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Fingernail versus Toenail Onychomycosis: A Dermoscopic and Mycological Study

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ABSTRACT

Background: A fungal infection of the nail unit, onychomycosis (OM) is brought on by dermatophytes, yeast, and non-dermatophyte moulds (NDM). It is the most prevalent nail infection in clinical practice, occurring at 5.5% of the time worldwide.

Objective: This study aimed to evaluate the role of dermoscopy in diagnosis of finger and toenail onychomycosis through correlating its finding with mycological study results.

Patients and methods: The current study was carried out on 45 patients with nail abnormality (clinically) suggesting onychomycosis. They were divided into three equal groups according to site of infection (finger, toe and both). Dermoscopic examination and taking photographs were taken to detect different clinical and dermoscopic patterns. Nail scrapings were collected and examined using direct microscopic examination with KOH (20%) and cultured on SDA media to detect causative organism.

Results: Of all studied groups, female gender showed the highest prevalence in all studied groups representing 80%, 66.7% and 66.7% in group I, II and III respectively. The mean ages of the three groups (I, II and III) were 43.5 ± 12.3, 39.3 ± 12.3 and 47.6 ± 13.1 years respectively. Thumb was the most common affected finger in groups I and III (finger affection) by 53.3%, while the big toe was the commonest affected toe in groups II and III by 100% and 73.3% respectively. According to occupation, 51.1% of all cases were housewives.

Conclusion: Onychomycosis had high prevalence in female gender, middle age, housewives and farmers. Thumb and big toenails were the most common affected nails. According to clinical types of onychomycosis, DLSO was the commonest clinical type between all groups of onychomycosis except in group III (toe affection) that PSO was the commonest clinical type. According to dermoscopic patterns, brown and black pigmentation, toe jagged proximal edge with spikes and Subungual hyperkeratosis was the commonest dermoscopic patterns in groups I, II and III respectively.

Keywords: Onychomychosis, Fingernail, Toe nail, Dermoscopic, Mycological.

INTRODUCTION

Because it can result in localised discomfort, paresthesia, difficulties carrying out everyday tasks, and impairment of social contact, onychomycosis is a significant issue [(1)].

Onychomycosis can be classified clinically into distal and lateral subungual onychomycosis (DLSO), proximal subungual onychomycosis (PSO), superficial white onychomycosis (SWO), endonyx onychomycosis and total dystrophic onychomycosis (TDO). This categorization was expanded to encompass mixed and 2ry infection types [(2)].

Weakened immune systems, trauma, advanced age, and diabetes mellitus are well-known risk factors for onychomycosis. Other risk factors include psoriasis, tenia pedis, and a family history of onychomycosis [(1)]. Onychomycosis is more prevalent in certain jobs as housewives, food handlers or food modelling and other workers that are exposed to excessive water, which increases the risk of onychomycosis. So employees suffer from employer reluctance to hire individual with abnormal nail particularly jobs of food handling or where interaction with the public is required [(3)].

Trichophyton rubrum is the most common cause of onychomycosis, however it can also be caused by other dermatophytes, such as Trichophyton interdigitale, Trichophyton mentagrophytes, and Epidermophyton floccosum. For 90% of toenail onychomycosis and 50% of fingernail onychomycosis, dermatophytes are found. Ten to twenty percent of cases of onychomycosis, particularly in fingernail onychomycosis, are caused by Candida species, particularly Candida albicans [(4)].

Non-dermatophyte saprophytic molds of onychomycosis are primarily cultured from toenails e.g. Fusarium, Aspergillus species that account for about 8% of nail infection [(4)].

Most studies regarding onychomycosis were performed on both finger and toenails together, however correlation between sites of infection in either fingernails or toe nails and clinical pattern, dermoscopic findings and type of causative fungi does not fully investigated [(5)]. Clinicopathological methods, which can be time-consuming and result in false negative results in up to 35% of cases, are being replaced with clinico-imaging methods in the diagnosis of onychomycosis [(6)].

Dermoscopy has opened a new dimension in the diagnosis of onychopathies. It is a non-invasive practical imaging method that used to diagnose onychomycosis and differentiate onychomycosis from traumatic onycholysis and other nail disorders [(7)]. Fungal culture still considered the criterion standard of onychomycosis and must be shielded against prolonged, needless medical care as well as its negative

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repercussions, which might harm the patient for no reason at all [(1)].

The aim of this study was to investigate the correlation between the sites of infection either finger nail or toe nail with clinical patterns, dermoscopic findings and type of causative organism. Also, this study aimed to evaluate the role of dermoscopy in diagnosis of finger and toe nail onychomycosis through correlating its finding with mycological study results.

PATIENTS AND METHODS

This cross sectional descriptive and analytical study was carried out at the Outpatient Clinic of Dermatology, Andrology & STDs department at Mansoura University Hospitals, Mansoura, Egypt.

Inclusion criteria: The study included 45 adult patients (over 18 years) with onychomycosis of one or more finger or toe nail or both types in both sex.

Exclusion criteria: Patients who had concomitant skin diseases e.g. lichen planus, psoriasis, alopecia areata, pityriasis rubra pilaris, autoimmune bullous diseases and genodermatosis. Patients who have recently taken systemic antifungal therapy and/or topical antifungal treatment within 1 month ago. Other systemic diseases as DM, cardiac, renal or hepatic diseases. Pregnant females and patients taking immunosuppressive drugs.

All patients were divided into 3 groups:

A) **Group 1:** 15 patients with one or more fingernail onychomycosis.
B) **Group 2:** 15 patients with one or more toenail onychomycosis.
C) **Group 3:** 15 patients with both finger and toenail onychomycosis.

Patient evaluation:

1. History taking

- Personal history including name, age, gender, residence, occupation, family history and special habits.
- Analysis of the complaint regarding its onset, course, duration, precipitating factors and improvement factors.
- Current systemic comorbidities with their durations and commenced medications.

2. General examination

- General examination to exclude any systemic disease.

3. Dermatological examination

- Exclusion of any other skin diseases or other fungal infection as tinea pedis and / or tinea manuum.
- Examination of all fingernails and toe nails clinically to determine the number of affected nails and clinical types of onychomycosis e.g. DLSO, PSO, sSWO and TDO.
- Calculation of score clinical index of onychomycosis (SCIO) was performed according to **Carney *et al.* [(8)].**

4. Photographs taking

- Photographs of the nail disorders were taken by a Samsung M31 smartphone, which has multiple resolutions by the main camera (64 mega pixels), depth camera (5 mega pixels). Macro camera (5 mega pixels) and ultra-wide camera (8 mega pixels), which zooms up to 8-10 xs.

5. Dermoscopic examination

- Dermoscopic examination and imaging were done by using polarized Dermlite DL3 dermoscope (3Gen, USA). Gel was applied over the examined nail to render the surface of the nail translucent for visualization of the underlying structures and identification of different dermoscopic features of different clinical types with onychomycosis.

6. Mycological assessments

- All patients' nails were sampled by scraping the subungual debris as close to the nail as feasible with a surgical blade and trimming the distal section of the nail following sterilisation with 70% alcohol to eliminate bacteria and debris. Nail samples were collected on sterile plates and delivered to the laboratory as soon as feasible for microbiological testing.
- Part of the nail samples were put in between two glass plates and heated for 10 minutes then examined by direct optical microscope at 100-400 x magnification using 20% potassium hydroxide to detect long-branched, filamentous hyphae with or without arthrospores, which were observed in dermatophytic infection, pseudohyphae in candidal onychomycosis and mycelia, arthrospores or yeast cells in non-dermatophytic (NDM) mold onychomycosis.
- Each sample was inoculated on two Sabouraud dextrose agar (SDA) media containing gentamycin (5 mg/L) and chloramphenicol (50 mg/L) then one plate only was supplied by cycloheximide (0.5-2 mg/L) to suppress saprophytic fungi.
- After incubating both plates of each sample at 25 ˚C for 3 weeks, the resultant colonies were studied macroscopically and microscopically to identify the causal organism.

Ethical consideration: The Institutional Review Board (IRB) of Mansoura University's School of Medicine approved the study with code number MS.20.06.1163. All participants provided written informed consents following a thorough description of the advantages and potential drawbacks of each strategy. The Helsinki Declaration was adhered to at every stage of the study.

Statistical analysis

The acquired data were updated, coded, tabulated, and entered into SPSS V. 25.0 on a PC. Data were given, and appropriate analysis was performed based on the type of data gathered for each parameter. The Shapiro test was used to determine the normality of the data distribution. For parametric numerical data, mean and standard deviation (SD) were used, whereas median and range were used for non-parametric numerical data. For non-numerical data, frequency and proportion were used. The student t-test was performed to determine the statistical significance of the difference between the means of the two research groups. One way analysis of variance (ANOVA) was performed to compare the means of the three groups.

The Mann Whitney (U) test was used to determine the statistical significance of a non-parametric variable difference between two research groups. The Kruskall-Wallis test was employed to determine the statistical significance of a difference in more than two non-parametric variables across research groups. To investigate the association between two qualitative variables, the Chi-Square test was performed. Fisher's exact test was employed to investigate the link between two qualitative variables when the predicted count was less than 5 in more than 20% of the cells. A $p \leq$ was deemed significant at 95% confidence interval.

RESULTS

The mean age of[t] group I was 43.5 ± 12.3 years, they were 3 males (20%) and 12 females (80%). The mean age of group II was 39.3 ± 12.3 years, they were 5 males (33.3%) and 10 females (66.7%). The mean age of group III was 47.6 ± 13.1 years, they were 5 males (33.3%) and 10 females (66.7%). No statistically significant differences were found between studied groups regarding age and gender ($p > 0.05$ for each). No statistically significant differences were found regarding occupations, special habit (smoking), family history of onychomycosis and previous topical and systemic treatment of onychomycosis (Table 1).

Table (1): Comparison of demographic data and occupations among studied groups

	Onychomycosis			P[1]	P[2]	P[3]
	Group I N=15 N (%)	Group II N=15 N (%)	Group III N=15 N (%)			
Males	3 (20%)	5 (33.3%)	5 (33.3%)	0.682	0.682	1
Females	12 (80%)	10 (66.7%)	10 (66.7%)			
Age (years), Mean ± SD	43.5±12.3	39.3±12.5	47.6±13.1	0.361	0.384	0.179
Occupations						
House wife	11 (73.3%)	5 (33.3%)	7 (46.7%)	0.128	0.136	0.456
Farmer	1 (6.7%)	3 (20%)	1 (6.7%)	0.283	1	0.283
Clean worker	0 (0%)	2 (13.3%)	3 (20%)	0.143	0.068	0.624
Food handler	1 (6.7%)	0 (0%)	2 (13.3%)	0.309	0.543	0.143
Teacher	1 (6.7%)	1 (6.7%)	0 (0%)	1	1	0.309
Student	0 (0%)	2 (13.3%)	0 (0%)	0.143	0.143	0.143
Baker	1 (6.7%)	0 (0%)	1 (6.7%)	0.309	0.309	0.309
Fisherman	0 (0%)	0 (0%)	1 (6.7%)	-	-	0.309
Carpenter	0 (0%)	1 (6.7%)	0 (0%)	0.309	0.309	0.309
Doctors	0 (0%)	1 (6.7%)	0 (0%)	0.309	0.309	0.309

P[1]: comparison between group I and II, P[2]: comparison between group I and III and P[3]: comparison between group II and III.

The most common type in group I was DSLO followed by PSO, while the most common type in group III was PSO followed by DSLO. No statistically significant differences were found regarding clinical types of fingers onychomycosis between group I and III (Table 2).

Table (2): Comparison of clinical types of finger onychomycosis among groups I and III

Clinical types of finger Onychomycosis	Group I N=15	Group III N=15	p
DSLO	8 (53.3%)	4 (26.7%)	0.136
PSO	7 (46.7%)	6 (40%)	0.713
PLSO	0 (0%)	2 (13.3%)	0.143
TDO	0 (0%)	1 (6.7%)	0.309
DSO	0 (0%)	2 (13.3%)	0.143

The most common clinical type in group II and III was DSLO. DSLO was statistically significantly more in group II than in group III. Otherwise, no statistically significant differences were found regarding clinical types of toe onychomycosis between group II and III. Among each group, DSLO was the most statistically significant clinical type found among all clinical types of toe onychomycosis (Table 3).

Table (3): Comparison of clinical types of toe onychomycosis among groups II and III

		Group II N=15	Group III N=15	p
Clinical types of toe Onychomycosis	**DSLO**	14 (93.3%)	8 (53.3%	0.013*
	PSO	1 (6.7%	2 (13.3%	0.543
	PLSO	0 (0%)	1 (6.7%)	0.309
	TDO	0 (0%)	3 (20%)	0.068
	DSO	0 (0)	1 (6,7%)	0.309
P value		<0.001	<0.001	

There was statistically significantly affected more with PSO as compared to toes (p=0.010). Otherwise, no statistical significant differences were found regarding clinical types of onychomycosis among fingers and toes (Table 4).

Table (4): Comparison of clinical types of onychomycosis among fingers and toes in studied groups

Clinical types of Onychomycosis	Fingers N=30	Toes N=30	p
DSLO	12 (40%)	22 (73.3%)	0.758
PSO	13 (43.3%)	3 (10%)	0.010*
PLSO	2 (6.7%)	1 (3.3%)	0.407
TDO	1 (3.3%)	3 (10%)	0.472
DSO	2 (6.7%)	1 (3.3%)	0.407

The most common dermoscopic feature in group I was brown to black pigmentation (86.7% of cases), while the most common dermoscopic feature in group III was subungual hyperkeratosis (93.3% of cases). Longitudinal streaks or patches had statistically significant association with group I, while longitudinal striations have statistically significant association with group III. Otherwise, no statistically significant differences were found between group I and III regarding dermoscopic features of finger onychomycosis (Table 5).

Table (5): Comparison of dermoscopic features of finger onychomycosis among studied groups

	Group I N=15	Group III N=15	p
	N (%)	N (%)	
1. Jagged proximal edge with spikes	9 (60%)	11 (73.3%)	0.439
2. Longitudinal streaks or patches	10 (66.7%)	4 (26.7%)	**0.028***
3. Longitudinal striations	5 (33.3%)	11 (73.3%)	**0.028***
4. Subungual hyper keratosis	10 (66.7%)	14 (93.3%)	0.169
5. Leukonychia	6 (40%)	4 (26.7%)	0.439
6. Brown to black pigmentation	13 (86.7%)	11 (73.3%)	0.651
7. Yellow to green discolouration	12 (80%)	8 (53.3%)	0.121

The most common dermoscopic features in group II were toe jagged proximal edge with spikes followed by toe subungual hyperkeratosis, while the most common dermoscopic features in group III were toe subungual hyperkeratosis followed by jagged proximal edge with spikes. No statistically significant differences were found between group II and III regarding statistically dermoscopic features of finger onychomycosis (Table 6).

Table (6): Comparison of dermoscopic features of toe onychomycosis among studied groups

	Group II N=15	Group III N=15	p
	N (%)	N (%)	
Toe Jagged proximal edge with spikes	14 (93.3%)	13 (86.7%)	0.543
Toe Longitudinal streaks or patches	4 (26.7%)	5 (33.3%)	0.690
Toe Longitudinal striations	6 (40%)	7 (46.7%)	0.713
Toe Subungual hyper keratosis	12 (80%)	14 (93.3%)	0.598
Toe leukonychia	2 (13.3%)	3 (20%)	0.651
Toe Brown to black pigmentation	11 (73.3%)	8 (53.3%)	0.256
Toe Yellow to green discoloration	11 (73.3%)	10 (66.7%)	0.690

Toes have statistically significant association with jagged proximal edge with spikes when compared to fingers. Otherwise, no statistically significant differences were found regarding dermoscopic features of onychomycosis among fingers and toes (Table 7).

Table (7): Comparison of dermoscopic features of onychomycosis among fingers and toes.

	Fingers N=30	Toes N=30	p
	N (%)	N (%)	
Jagged proximal edge with spikes	20 (66.7%)	27 (90%)	**0.028***
Longitudinal streaks or patches	14 (46.7%)	9 (30%)	0.184
Longitudinal striations	16 (53.3%)	13 (43.3%)	0.438
Subungual hyper keratosis	24 (80%)	26 (86.7%)	0.488
Leukonychia	10 (33.3%)	5 (16.7%)	0.136
Brown to black pigmentation	24 (80%)	19 (63.3%)	0.152
Yellow to green discoloration	20 (66.7%)	21 (70%)	0.781

Aspergillus niger was statistically significantly cultured in fingers of onychomycosis in group I when compared to those in group III (p=0.046). However, no statistically significant differences were found regarding results of onychomycosis culture without cycloheximide among all studied groups (Table 8).

Table (8): Comparison of results of sabouraud dextrose agar culture without cycloheximide among studied groups with onychomycosis

	Group I N=15	Group II N=15	Group III N=15		P^a	P^b
			Fingers	Toes		
	N (%)	N (%)	N (%)	N (%)		
Aspergillus niger	13 (86.7%)	5 (33.3%)	8 (53.3%)	6 (40%)	**0.046***	0.705
Candida albicans	2 (13.3%)	7 (46.7%)	2 (13.3%)	5 (33.3%)	1	0.713
Candida non albicans	1 (6.7%)	1 (6.7%)	1 (6.7%)	1 (6.7%)	1	1
Aspergillus Fumigates	2 (13.3%)	1 (6.7%)	0 (0%)	0 (0%)	0.483	0.309
Penicillium	0 (0%)	1 (6.7%)	1 (6.7%)	2 (13.3%)	0.309	0.543
Alternaria Stemphylium	0 (0%)	0 (0%)	2 (13.3%)	1 (6.7%)	0.483	0.309
Trichophyton interdigitale	0 (0%)	1 (6.7%)	1 (6.7%)	0 (0%)	0.309	0.309
Fusarium	1 (6.7%)	1 (6.7%)	0 (0%)	1 (6.7%)	0.309	1
Ulocladium Preuss	0 (0%)	0 (0%)	1 (6.7%)	1 (6.7%)	0.309	0.309
Trichophyton erinacei	1 (6.7%)	0 (0%)	0 (0%)	2 (13.3%)	0.309	0.483

P^a: comparison between G I, G III fingers affected. P^b: comparison between G II, G III toes affected.

Aspergillus niger was statistically significantly cultured in toes of onychomycosis in group III when compared to those in group I (p=0.011). However, no statistically significant differences were found regarding results of sabouraud dextrose agar culture with cycloheximide among all studied groups (Table 9).

Table (9): Comparison of results of sabouraud dextrose agar culture with cycloheximide among studied groups with onychomycosis.

	Group I N=15	Group II N=15	Group III N=15		P^a	P^b
			Fingers	Toes		
	N (%)	N (%)	N (%)	N (%)		
Aspergillums niger	11 (73.3%)	2 (13.3%)	4 (26.7%)	2 (13.3%)	**0.011***	1
Candida albicans	3 (20%)	8 (53.3%)	6 (40%)	5 (33.3%)	0.427	0.269
Candida non albicans	1 (6.7%)	2 (13.3%)	5 (33.3%)	3 (20%)	0.624	0.598
Aspergillus fumigates	0 (0%)	4 (26.7%)	0 (0%)	3 (20%)	-	0.666
Penicillium	1 (6.7%)	1 (6.7%)	1 (6.7%)	2 (13.3%)	1	0.543
Alternaria Stemphylium	1 (6.7%)	0 (0%)	2 (13.3%)	1 (6.7%)	0.543	0.309
Fusarium	1 (6.7%)	0 (0%)	0 (0%)	0 (0%)	0.309	-
Trichophyton erinacei	2 (13.3%)	0 (0%)	0 (0%)	2 (13.3%)	0.483	0.483
Trichophyton interdigitale	0 (0%)	2 (13.3%)	1 (6.7%)	0 (0%)	0.309	0.483

P^a: comparison between G I, G III fingers affected. P^b: comparison between G II, G III toes affected.

DISCUSSION

Regarding the gender of the affected cases, female gender showed the highest prevalence in the three study groups representing 80%, 66.7% and 66.7% in group I, II and III respectively. This agrees with **Ahmed *et al.*** [9] who showed that 27.5% of patients were males and 72.5% were females; females being more susceptible to onychomycosis than males. Similarly, **Elnagar and**

Shrief [10] revealed that 64.1% of patients were female and 35.9% of patients were male. The group with aberrant nails that presented with the greatest frequency was females. This is explained by the fact that women perform household chores like cleaning and laundry. However, these findings deviate from previous research that indicated onychomycosis was more prevalent in men than in women as that of **Kayarkatte *et al.*** [11] who showed that 71.5% of patients were men and 28.4% were women (M:F= 2.5:1). Similarly, **Nair *et al.*** [12] found that males were 60.1% and females were 39.9% of patients with onychomycosis (M: F= 1.5:1). One possible explanation is that men are more likely to use occlusive shoes and play sports, both of which are known risk factors [13].

In the current study, the mean age of group I was 43.5 ± 12.3 years, the mean age of group II was 39.3 ± 12.3 years and the mean age of group III was 47.6 ± 13.1 years. This agrees with the findings of **Jayatilake *et al.*** [14] and **Hwang *et al.*** [15] who found that the frequency of onychomycosis rises with age, peaking between the ages of 40 and 60.

Regarding the occupations of the included cases in our study, the highest percentage of the cases were housewives representing (51.1%) totally and 73.3%, 33.3% and 46.7% in group I, II and III respectively, followed by farmers and clean workers who represent (11.1%) in the three groups totally. Similar findings were reported by **Bedaiwy *et al.*** [16] who found that housewives had a considerably higher incidence of onychomycosis (72%) compared to manual labourers (16%) and farmers (7%). One possible explanation is that housewives engage in household chores like cleaning and laundry, which require wet labour. Furthermore, the increased frequency of female participants in the current study may be attributable to a growing awareness among women about the potential influence of cosmetics on dermatological illnesses.

In our study, no statistically significant differences were found regarding association of onychomycosis with other fungal infections between studied groups. Among each group, there was statistically significant absence of association with other fungal infections. Tinea pedis was the most commonly isolated type in 26.7%, 26.7% and 13.3% in group I, II and III respectively. This is in agreement with **Vinod *et al.*** [17] who described that tinea pedis was the commonest isolated type representing 14.3%. **Kayarkatte *et al.*** [11] also reported that concurrent dermatophytic infections of skin were 39.8%. The development of onychomycosis may be caused by concurrent dermatophytosis due to autoinoculation of fungus into the nail during scratching of the dermatophytic skin disease. Furthermore, OM may act as a haven for fungi that repeatedly cause dermatophytic skin diseases.

According to our findings, the most common clinical type of finger onychomycosis in group I was DSLO (53.3%) followed by PSO (46.7%), while the most common type in group III was PSO (40%) followed by DSLO (26.7%). No statistically significant differences were found regarding clinical types of fingers onychomycosis between group I and III. The most common clinical type of toe onychomycosis in group II and III were DSLO (93.3% & 53.3%) followed by PSO (6.7% &13.3%) in groups II and III respectively. DSLO was statistically significantly more in group II than in group III (p value=0.013). Otherwise, no statistically significant differences were found regarding clinical types of toe onychomycosis between group II and III. Among each group, DSLO was the most statistically significant clinical type found among all clinical types of toe onychomycosis (p value<0.001). In all studied groups, DLSO was the most common clinical type of onychomycosis representing 40% in fingers and 73,3% in toes, followed by PSO (43.3%) in fingers and (10%) in toes, followed by TDO (10%) in toes and (3.3%) in fingers, followed by PLSO and DSO as the least commonest types (6.7%) in fingers and (3.3%) in toes. Our findings are in accordance with results of **Elnagar and Shrief** [10], which showed that DLSO was the most common presented clinical type by 66.0%, followed by TDO (29.1%). **Litaiem *et al.*** [18] also reported that DLSO is the commonest clinical type of onychomycosis representing 71.7%, followed by TDO in 14.1% and followed by PSO representing 1.1%. In our study, direct microscopy with KOH 20% test was positive in 26.7%, 66.7% and 53.3% in groups I, II and III respectively. No statistically significant differences were found in our study regarding fingers and toes onychomycosis KOH 20% test results among studied groups.

The most common dermoscopic features according to our study in group I were brown to black pigmentation (86.7% of cases), followed by yellow to green discoloration (80% of cases), followed by longitudinal streaks or patches and subungual hyperkeratosis (66.7% of cases), while the most common dermoscopic features in group III finger onychomycosis were subungual hyperkeratosis (93.3% of cases), followed by jagged proximal edge with spikes, brown to black pigmentation and longitudinal striations (73.3%). The most common dermoscopic features in group II were toe jagged proximal edge with spikes (93.3%) followed by toe subungual hyperkeratosis (80%) followed by toe Brown to black pigmentation and toe Yellow to green discoloration (73.3%). However, the most common dermoscopic features in group III toe onychomycosis were toe subungual hyperkeratosis (93.3%), followed by jagged proximal edge with spikes (86.7%) and toe yellow to green discoloration (66.7%). Our findings corroborate those of **Abdallah *et al.*** [2] who discovered that in patients with onychomycosis, longitudinal white striae were present in 82.5% of cases, a jagged proximal edge in 50% of cases, and an intermittent spiking pattern in 60% of cases. The current results also agree with that of **Yorulmaz and Yalcin** [7] who showed that jagged

proximal edge with spikes (51.9%), followed by longitudinal streaks and patches in 44.4%, followed by subungual hyperkeratosis in 27.2% and brown-black pigmentation in 9.9% of patients with onychomycosis. On the other side, in the research by **Litaiem *et al.* [18],** the predominant dermoscopic symptoms of onychomycosis were "ruin appearance", "longitudinal striae", and "spikes" on the proximal boundary of oncholytic regions, with specificities of 99.38%, 83.78%, and 85.64%, respectively. The "aurora borealis" sign exhibited the best sensitivity and specificity, the differences in dermoscopic features may be due to different causative organisms of onychomycosis [18].

Our findings of SDA culture not supplied with cycloheximide revealed that Aspergillus niger (NDM) was the commonest isolated organism in 86.7%, 53.3% and 40% of patients, followed by Candida albicans that isolated in 13.3%, 13.3% and 33.3% of patients and followed by dermatophytes (Trichophyton) that isolated in 6.7%, 6.7% and 13.3% of groups I, II and III patients (finger and toe onychomycosis) respectively. However, Aspergillus niger (NDM) was the second common isolated organism in group II by 33.3% after Candida albicans 46.7% and followed by dermatophytes (Trichophyton) 6.7%. Our findings become in harmony with the findings of **Abdallah *et al.* [2]**, which showed that Aspergillus niger (NDM) was the commonest isolated organism from SDA without cycloheximide by (45%), followed by Candida albicans by (30%) and followed by dermatophytes (Trichophyton) by (2.5%) in Egypt. This also is in agreement with the results of **Ahmed *et al.* [9]** that revealed a significant predominance of Aspergillus species, which were the most prevalent species (71.6%), with A. niger (46.1%) and A. flavus (18.6%) being the most frequently encountered species, followed by candida (7.8%). On the other side, according to **Cengiz *et al.* [19]** dermatophytes (Trichophyton) were identified more frequently (55.1%) than other NDM (3.1%) and Candida species (40.4%). Because of variations in climatic circumstances, the agents responsible for onychomycosis vary depending on the geographical location [20, 21].

In our results of SDA culture supplied with cycloheximide, Candida albicans was the most common isolated organism in 53.3%, 40% and 33.3% of groups I, II and III patients (finger and toe onychomycosis) respectively, followed by Aspergillus fumigates 26.7%, 20% and Candida non albicans 33.3% in groups II and III patients (toe and finger onychomycosis) respectively and followed by dermatophytes (Trichophyton) of groups II and III patients (finger and toe onychomycosis) respectively. However, Candida albicans was the second common isolated organism in group I by 20% after Aspergillus niger that still the commonest organism but with less prevalence with cycloheximide by 73.3% followed by dermatophytes (Trichophyton) in 13.3%. The variation in results of SDA before and after supplement of cycloheximide was due to cycloheximide suppresses saprophytic fungi and encourages growth of dermatophytes. Results of **Chadeganipour and Mohammadi [22]** are in accordance with our results, which showed that Candida albicans (51.1%) had a higher incidence than dermatophytes (26.8%) or NDM (22%). According to the study of **Nada *et al.* [5]** that was done in Egypt, Candida yeasts were found to be the most frequent causative agents of onychomycosis that isolated from SDA with cycloheximide in 65% of casas, followed by dermatophytes (7.5%) and NDM (2.5%). On the other side, results that reported by **Segal *et al.* [23]** showed higher percentage of dermatophytes in 61.5% of patients with onychomycosis, followed by lower percentages of Candida in 34.45% and other NDM in 4.05% of patient with onychomycosis.

CONCLUSION

Onychomycosis had high prevalence in female gender, middle age, housewives and farmers. Thumb and big toe nails were the most common affected nails. According to clinical types of onychomycosis, DLSO was the commonest clinical type between all groups of onychomycosis except in group III (toe affection) that PSO was the commonest clinical type. According to dermoscopic patterns, brown and black pigmentation, toe jagged proximal edge with spikes and Subungual hyperkeratosis was the commonest dermoscopic patterns in groups I, II and III respectively. According to SDA culture without cyclohexamide, non-dermatophytes as Aspergillus niger was the most common isolated mold between all groups except in group II as Candida albicans was the commonest. In SDA culture with cyclohexamide, Candida albicans was the commonest isolated organism in all groups except in group I that Aspergillus niger (NDM) was the commonest isolated mold.

RECOMMENDATIONS

- Improvement of the knowledge about onychoscopy among the dermatologist to help in nail diseases diagnosis.
- Widening the spectrum of using dermoscopy in further dermatological studies with increased number of cases.
- Further dermoscopic and mycological studies should be done on more number of cases and different environments to detect epidemiological variations.
- Dermoscopic and mycological studies should be done before treatment for suitable antifungal treatment selection then during treatment for follow up and after treatment to confirm complete recovery from onychomycosis.
- Using the hygienic methods before dermoscopic examination to prevent transmission of infection between the patients by dermoscope.

- Further studies are needed to correlate the dermoscopic findings with results of fungal cultures.

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