sustain in undergarments, even after washing; causing recurrent and chronic tinea cruris.

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1. Introduction

The prevalence of superficial dermatophyte infections is rising on a dramatic rate globally accounting for 20-25% of cases seen in dermatology units and poses a major therapeutic challenge in today's scenario.^{1,2} Worldwide, the prevalence of chronic and recurrent tinea infections is

also increasing. The prevalence of these infections are very common in tropical countries like India.^{3,4} Cases involving more than one anatomical sites, mixed clinical subtypes, clinically extensive lesions with erythroderma like picture are also being seen now a days.

Despite the development of many newer systemic and topical antifungal agents in last two decades, the change in epidemiology and inadequate treatment response is of

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great concern in clinical practice. Although there are various mechanisms implicated, the role of changing lifestyle and clothing patterns is highly suggestive. The increasing use of tightly fitting synthetic undergarments and sharing of clothes among family members may be regarded as a reason for chronic or recurrent exposure to fungus explaining treatment failure. The retention of moisture in occlusive environment for prolonged periods is an added drawback of tight undergarments.

Our study was done to identify whether the dermatophytes could be cultured from undergarments of the patients. Also, the persistence of organisms after washing the undergarments by conventional washing techniques was studied.

2. Materials and Methods

It was a cross-sectional study carried on the patients attending out-patient department of Department of skin and VD of Jhalawar Medical College. Approval of institutional ethical committee was duly obtained before starting the study. The study was carried out over a 4-month period from September 2019 to December 2019. The sample size of 50 was calculated statistically. Patients of any sex of >15 years of age with recurrent or persistent tinea cruris and willing to participate in study were included in study where as new cases, cases responding adequately to treatment such as lesions showing complete clinical remission, or those with co-morbidities such as diabetes mellitus, tuberculosis, HIV, solid organ transplant, patients on long term systemic or topical corticosteroids or other immune-suppressive, or other causes of congenital or acquired immunosuppression were excluded.

For the purpose of study recurrent tinea cruris was disease with at-least one documented evidence of tinea cruris with complete clinical resolution at least 3 months back and persistent tinea cruris was a case with no or incomplete clinical resolution after atleast 4 weeks of systemic antifungal treatment (with or without topical therapy) in appropriate doses.

2.1. Equipments and Materials

1. Number 10 surgical blade
2. Gloves
3. 70% alcohol
4. Sterile petri dish
5. Commonly marketed detergents for washing clothes
6. Sabouraud's Dextrose Agar with chloramphenicol and cycloheximide
7. Lactophenol cotton blue
8. 10% KOH

2.2. Methodology

50 consecutive patients of tinea cruris and fulfilling the inclusion criteria were included in the study. Detailed history and clinical examination were performed. The purpose and method of study were explained to the patient in his/ her own language after taking written informed consent. Systemic/topical antifungal treatments were discontinued for a period of 2 weeks after which sample was collected.

First, the affected area was cleaned with 70% alcohol to avoid bacterial contamination and skin scraping from the lesion was gently performed using a surgical blade number 10 and sample was collected in sterile petri dish. At the same time, the currently worn undergarment was taken from the patient (a replacement was provided) and two 2*2 cm sized portion of the clothe piece was cut (the site of cloth piece was from joint between crural and genital area). Samples from skin scraping and one piece of undergarment (unwashed) were immediately sent to microbiology laboratory and processed within 2 hours. A part of skin scraping was used for direct microscopic examination for fungal elements after putting a drop of 10% KOH on it and remaining part was sent for culture. The remaining cloth piece was soaked for 10 minutes in commonly marketed detergent followed by washing and drying. The dried clothe was sent to microbiology laboratory for culture on next day. The clothe pieces were cut into 3 pieces of circular shape of size 5 mm and imprinted directly on culture medium. SDA with chloramphenicol and cycloheximide were used as culture medium and incubated at 30 degree Celsius for a maximum of 14 days and lacto-phenol cotton blue staining was performed for species identification.

Routine investigations including complete blood count, fasting blood sugar, liver function test, renal function test, urine complete, VDRL, HIV were done for each of the patient.

Culture findings were divided into following groups:

1. Culture status from skin scapings.
2. Culture status from unwashed undergarments.
3. Culture status from washed undergarments.

3. Results

Our study included 50 patients of chronic and recurrent tinea cruris, with 28(56%) males and 22 (44%) females. Age group was between 19-60 years of age with mean of 31.02 ± 8.36 years. Maximum patients belonged to the age group 21-30 years accounting for 27(54%) cases. Among them, 18(36%) patients had chronic disease; while 32(64%) patients had recurrent disease (Table 1). Socio-demographic distribution of cases is represented in Figure 1 and 2.

Majority of patients in our study (26/50, 56%) preferred to wear tight fitting synthetic undergarments [Table 2].

44/50(88%) cases were KOH positive on skin scraping from crural area, among which 25 were males and 19 females[Table 3]. Among 6 cases who were KOH negative, 1 sample from skin scrapings, unwashed and washed undergarment samples were positive for culture of dermatophyte *Trichophyton rubrum*, while 1 skin scraping sample was positive for *Trichophyton rubrum*, but negative in culture of undergarment pieces, rest 4 skin samples were negative. In 4 cases who were KOH and skin scraping negative, culture of 1 sample of unwashed and washed undergarment showed presence of *Candida albicans*, culture of 1 unwashed and washed samples were positive for *Trichophyton mentagrophytes*, culture of 1 unwashed and washed samples of undergarments were positive for *Trichophyton rubrum*, culture of 1 specimen from unwashed undergarment was positive for *Trichophyton mentagrophytes*, but negative in washed undergarment sample.

On culture from skin scraping 28/50(56%) specimen turned out to be culture positive for dermatophytes and candida species, with 17 males and 11 females [Table 3]. Most common species was *Trichophyton mentagrophytes*. Among patients with skin scraping negative on culture 8 cases were positive for KOH mount, while negative culture status of samples from inoculation of pieces from unwashed and washed undergarments; 5 cases showed positive KOH mount and growth of *Trichophyton mentagrophytes* from samples of both unwashed and washed undergarments, 3 cases showed positive KOH mount, presence of *T. mentagrophytes* on culture of unwashed undergarment, but negative culture status of washed undergarments; 1 case showed positive KOH mount and presence of *Trichophyton rubrum* on culture of both washed and unwashed undergarments [Table 4].

On culture from unwashed undergarments, 22/50 (44%) samples were positive for culture for dermatophytes and candida species, with 12 males and 10 females [Table 5]. Most common species identified was *Trichophyton mentagrophytes*.

On culture from washed undergarments, 15/50 (30%) specimen turned out to positive for dermatophytes and candida species, with 9 males and 6 females [Table 6]. Most common species was *Trichophyton mentagrophytes*. The species identified on culture are given in Table 6.[Figures 3, 4, 5, 6, 7 and 8]

Table 1: Clinical subtypes of tinea cruris

Type of disease	M	F
Chronic	7	11
Recurrent	21	11

Table 2: Types of undergarments worn regularly by cases

Type of under garment	M	F	Total
tight synthetic	15	13	28
tight cotton	10	7	17
loose synthetic	1	2	3
loose cotton	2	0	2
Total	28	22	50

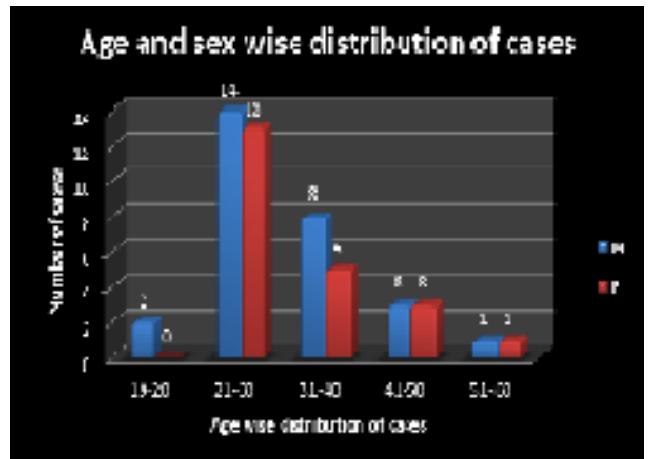


Fig. 1: Age and sex distribution of cases

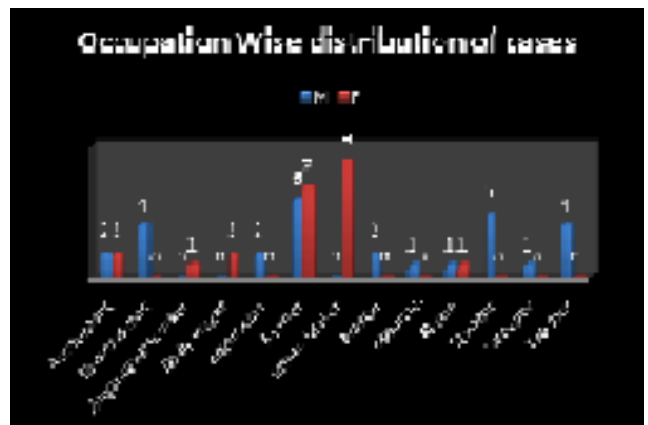


Fig. 2: Occupation wise distribution of cases

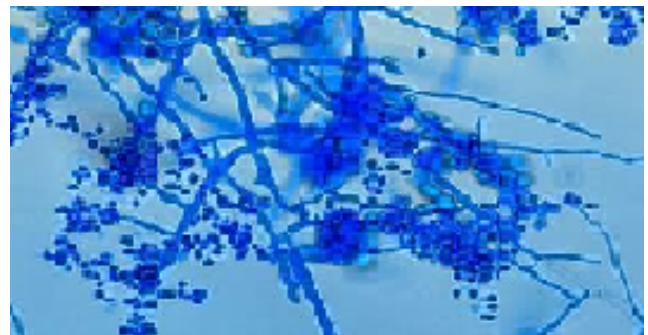


Fig. 3: *Trichophyton mentagrophytes* microscopy -thin septate hyphae with abundant grape like clustures of conidia on conidiophores

Table 3: KOH and culture status of samples

			Number of samples	Percentage
KOH status	Negative	Female	3	50.0%
		Male	3	50.0%
		Total	6	100.0%
	Positive	Female	19	43.2%
		Male	25	56.8%
		Total	44	100.0%
Culture status from skin scraping	Negative	Female	11	50.0%
		Male	11	50.0%
		Total	22	100.0%
	Positive	Female	11	39.3%
		Male	17	60.7%
		Total	28	100.0%
Culture status from unwashed undergarment	Negative	Female	12	42.9%
		Male	16	57.1%
		Total	28	100.0%
	Positive	Female	10	45.5%
		Male	12	54.5%
		Total	22	100.0%
Culture status from washed undergarment	Negative	Female	16	45.7%
		Male	19	54.3%
		Total	35	100.0%
	Positive	Female	6	40.0%
		Male	9	60.0%
		Total	15	100.0%

Table 4: Species identified on culture of skin scraping from crural region of cases

Species identified in skin scraping	M	F	Total
Candida albicans	1	1	2
Epidermophyton floccosum	3	0	3
Microsporum canis	1	1	2
Microsporum gypseum	0	1	1
Trichophyton mentagrophytes	9	5	14
Trichophyton rubrum	3	3	6
Total	17	11	28

Table 5: Species identified on culture of unwashed undergarment

Species identified in unwashed undergarment	M	F	Total
Candida albicans	2	1	3
Epidermophyton floccosum	1	0	1
Trichophyton mentagrophytes	8	6	14
Trichophyton rubrum	1	3	4
Total	12	10	22

Table 6: Species identified on culture of washed undergarment

Species identified in washed undergarment	M	F	Total
Candida albicans	2	1	3
Trichophyton mentagrophytes	7	2	9
Trichophyton rubrum	0	3	3
Total	9	6	15

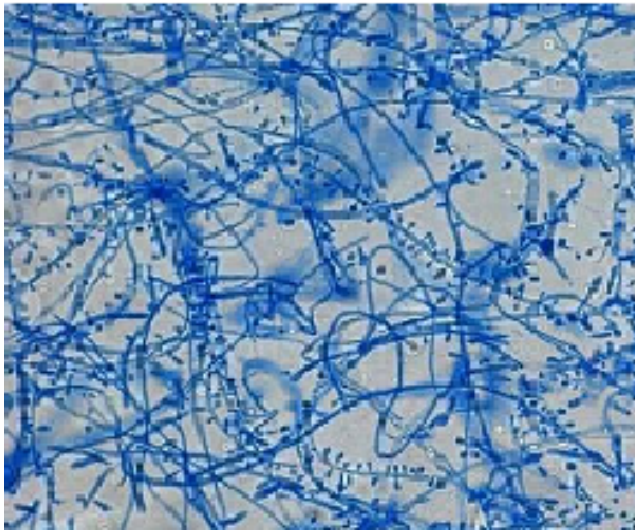


Fig. 4: *Trichophyton rubrum* microscopy-hyaline septate hyphae with clavate microconidia



Fig. 6: *Trichophyton mentagrophytes* colony-reverse side-white powdery colonies



Fig. 5: *Trichophyton mentagrophyte* front side colony-white powdery colony

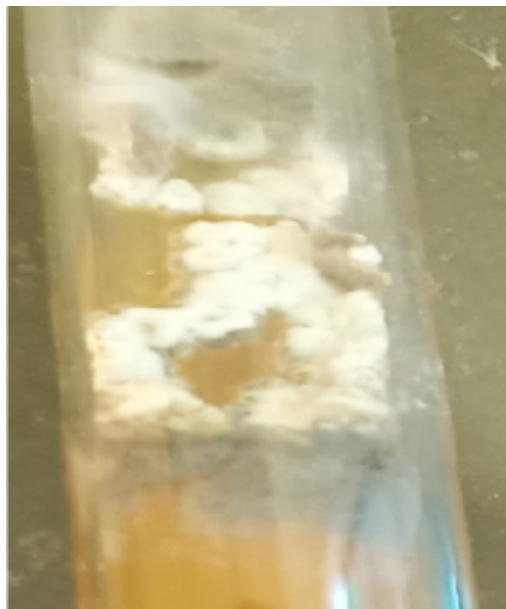


Fig. 7: *Trichophyton rubrum* colony-front side-white dry rough colonies



Fig. 8: Trichophyton rubrum colony-reverse side

4. Discussion

Recurrent and chronic tinea infections are becoming causes of increasing financial burden and impaired quality of life of affected patients and concern in treating dermatologists.

The majority of patients in current study were between 20-30 years of age group, which was in congruence with previous studies conducted in past like Grover et al.⁵ and Hazarika et Al.⁶

The males (56%) were affected more frequently than females (44%) with male to female ratio of 1.2:1, a trend observed in many previous studies.^{7,8}

Fungal hyphae were seen in 44/80 (88%) of cases on unstained direct microscopic examination of KOH mount of skin scraping from advancing border of tinea in current study. Culture of skin scraping was positive for fungal elements in 56 % samples in our study. It was similar to KOH positivity in previous studies.^{9,10} Predominant species observed was Trichophyton mentagrophytes.

In 44% samples from unwashed pieces of undergarments in current study, fungal hyphae or candida elements were observed, predominant species being Trichophyton mentagrophytes. No previous studies were found for comparison of data on culture of undergarments. This finding implicates that fungal elements in the form of spores may remain in undergarments of patients of tinea cruris, causing recurrent disease or contributing to chronicity of lesions.

In 30% samples obtained from washed undergarments, fungal hyphae or candida elements were seen in culture, predominant species being Trichophyton mentagrophytes, followed by Trichophyton rubrum. There were no previous

data available for comparison of this finding. This implicates that conventional washing techniques may not be adequate for removal of superficial fungi.

In current study, none of the samples were positive for non-dermatophyte moulds in skin scraping, unwashed or washed undergarment samples.

On culture from skin scraping, unwashed undergarments and washed undergarments the species identified on culture positive samples were same in all samples analyzed.

Our study pointed that although culture is not a very sensitive method to confirm dermatophytic infections, yet fungal elements can sustain in undergarments of patients affected by chronic and recurrent tinea cruris which may lead to non-response to standard dose and schedule of antifungal agents.

Our study highlighted that conventional washing techniques may not kill all spores and mycelia of dermatophytes, and fungal elements may harbor in washed undergarments causing chronicity of tinea or recurrent bouts of tinea cruris.

5. Limitations

Small sample size was a limiting factor in our study, acknowledging increasing burden of dermatophytosis in India. Short duration of study was another limiting factor. We could not perform PCR of species identified on culture to know genome of species identified, due to non-availability of such techniques in our hospital setting. Sensitivity of species to prescribed antifungal agents was also not done in our study to know whether any changes in fungal genome is causing chronic tinea infections.

6. Conclusion

Chronic and recurrent tinea cruris is a bothersome problem for patients and treating dermatologists alike. Changing patterns in undergarments with more people adopting for tight synthetic materials for undergarments can cause chronic and recurrent tinea due to occlusion, constant friction and retention of moisture in the crural region. Fungal elements may sustain in undergarments, even after washing; causing recurrent and chronic tinea cruris.

7. Source of Funding

No financial support was received for the work within this manuscript.

8. Conflict of Interest

The authors declare they have no conflict of interest.

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