



Original Article

A CLINICAL ONYCHOSCOPIC ANALYSIS IN THE DIAGNOSIS OF PRIMARY ONYCHOMYCOSIS

Zohra Begum¹, Vidhya C², Anitha Christy³, Monica S⁴, Vijayabhaskar C⁵, Sandeep R⁶

¹ GOVERNMENT STANLEY MEDICAL COLLEGE, CHENNAI - 600001

² RAJIV GANDHI GOVERNMENT GENERAL HOSPITAL, CHENNAI - 600003

³⁻⁶ GOVERNMENT STANLEY MEDICAL COLLEGE, CHENNAI - 600001

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Corresponding Author:

Sandeep R

GOVERNMENT STANLEY MEDICAL
COLLEGE, CHENNAI - 600001.

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ABSTRACT

Background: Onychomycosis is one of the commonest fungal infections affecting the nails. Laboratory investigations for onychomycosis are often time-consuming, so there is a need for a quick and reliable modality to establish a definitive diagnosis. Dermoscopy is a non-invasive, rapid and effective method of investigation in dermatology. In this study, we have analyzed various patterns of onychoscopy among the clinical subtypes of onychomycosis.

Methodology: This cross-sectional observational study included 132 patients attending the dermatology Outpatient Department (OPD) who were clinically diagnosed with onychomycosis. Of these, 101 patients with KOH-positive fingernail samples, underwent onychoscopic examination using a DermLite DL4E4767 with X10 magnification. Various dermoscopic patterns of the affected nails were recorded and analysed.

Results: Among the 101 patients, Distal subungual onychomycosis (DLSO) was the most common subtype (75.2%), followed by Total dystrophic onychomycosis (TDO) (31.7%), Paronychia (27.72%), Proximal subungual onychomycosis (PSO) (6.9%) and Superficial White onychomycosis (SWO) 5%. No cases of the endonyx type were observed. The most frequent dermoscopic features included: Ruin pattern (68.31%), superficial transverse striations (42.57%), chromonychia (40.59%), jagged spikes (31.6%), longitudinal ridges (22.7%), Subungual hyperkeratosis (15.84%), Aurora borealis (10.8%), Splinter haemorrhage (3%), and Leukonychia (3%).

Conclusion: We identified several dermoscopic features that were highly specific for onychomycosis. Onychoscopy, being a simple bedside procedure, should be considered an important diagnostic tool in suspected cases of onychomycosis, particularly when laboratory confirmation is delayed or unavailable.

Keywords: Onychomycosis, Dermoscopy, Onychoscopy, Ruin pattern.

INTRODUCTION

Onychomycosis is a superficial fungal infection of the nail. The worldwide prevalence of onychomycosis is 4.3% (B Sigurgeirsson et al), while in India, its incidence ranges from 0.5-12% (Shivani Tyagi et al.). It accounts for more than half of nail-related consultations in the dermatology outpatient clinics (Kaur, Murray, Sobbanadhri et al). It is most commonly caused by dermatophytes (*Trichophyton rubrum*, *T. mentagrophytes*, *T. interdigitale*, *E. floccosum*) and non-dermatophyte moulds (*Candida albicans*, *Fusarium* spp, *Neoscytalidium* spp, *Scopulariopsis brevicaulis*). It affects both sexes equally, though it is rare in children. Treatment of onychomycosis is often prolonged due to slow nail regrowth, possible drug side effects and chance of recurrence despite adequate treatment.

The diagnosis is primarily clinical, supported by potassium hydroxide (KOH) examination or fungal culture. However, KOH examination results are highly variable. The sensitivity is as low as 50% as it is dependent on technical expertise of the examiner (Piraccini BM et al.). Despite negative KOH results, if clinical suspicion is high, punch biopsy followed by

special stains like Gomori-Grocott or periodic acid-schiff (PAS) stain can be used. These procedures, however, are expensive, time-consuming, and often yield negative culture results, particularly when sampling the nail plate.

Dermoscopy, a simple and non-invasive office procedure, has revolutionized the field of dermatological diagnosis. The device comes with either polarized or non-polarized illumination. Polarized dermoscopy helps to visualize deeper structures situated as deep as 100 micrometers while Non-polarized dermoscopy allows to visualize surface features. Modern devices often come with both illumination modes as we need both illumination types to assess surface features and deeper structures. Recently, videodermoscopy devices have been introduced for better visualization and recording of the procedure. Dermoscopy has a wide range of application which includes onychoscopy, mucoscopy, capillaroscopy, trichoscopy, inflammoscopy and entomodermatoscopy. Onychoscopy is the dermoscopic evaluation of the nail unit which helps in diagnosing nail disorders. Non-polarized onychoscopy requires ultrasound gel due the convex shape of the nail plate. Nail plate onychoscopy shows nail plate pigment abnormalities, nail bed vessel abnormalities, other inflammatory dermatosis and the identification and progression of onychomycosis.

Dermoscopy of the proximal nail fold capillaroscopy shows capillary flow parallel to the skin surface, and any abnormality raises the suspicion of connective tissue disorders. Dermoscopy of the distal edge of the nail plate is very useful in localizing nail pigmentation and tumors such as onychopapilloma and onychomatricoma.

Dermoscopy of the hyponychium normally shows capillary networks and capillary loops, which appear as regular red dots due to their perpendicular arrangement. These findings are most often altered in vascular abnormalities such as nail psoriasis.

Onychoscopy can play a significant role in determining various features of onychomycosis, aiding in its diagnosis. In this study, we analyzed the clinical and onychoscopic findings of onychomycosis and identified the onychoscopic features of its various subtypes. (Walter et al., Park et al., 2012).

METHODS AND METHODOLOGY

This was a cross-sectional observational study conducted in the Department of Dermatology, Government Stanley Medical College and Hospital, Chennai, from March 2023 to August 2023 (6 months). The study was carried out after obtaining approval from the Ethical Committee of Stanley Medical College and Hospital.

[IEC Number: ECR/131/Inst/TN/2013/RR-22; DHR Number: EC/NEW/2020/46]

The study population included patients attending the Dermatology OPD who were clinically diagnosed with onychomycosis. The sample size was 132 patients. All patients underwent KOH examination, and only KOH-positive patients were included in the study, after obtaining informed consent. A complete study protocol was explained, and written informed consent was obtained from all participants.

INCLUSION CRITERIA

- All patients attending the Dermatology OPD who were clinically diagnosed with onychomycosis and had a positive KOH examination.
- Patients who were able to understand the requirements of the study.
- Patients who were willing to undergo dermoscopic examination and clinical photography.

EXCLUSION CRITERIA

- Patients who had received systemic or topical antifungal treatment within the past three months.
- Patients with other dermatological diseases affecting the nails.

A total of 132 patients were included in the study. An elaborate history and physical examination were performed, followed by a detailed clinical examination of all fingernails and toenails. The features of onychomycosis in each affected nail were documented, and clinical photographs of the diseased nails were taken. All patients underwent onychoscopic examination of the affected fingernails and toenails using a handheld dermoscope (DermLite DL4E4767, ×10 magnification). Both polarized and non-polarized modes were used for visualization of the affected nails

RESULTS

Out of 132 patients, 101 patients who were KOH-positive underwent onychoscopic examination. The age of the patients ranged from 17 to 75 years. Females were more commonly affected (58.4%) compared to males (41.6%). When occupations were analysed, housewives accounted for the highest proportion (39.6%), followed by individuals working as manual labourers (coolies).

Among the 101 patients studied, fingernails were more commonly affected (71.2%) compared to toenails (28.7%). The right thumb was the most frequently affected fingernail, while the great toe was the most commonly affected toenail.

In terms of clinical subtypes, distal lateral subungual onychomycosis (DLSO) was the most common (75.2%), followed by total dystrophic onychomycosis (TDO) (31.7%), paronychia (27.7%), proximal subungual onychomycosis (PSO) (6.9%), and superficial white onychomycosis (SWO) (5%). No cases of endonyx onychomycosis were observed.

The most common dermoscopic patterns observed were the **ruin pattern** (68.3%), superficial transverse striations (42.6%), chromonychia (40.6%), jagged spikes (31.6%), longitudinal ridges (22.7%), subungual hyperkeratosis, aurora borealis pattern (10.8%), splinter haemorrhages (3%), and leukonychia (3%).

Among the dermoscopic features of **DLSO (N = 75)**, the most common pattern was the *ruin pattern* (62.7%), followed by superficial transverse striations (32%), chromonychia (30.6%), jagged spikes (22.7%), longitudinal ridges (17.3%), subungual hyperkeratosis (12%), aurora borealis pattern (8%), and splinter haemorrhage (2.7%). The least observed finding was leukonychia (2.6%).

In patients with **TDO (N = 32)**, the most frequent pattern was the ruin pattern (37.5%), followed by superficial transverse striations (28.1%), jagged spikes (28.1%), chromonychia (28.1%), aurora borealis (15.6%), and subungual hyperkeratosis (12.5%). Leukonychia and longitudinal ridges were not observed in this group.

When analysing the dermoscopic features of **SWO (N = 5)**, superficial transverse striations were seen in 40%, while leukonychia, appearing as white fluffy shadows, was noted in 60%. In patients with **PSO (N = 7)**, superficial transverse striations were observed in 67%, longitudinal ridges in 33%, and jagged spikes in 17%. **Fungal paronychia**, analysed separately in 28 patients, showed dermoscopic features including the ruin pattern in 32.1%, superficial transverse striations in 14.2%, jagged spikes in 10.7%, subungual hyperkeratosis in 10.7%, and chromonychia in 7%.

Table 1: Descriptive of Socio-economic characteristics of the study population

Variable		Descriptive
Age (Mean±SD)		48.71±11.93
Sex (n, %)	Male	42, 41.6%
	Female	59, 58.4%
Occupation (n, %)	Coolie	23, 22.8%
	Desk job	6, 5.9%
	Driver	3, 3%
	Farmer/ Flower handler	3, 3%
	Housemaid/ Housekeeper	15, 14.9%
	Housewife	40, 39.6%
	Mechanic	5, 5%
	Security staff/ Student/ Tailor/ Teacher	4, 4%
	Tea stall	2, 2%

Table 2: Clinical features of Onychomycosis among the study population N = 101

Clinical feature	Present (n, %)
DLSO	76, 75.2%
TDO	32, 31.7%
Endonyx	0, 0%
Paronychia	28, 27.72%
PSO	7, 6.9%
SWO	5, 5%

Table 3: Dermoscopic features of Onychomycosis among the study population N = 101

Dermoscopic feature	Present (n, %)
Superficial Transverse Striations	43, 42.57%
leukonychia	3, 3%
Subungual hyperkeratosis	16, 15.84%
Longitudinal ridges	23, 22.7%
Jagged spike	32, 31.6%
Splinter hemorrhage	3, 3%
Aurora borealis	11, 10.8%
Chromonychia	41, 40.59%
Ruin pattern	69, 68.31%

Table 5: Correlation between clinical and dermoscopic features of Onychomycosis

Dermoscopic Features	CLINICAL FEATURES						P-value
	DLSO	TDO	Endonyx	Paronychia	PSO	SWO	
Superficial Transverse Striations	24	9	0	4	4	2	0.000*
leukonychia	0	0	0	0	0	3	0.700
Subungual hyperkeratosis	9	4	0	3	0	0	0.000*
Longitudinal ridges	13	5	0	2	2	1	0.000*
Jagged spike	17	9	0	3	2	1	0.000*
Splinter hemorrhage	2	0	0	0	1	0	0.315
Aurora borealis	6	5	0	0	0	0	0.012
Chromonychia	23	9	0	9	0	0	0.000*
Ruin pattern	47	12	0	10	0	0	0.000*

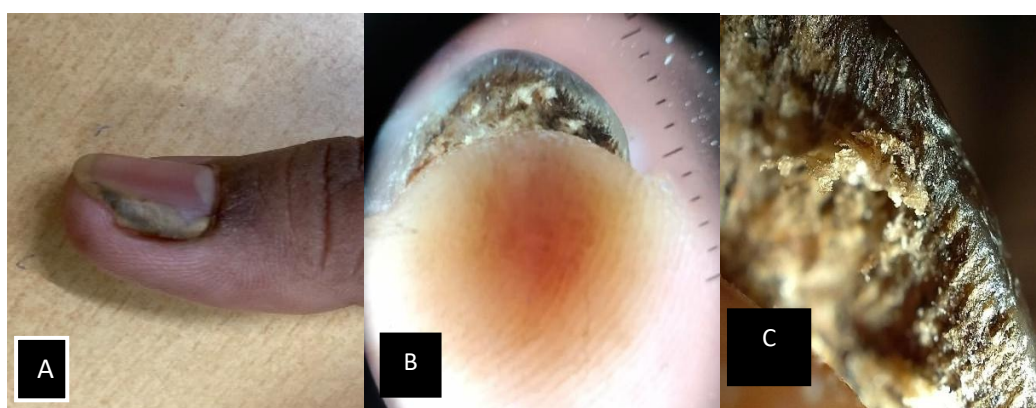


Figure 1: (A) Distal lateral subungual onychomycosis (DLSO) of the thumb. (B) Dermoscopic image showing the *ruin pattern*. (C) Magnified dermoscopic image of the *ruin pattern*.

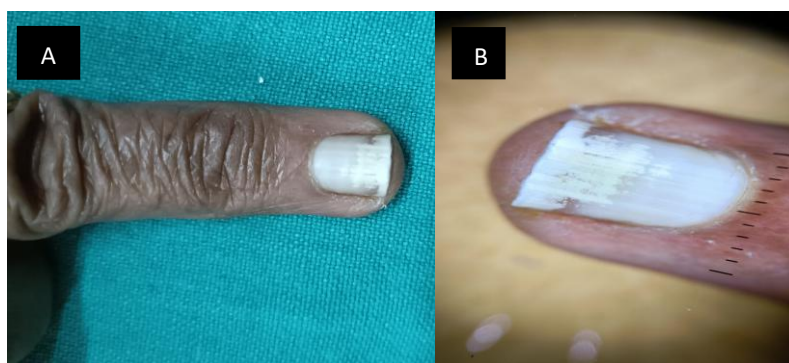


Figure 2: (A) Shows superficial white onychomycosis of right index finger (B) Shows onychoscopic image of Leukonychia showing White fluffy shadows

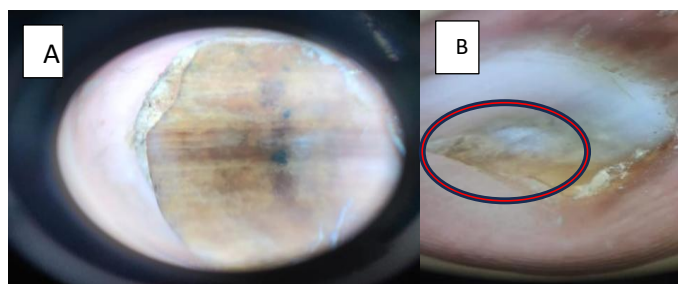


Figure 3: (A) Shows Onychoscopy image of Aurora borea (B) Shows onychoscopic image of Dermatophytoma (Red circle)

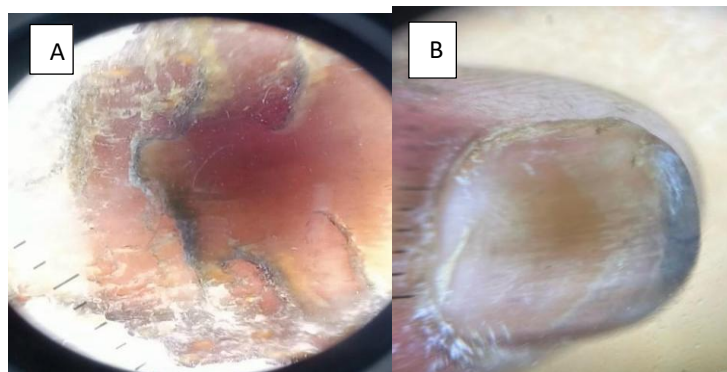


Figure 4: (A) Shows onychoscopic image of Superficial transverse striations (B) Shows necroscopic image of jagged spikes.



Figure 5:(A) Clinical image of Tinea manuum (B)Shows same patient having onychomycosis of almost all fingers

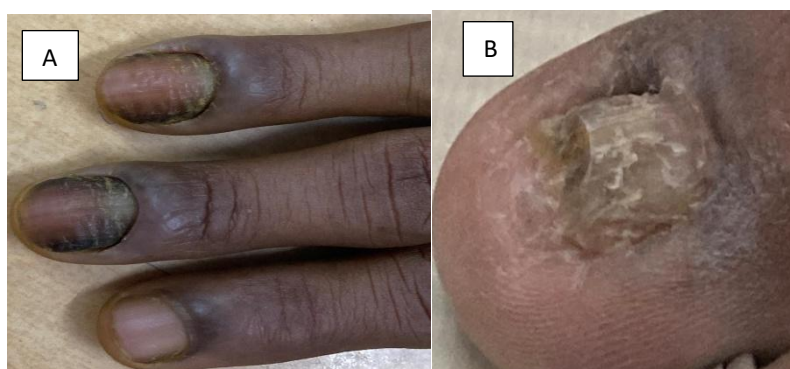


Figure 6: (A)Shows clinical image of paronychia affecting left ring,middle and index fingers. (B)Shows clinical image of total dystrophic onychomycosis

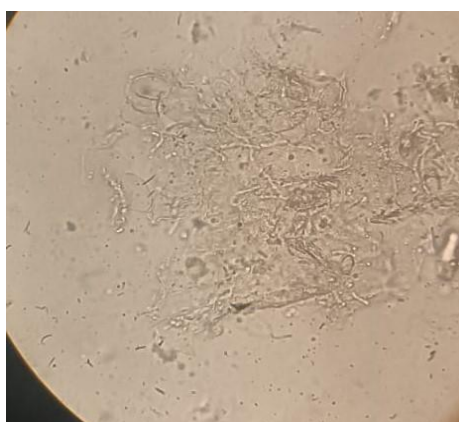


Figure 7: KOH examination of nail clipping showing fungal hyphae

DISCUSSION

Onychomycosis is the most common nail condition encountered in dermatology, accounting for more than 50% of all nail consultations. Onychoscopy is a non-invasive, quick, and reliable diagnostic tool for onychomycosis. Onychomycosis is

an umbrella term that refers to fungal infection of the nail plate, caused by both dermatophytes and non-dermatophyte molds. The most common dermatophytic species include *Trichophyton rubrum*, *T. mentagrophytes*, *T. soudanense*, and *T. violaceum*. Non-dermatophytes include *Candida albicans*, *Fusarium* spp., *Neoscytalidium* spp., *Scopulariopsis brevicaulis*, *Acremonium* spp., and *Onychocola canadensis*.

Fungal paronychia is commonly associated with DLSO or PSO and is frequently caused by *Candida* spp., *Fusarium* spp., and *Neoscytalidium* spp. The hyponychium is the weakest part of the nail apparatus and may serve as a reservoir for pathogens.

Routine investigations include KOH examination, fungal culture, fluorescent microscopy, and nail biopsy with special stains (PAS, Gomori, and Grocott). Modern molecular techniques are also available, with fungal culture remaining the gold standard.

KOH examination: Nail clippings treated with 40% KOH and examined under light microscopy reveal branched, translucent, septate, long hyphae and arthroconidia. However, this test has a high false-negative rate (>15%). Fungal culture requires 10–14 days, and incubation must be continued for 21 days before declaring a negative result. The false-negative rate for culture is even higher, ranging from 15–50%.

In our study, females were more commonly affected (58.4%) compared to males (41.6%), consistent with the findings of Piraccini et al. (2013), Jesus-Silva et al. (2015), and Kanth et al. (2016). The most common occupation associated with onychomycosis was housewives (39.6%), followed by manual laborers (coolies). This is likely due to frequent hand wetting, creating a favorable environment for fungal growth.

Fingernails (71.2%) were more commonly affected than toenails (28.7%), possibly due to frequent immersion of hands in water. The thicker nail plates in males may also explain this observation, which is consistent with Rathod et al. (2017).

The most common clinical subtypes were distal lateral subungual onychomycosis (DLSO, 75.2%), followed by total dystrophic onychomycosis (TDO, 31.7%), proximal subungual onychomycosis (PSO, 6.9%), and superficial white onychomycosis (SWO, 5%). These findings were consistent with De Crignis et al. (2014), Yadav and Khopkar (2016), and Rathod et al. (2017). Notably, paronychia accounted for 27.7%, which is significant but often underreported as a distinct entity in other studies. No cases of endonyx onychomycosis were observed.

Dermoscopic Features: The most common dermoscopic feature was the ruin pattern (68.3%), followed by superficial transverse striations (42.6%), chromonychia (40.6%), jagged spikes (31.6%), longitudinal ridges (22.7%), subungual hyperkeratosis and aurora borealis (10.8%), splinter hemorrhages (3%), and leukonychia (3%).

- **Ruin pattern:** The most common finding in DLSO (62.7%), TDO (37.5%), and paronychia (32.1%), but not observed in PSO or SWO. This pattern results from ventral indentations of the nail plate caused by dermal debris. Our findings are consistent with De Crignis et al. (2014).
- **Superficial transverse striations:** Second most common feature, observed in DLSO (32%), TDO (28.1%), SWO (40%), PSO (67%), and paronychia (14.2%).
- **Jagged spikes:** Non-linear borders at the proximal margin of onycholytic areas with sharp white longitudinal projections pointing to the proximal nail fold. Observed in DLSO (22.7%) and TDO (28.1%).
- **Longitudinal ridges:** Observed in DLSO (17.3%) and PSO (33%), consistent with Yadav and Khopkar (2016).
- **Chromonychia:** Pigmentations of various colours (black, brown, white, yellow) were observed in DLSO (30.6%), TDO (28.1%), and paronychia (25%).
- **Subungual hyperkeratosis:** Observed in DLSO (12%), TDO (12.5%), and paronychia (33%) (Yadav and Khopkar, 2016).
- **Aurora borealis pattern:** Multi-coloured areas with green, bluish-grey, black, white, and yellow, associated with onycholysis, striae, and streaks. Seen in DLSO (6.7%) and more commonly in TDO (15.6%).
- **Splinter hemorrhages:** Linear brown, black, or purple haemorrhages, observed in 2.7% of DLSO cases only.
- **Leukonychia:** Seen mainly in SWO, characterized by homogeneous white opacities (40%) and fluffy shadows suggestive of dermatophytoma (60%), consistent with Manasa Narayan et al. (2020).

Statistical Correlation: Correlation analysis between dermoscopic features and clinical subtypes showed statistically significant associations for ruin pattern ($p = 0.000$), superficial transverse striations ($p = 0.000$), chromonychia ($p = 0.000$), jagged spikes ($p = 0.000$), and aurora borealis ($p = 0.012$) (Piraccini, Jesus, and Nargis et al.).

CONCLUSION

Onychomycosis is a chronic disease requiring prolonged treatment. Conventional diagnostic methods such as KOH examination, fungal culture, and biopsy have their own limitations, being time-consuming and having variable positive

predictive values. Onychoscopy, as a simple bedside procedure, overcomes the need for tedious laboratory investigations and may serve as a valuable adjunct in the diagnosis of onychomycosis. In this study, we observed that certain dermoscopic features were specific for onychomycosis; therefore, onychoscopy should be considered in all suspected cases where fungal culture or biopsy cannot be performed.

Limitations of the Study:

Fungal culture was not performed for confirmation of the diagnosis, as culture requires a minimum of four weeks for results.

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