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Original Article

Nail dystrophy in hand eczema and correlation with severity index: A cross-sectional study

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ABSTRACT

Objectives: Hand eczema (HE) causes frequent periungual inflammation, affecting the functioning of the nail matrix unit leading to varied clinical reaction patterns. The objective of the study was to study nail dystrophic changes among patients of HE and to investigate the association between the prevalence of nail dystrophy and HE severity.

Material and Methods: In the present study, 100 consecutive patients of HE presenting to our hospital were evaluated. Morphological features of nail dystrophy, involvement of HE in the fingertip area, and presence of paronychia were assessed. Where indicated, samples of nail unit were sent for bacterial and fungal cultures.

Results: Nail involvement was seen in 76% of the patients; loss of cuticle was the commonest (37%) finding. A positive correlation ($P = 0.012$) was found between paronychia and nail dystrophic changes. Hand eczema severity index >12 was seen in 28.9% of patients with nail dystrophy as compared to 12.5% without nail dystrophy ($P = 0.259$). Severity index of 3+ was documented more in the presence of nail dystrophy as compared to 0 in patients without nail dystrophy ($P = 0.001$). Out of 20 samples sent for bacterial nail culture, 8 (40%) grew *Staphylococcus aureus* and two *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Serratia* species, and *Klebsiella pneumoniae*. Yeast grew in nail KOH in 7 (30.4%) of 23 samples but cultures were negative.

Conclusion: Nail involvement adds up to the clinical severity of the disease and may be affected by chronicity, duration of disease, and impacts the disease prognosis.

Keywords: Nail dystrophy, Hand eczema, Hand eczema severity index

INTRODUCTION

The exact etiology of nail dystrophy in hand eczema (HE) has not been fully understood, but it is suggested that eczema can adversely affect the nail matrix due to frequent periungual inflammation and lead to transient defects in the nail plate, causing Beau's lines and pitting.[1] As the nail unit is in constant contact with the environment, the nail apparatus is particularly vulnerable to eczematous involvement irrespective of the nature of the allergen or route by which it reaches the nail apparatus. Therefore, the paucity of reports of contact dermatitis of nail apparatus in the literature compared to the rest of the skin is remarkable. This may probably be attributed to the barrier that the nail plate, eponychium, and hyponychium pose to the outside world, protecting the susceptible nail bed and germinal matrix from harm.[2] Despite this, irritants or allergens find their way into the nail bed and frequently cause damage that may present itself as onycholysis, longitudinal ridging, or chronic paronychia. Further, the destruction of the cuticle with nippers or chemicals, and the disruption of the hyponychium with nail files open portals of entry for organisms and chemicals. Evaluation of severity index can be a useful parameter that could be correlated with nail dystrophy in patients with HE. The paucity of studies correlating the severity of HE and nail dystrophy indicates a need for cohort studies to establish a significant correlation between the two parameters, if any.

MATERIAL AND METHODS

In the present study, 100 consecutive patients of HE presenting to our hospital were evaluated after obtaining clearance from the Institutional Ethical Committee of our hospital and written informed consent was taken from each

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subject. It was an observational study conducted over 1 year. To estimate the 35% prevalence of nail changes in HE patients subjected to 10% absolute precision and 95% confidence level, a sample size of 98 HE subjects was found to be sufficient. Diagnosis of HE was made primarily on a clinical basis correlating with history and clinical findings. However, in a few doubtful cases, a skin biopsy was taken to rule out other mimicking dermatoses. Dermoscopy was performed on patients who were unwilling to biopsy for confirmation.

A detailed comprehensive history from each patient of HE regarding when and where eczema started, their symptoms, duration, trigger factors, frequency of eruptions, complete details of occupation (present and past), manual work such as laborers, housewives, factory workers, painters, and beautician and non-manual (desk job and students), use of personal objects, home environment, use of any topical or systemic medicaments and history of wet work (as defined by German criteria) including frequent (>20) hand washing, usage of occlusive gloves, prolonged wet hands, and care of <4-year-old child was taken.[3] Furthermore, personal as well as family history of atopy, childhood eczema, past treatment if any, or any other skin or systemic disease and family history was recorded. All the details were recorded in a pre-designed case record form. Scoring of disease severity was done using severity index and hand eczema severity index (HECSI).[4] (a) Severity index: On the basis of clinical signs, the severity of HE was graded as 1+, 2+, and 3+, showing increasing severity with a higher score and (b) HECSI, which included grading of morphological symptoms (erythema, induration, vesicles, fissuring, edema, and scaling) of affected areas on the hands divided into five sites: fingertips, fingers (except tips), palms, back of hands, and wrist on the following scale. For each location, the affected area was given a score from 0 to 4 (0 = 0%, 1 = 1–25%, 2 = 26–50%, 3 = 51–75%, and 4 = 76–100%). Finally, the score given for the extent at each location was multiplied by the total sum of the intensity of each clinical feature, and the total sum was calculated.

After complete clinical examination and recording all details about the nature, extent, and morphology of lesions, patients were subsequently subjected to patch testing after clearance of eczema and assessment of the probable contactants relevance in each individual patient. The protocol established by the International Contact Dermatitis Research Group[5] was adopted throughout the study. HE was classified based on the definition of relevant criteria for the classification of chronic HE subtypes into allergic contact dermatitis (ACD), irritant contact dermatitis (ICD), atopic hand eczema (AHE), ACD+AHE, ACD+ICD, and not specified.[6]

Nail units of both the hands in patients were examined to look for signs of periungual inflammation affecting the functioning of the nail matrix unit leading to different clinical reaction patterns and findings were recorded in case record form for every patient. The parameters evaluated were as follows: (1) proximal matrix: pitting/Beaus lines/transverse grooving/trachyonychia/onychomadesis/nail shedding/ longitudinal ridging, (2) distal matrix: Leukonychia, (3) nail bed and hyponychium: onycholysis, (4) paronychium, (5)surrounding tissue: pulpitis/fissures, (6) surrounding contour: brittle nails/worn down nails, and (7) underlying bone: distal bony phalanx anomaly. Samples of nail unit (nail scrapings/subungual debris/nail swab) were sent for bacterial and fungal culture depending on the clinical findings of nail unit examination, such as the presence of chronic paronychia, yellowish or greenish discoloration of nail plate, or subungual hyperkeratosis with onycholysis. Nail scraping or pre-moistened sterile cotton swab rubbed over slightly lifted-up proximal nail fold or subungual debris if any were sent for microbiology for bacterial culture and sensitivity of testing. These specimens were inoculated on blood agar and MacConkey agar plates. The inoculated culture plates were incubated at 37 ± 2°C for 24–48 h for isolation of the bacterial agents. Presumptive identification was done on the basis of colony characteristics, Gram's staining, and catalase test. *In vitro,* antimicrobial sensitivity testing of the isolates was performed by Kirby–Bauer disk diffusion method as recommended by the Clinical and Laboratory Standards Institute (CLSI).[7] Briefly, Muller–Hinton Agar was used as the medium and was inoculated with a suspension of each isolate equivalent to 0.5 McFarland turbidity standards, and disks were applied. Inhibition zones were interpreted according to CLSI guidelines. Recommended ATCC standards were used for quality control.[7] With similar indications, as mentioned for bacterial culture or any other change suspected of colonization by fungal elements, nail scrapings or subungual debris from affected nail were sent for microscopic examination in 10% KOH for colonization in the nail by fungal elements such as hyphae, spores or pseudohyphae. Positive sample on microscopy was sent for further fungal culture, using Sabouraud dextrose agar with or without cycloheximide, and observed for growth-forming colonies.

RESULTS

The age of the patients in our study ranged from 18 years to 64 years and the majority (85%) belonged to the age group of 18–47 years. Females (55%) outnumbered males (45%) in our series of patients. On classifying the patients on the basis of morphology, chronic dry fissured (36%) was the most common pattern followed by the mixed type of morphology (19%), hyperkeratotic palmar (15%), vesicular with recurrent eruption (9%), nummular eczema (7%), and wear and tear dermatitis alone (7%) in our study. Minimal involvement of sites other than the hand was evident in 9%. Bilateral hand involvement was seen in 87% of the patients. Fingers (97%) were the most frequent site to get involved, followed by

palms (69%), dorsum of hand (42%), fingertips (16%), and wrist was the least involved (7%).

Nail involvement was seen in 76% of the patients with females (42%) outnumbering males [34%; Table 1] and 60% had bilateral hand nail involvement. The average duration of disease in our study subjects presenting with nail dystrophy (3.46 years) was comparable to the non-dystrophy group (3.03 years). Loss of cuticle [37%; Figure 1] was the most common nail dystrophic change followed by pitting [30%; Figure 2], longitudinal ridging (28%), beau's lines [26%; Figure 2], paronychia (20%), pulpitis [11%; Figure 3], melanonychia (10%), onycholysis (9%), brittle nails (4%), leukonychia [4%; Figure 4], and onychomadesis [2%; Table 1]. Nail dystrophy was found in 77.6% of patients engaged in manual jobs (masons, factory workers, farmers, housewives, and painters) and it was comparable with non-manual job workers (Clerical work, students, and healthcare worker) [P = 0.359; Table 2]. However, chronic paronychia was significantly higher in patients engaged in manual work (P = 0.036). Patients with a chronic dry fissured type of eczema were found to have the highest chance of nail dystrophy compared with other variants (P = 0.830); as is shown in Table 3.

Nail dystrophy was also found to be most common in patients with ACD+AHE (78.9%), followed by ICD (78.6%), ACD (77.7%), and AHE (71.4%), and it was least in ACD+ICD (61.5%). The association between the prevalence of nail dystrophy and periungual involvement by HE was evaluated, and a highly positive correlation (P = 0.012) was found for paronychia and nail dystrophic changes, while only a marginal correlation could be elicited with fingertip involvement and prevalence of nail dystrophy [P = 0.070; Table 4] History of wet work (as defined by German criteria), including frequent (>20) hand washing, usage of occlusive gloves, prolonged wet hands, and care of <4-year-old child, was reported by 63% of our patients; higher in females (78.2%) than males (44.4%). Periungual swab was reported to be positive for *Staphylococcus aureus* in 8 patients, whereas, one sample was positive for *Pseudomonas aeruginosa*, and one was colonized with *Acenitobacter baumanii, Serratia* species, *Klebsiella pneumoniae*. Nail KOH was positive for yeast in 7 samples sent; however, fungal culture was reported to be negative. *Staphylococccus aureus* colonization over hands was detected in 57 % in patients of HE and 75.4% of those with colonization over hands had nail dystrophy.

On analysis with cutoff values of HECSI (<6, 6–12, >12), 28.9% of patients with nail dystrophy had HECSI >12 (defined as severe), compared to 12.5% in those without nail dystrophy [P = 0.259; Table 5]. Interestingly, 28.9% of the patients with nail dystrophic changes had a disease severity index of 3+, compared to 0 in patients without nail dystrophy (P = 0.001). Similarly, disease duration of more than 5 years was found to be more in patients with nail dystrophy (83.3%),

Table 1: Proportion of nail dystrophic changes according to gender.

Nail changes	Males (n=45)		Females (n=55)		Total	
	No.	%	No.	%	No.	%
Lost cuticle	16	35.6	21	38.2	37	37
Pitting	14	31.1	16	29.1	30	30
Longitudinal ridging	12	26.7	16	29.1	28	28
Beaus lines	12	26.7	14	25.5	26	26
Paronychia	8	17.8	12	21.8	20	20
Pulpitis	2	4.4	9	16.4	11	11
Melanonychia	7	15.6	3	5.5	10	10
Onycholysis	4	8.9	5	9.1	9	9
Brittle nails	0	0	4	7.3	4	4
Leukonychia	4	8.9	0	0	4	4
Onychomadesis	2	4.4	0	0	2	2

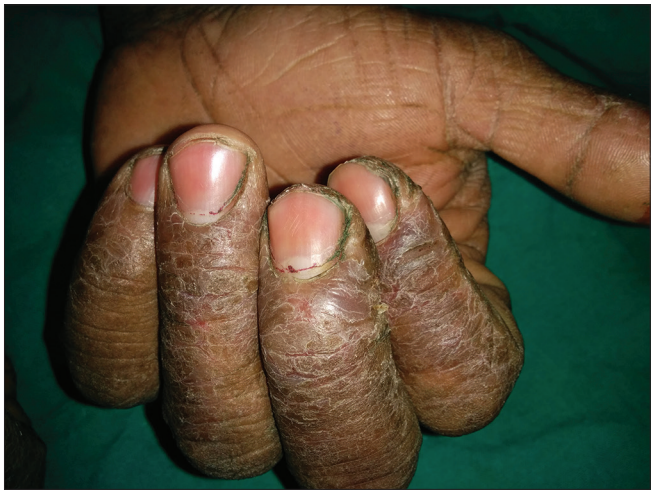

Figure 1: Loss of cuticle in most of the nails in a cement worker with chronic hand eczema.

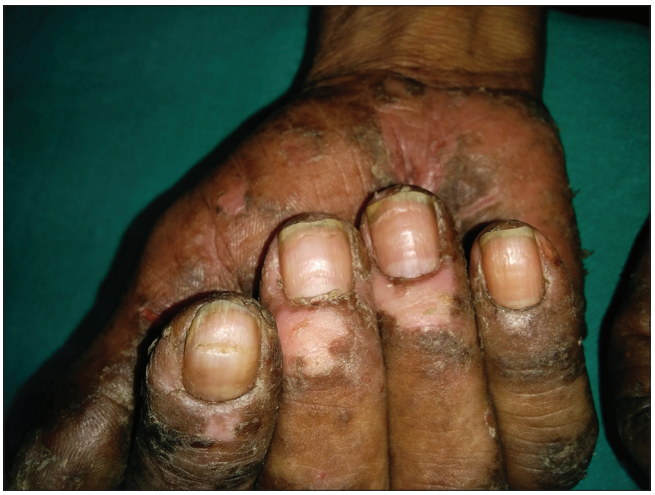

Figure 2: Nail pitting as well as Beau's lines in the nail of a factory worker with contact irritant type of hand eczema.

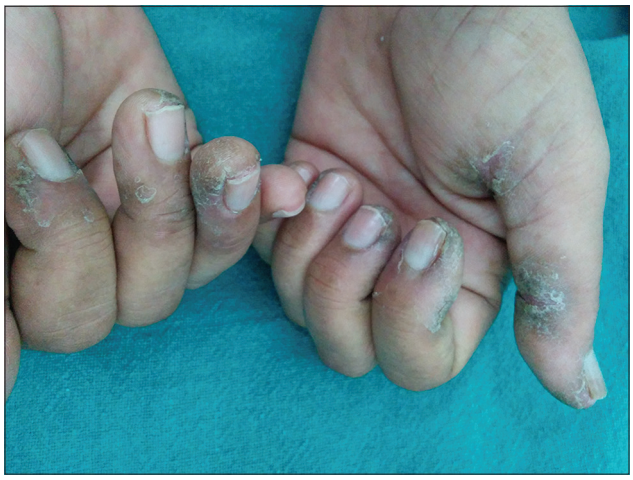

Figure 3: Pulpitis affecting fingers of both hands in a housewife with chronic dry fissured eczema.

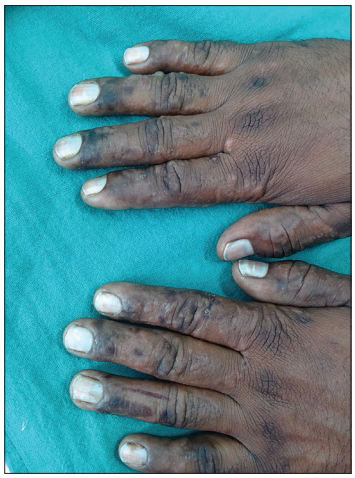

Figure 4: Leukonychia in nails of factory worker with chronic hand eczema.

but no statistically significant correlation was found with <5 years disease duration ($P = 0.550$).

DISCUSSION

Exogenous factors such as wet work and chemical handling can also contribute to nail dystrophic changes, causing cosmetic problems, and affecting quality of life negatively.[8] In the present study, 76% of the total patients had one or more forms of nail dystrophic changes with females (42%) outnumbering males (34%). Only a single study in literature, by Yu *et al.*[1] has evaluated nail dystrophy in HE patients and reported the prevalence of nail dystrophy to be 32.3% in their 124 patients. Beau's lines were also the predominant finding among both sexes (38.3%) in their study followed by nail pitting (17.6%) and longitudinal ridging (11.8%). In our cohort, the incidence of nail dystrophy in patients with manual jobs was 86.8% versus non-manual (13.2%), the difference being insignificant ($P = 0.359$). However, paronychia was significantly more in patients with manual jobs ($P = 0.036$). Whereas, Yu *et al.* failed to establish any significant difference in incidence and morphological features of nail dystrophy accompanied by HE between the two groups of manual and non-manual workers.

Table 2: Differences in nail dystrophy in manual versus non-manual job workers.

Nail dystrophy (*n*=76)	Manual job (*n*=85) *n* (%)	Non-manual job (*n*=15) *n* (%)
Loss of cuticle (*n*=37)	32 (37.6)	5 (33.3)
Pitting (*n*=30)	25 (29.4)	5 (33.3)
Beaus lines (*n*=26)	24 (28.2)	2 (13.3)
Longitudinal ridges (*n*=28)	24 (28.2)	4 (26.6)
Paronychia (*n*=20)	20 (23.5)	0
Pulpitis (*n*=11)	11 (12.9)	0
Melanonychia (*n*=10)	10 (11.8)	0

Table 3: Nail dystrophy in different morphological patterns of Hand eczema.

Morphology	Nail dystrophy *n* (%)
Chronic dry fissured (*n* = 36)	30 (83.3)
Hyperkeratotic palmar eczema (*n* = 15)	10 (66.7)
Nummular eczema (*n* = 7)	5 (71.4)
Vesicular with recurrent eruptions (*n* = 9)	6 (66.7)
Wear and tear dermatitis (*n* = 7)	5 (71.4)
Mixed type (*n* = 19)	14 (73.7)

Table 4: Proportion of patients with periungual involvement with nail dystrophy.

Periungual involvement	Nail dystrophy *n* (%)	*P*-value
Paronychia (*n*=20)	19 (95)	0.012
Fingertip (*n*=16)	15 (93.8)	0.070
Pulpitis (*n*=11)	10 (90.9)	0.289

Table 5: Distribution of HECSI and disease duration among patients with and without nail dystrophy.

	Nail dystrophy		
HECSI	Present (*n*=76) *n* (%)	Absent (*n*=24) *n* (%)	Overall *n* (%)
HECSI <6	24 (31.5)	10 (41.6)	34 (34)
HECSI 6–12	30 (39.4)	11 (45.8)	41 (41)
HECSI >12	22 (28.9)	3 (12.5)	25 (25)
Disease duration≤5 years	61 (80.2)	21 (87.5)	82 (82)
Disease duration>5 years	15 (19.7)	3 (12.5)	18 (18)

HECSI: Hand eczema severity index

In contrast to the findings of Yu *et al*., wherein patients with nail changes had significantly longer disease duration than those who did not have nail involvement ($P < 0.5$), no such significant correlation could be established between disease duration and nail involvement among patients of HE. The possible reason for such a major difference could be attributed to the inclusion of patients with severe disease, (median HECSI of 30.54) by Yu *et al*., compared to our patients (median HECSI of 9.0). Simpson *et al*.[9] reported nail changes in 16% of their atopic dermatitis patients, whereas, we detected nail changes in 28% of our atopic patients ($P = 0.663$).

Furthermore, no significant difference in HECSI between the two groups with and without nail dystrophy was found in our study. On further analysis with cutoff values of HECSI, as mild, moderate, and severe; 28.9% of patients with nail dystrophy had HECSI >12 (defined as severe), compared to 12.5% in those who did not have nail dystrophy, and further, significance could not be elicited ($P = 0.259$). Our findings were in accordance with Yu *et al*., who also did not detect any significant difference in HE severity with nail dystrophy. Interestingly, 28.9% of our patients with nail dystrophic changes had a severity index of 3+, compared to 0 in patients without nail dystrophy ($P = 0.001$). Therefore, the severity index can be a useful parameter that correlates with nail dystrophy in patients with HE. The paucity of studies correlating the severity of HE and nail dystrophy indicates a need for further large cohort studies to establish a significant correlation between the two parameters, if any.

Removal of surface lipid by solvents like detergents leads to the dissolution of hygroscopic substances by water, that is, required to keep the skin pliable and, thus, potentiates the actions of allergens and gives rise to a high proportion of contact allergy in individuals involved with wet work.[10] Most of the Indian studies[11,12] have focused mainly on masons, factory workers, and housewives pertaining to HE and only a few[13] have mentioned about other occupations with wet work. While globally, Meding *et al*.[14] reported a similar (67%) proportion of patients reporting a history of wet work in a questionnaire-based study of 15,000 citizens. Anveden Berglind *et al*.[15] evaluated 18,267 gainfully employed individuals aged 18–64 years in Sweden, and they reported that 16% were exposed to water for ½ h or more a day, and 13% reported exposure to water more than 10 times a day. Furthermore, 7% reported water exposure of more than 2 h and 6% of more than 20 times a day, and females reported more water exposure than males, while, in our study, 59% of the patients reported a history of wet hands more than 2 h, and 47% gave a history of hand washing more than 20 times. Higher proportion of aforementioned factors of wet work in our study can be attributed to higher percentage of housewives and manual occupation like construction workers in our study population while Anveden Berglind *et al*. evaluated gainfully employed individuals.

Contrary to the study by Yu *et al*.,[1] a significant association of periungual involvement in the form of paronychia ($P = 0.012$) and nail dystrophy was established in our study.

CONCLUSION

Nail dystrophic changes were found in a high number of patients with HE affecting the nail matrix due to periungual inflammation leading to defects in the nail plate including loss of cuticle, beau's lines, and coarse pitting. The severity index was significantly higher among patients with nail dystrophy versus those without nail dystrophy. Therefore, it is recommended to include nail dystrophy as an essential part of the evaluation of HE, including the assessment of its severity, and also as a poor prognostic factor in CHE. This emphasizes that nail unit examination constitutes an important part of the examination in all the patients with HE, as it may affect disease course and long-term prognosis.

Declaration of patient consent

The Institutional Review Board (IRB) permission obtained for the study.

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Nil.

Conflicts of interest

Dr. Deepika Pandhi is on the editorial board of the Journal.

Use of artificial intelligence (AI)-Assisted technology for manuscript preparation

The author(s) confirms that there was no use of Artificial Intelligence (AI)-Assisted Technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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