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ORIGINAL ARTICLE

Nail changes in chronic renal failure patients under haemodialysis

A Salem,† S Al Mokadem,*,† E Attwa,† S Abd El Raoof,† HM Ebrahim,† KT Faheem‡

Department of †Dermatology & Venereology and ‡General Medicine, Zagazig University, Zagazig, Egypt

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*Corresponding author, Department of Dermatology & Venereology, Zagazig University, 82 Abd El Aziz Ali Street, Zagazig 11321, Egypt, tel. +010 3571 478; fax +055 2313 199; E-mail: saharmokadem@yahoo.com

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Abstract

Background Chronic renal failure is known to cause various nail pathologies. They may be directly related to the renal condition itself or its complications or to the therapy.

Objective To compare nail changes in end-stage renal failure patients under haemodialysis with healthy persons and to study the potential relationship with various parameters in the patients.

Patients and Methods The study comprised 100 patients with chronic renal failure under regular haemodialysis as well as 100 healthy control subjects of matched age and sex. Both groups were subjected to full history taking and thorough general and nail examination. Complete blood picture, liver and kidney function tests and fasting blood glucose level were investigated.

Results Nail disorders were more prevalent in patients (76%) than in control group (30%). The half and half nail was the most common finding (20%) followed by – in descending manner – absent lunula, onycholysis, brittle nail, Beau's lines, clubbing, longitudinal ridging, onychomycosis, subungual hyperkeratosis, koilonychias, total leukonychia, splinter hemorrhage, pitting and pincer nail deformity. There was non-significant correlation between nail changes and age of the patients or duration of haemodialysis. In addition, no evidence of significant relation was found between nail changes and both haemoglobin and albumin levels.

Conclusion Frequent nail changes are observed on systematic nail examination of uraemic patients undergoing haemodialysis; however, the cause of them remains obscure and could not be traced to a particular abnormality in the renal condition, medication or the procedure itself and it needs further investigations.

Introduction

Abnormalities of the nails can provide clues to common medical problems or severe systemic diseases. Inheritance, minor trauma, common habits and a variety of infections account for many changes in the appearance of nails[1]. Awareness of normal variants, abnormalities and the disease associations could be beneficial as nails are readily examined and may be the only initial signal of a systemic disease.[2]

For example, koilonychia may indicate either iron deficiency or iron overload. Similarly, clubbing is associated with cyanotic conditions such as lung cancer, pulmonary fibrosis and various types of cardiac disease but may also occur in thyroid, liver and bowel conditions, and occasionally in healthy persons. Yellow nail syndrome is associated with lymphoedema, chronic pulmonary infections, thyroid disease and human immunodeficiency virus infection. Connective tissue disorders such as systemic lupus erythematosus, dermatomyositis and systemic sclerosis may produce erythema and telangiectasia of the nail folds.[3,4]

Patients with chronic renal failure may exhibit various cutaneous abnormalities, including changes in skin colour, xerosis, pruritus, metastatic calcinosis and bullous dermatosis in addition to nail changes.[5]

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The most frequent onychopathy observed in chronic renal failure is half-and-half nail (Lindsay nail), absence of lunula, splinter haemorrhages and less frequently brittle nails.[6,7] Half-and-half nail is described as proximal pallor and distal brown-yellow pigmentation of the nail plate, and it was estimated that approximately one third of all haemodialysis patients would exhibit this characteristic nail.[8]

Aim of the work

The aim of this study is to record the overall frequency and spectrum of nail diseases in end-stage renal failure patients under haemodialysis in comparison with healthy persons and to evaluate the potential relationship between nail alterations and some demographic and laboratory parameters in these patients.

Patients and methods

Subjects

This study comprised 100 patients as well as 100 normal control subjects of matched age and sex, divided in two groups:

Group (A): the patient group was composed of 100 patients with end-stage renal failure under regular haemodialysis three times weekly for a period varying from 6 months to 15 years. Haemodialysis was carried out in the Haemodialysis Unit at Zagazig University Hospital, using modified cellulose acetate hollow-fibre dialysers using F80B (Fresenius, Homburg, Germany). All dialysis was performed using acetate-based dialysate. The blood flow rates were usually kept between 250 and 300 mL/min, and the dialysate flow rate was 500 mL/min. All the patients had functioning arteriovenous fistulas in the upper limbs. Their ages ranged from 20 to 73 years. They were 61 males and 39 females.

Group (B): The control group was composed of 100 apparently healthy individuals who were randomly selected with negative history of renal, cardiac or hepatic troubles. Their ages ranged from 21 to 65 years. They were 64 males and 36 females.

Patients and controls had given informed consent to be included in the study.

Patients and controls had to be free from

1 Congenital, systemic or primary skin disorders contributing to nail changes.
2 Application of henna (a common topical colouring herbal extract).
3 Features suggestive of the carpal tunnel syndrome or vascular steal syndrome secondary to arteriovenous fistula.

Methods

After a written consent; both groups were subjected to the following:

1 Full history taking and thorough general examination.
2 Laboratory investigations:
Complete blood picture. Liver function tests including: serum albumin level, serum bilirubin levels (direct and indirect) and SGOT and SGPT enzymes.
Kidney function tests including blood urea level, serum creatinine level and creatinine clearance.
Fasting blood sugar level.
3 Dermatological examination:
Nails were examined for changes as regard texture, colour, thickness, curvature of nail plates and presence or absence of paronychia. The diseased nails were photographed and mycological examination was done when onychomycosis was suspected.
4 Statistical analysis: Data were entered, checked and analysed using Epi-Info version 6 and SPP for Windows version 8. The arithmetic mean (X), the standard deviation (SD), Chi-squared (X^2) test and Student's t-test were used when appropriate. P-value less than 0.05 was considered significant.

Results

The mean age ± SD of the patients was 46.5 ± 11.1 (range, 20–73 years) and of control subjects was 44.26 ± 12.0 (range, 21–65 years) with no significant difference (Table 1).

In general, we found that nail disorders were more prevalent in group A than in group B. One or more nail changes were observed in 76 out of the 100 patients (76%) of group A in comparison with 30 out of 100 persons (30%) of group B with highly significant difference between them ($P > 0.001$; Table 2).

Subgroup analysis revealed that the half-and-half nail was the most common finding in group A (fig. 1) (in 20% of total number of nail changes), while it was only present in 1% in group B. The other nail changes in group A are arranged in descending manner as follows: absent lunula (fig. 2), onycholysis, brittle nail, Beau's lines, clubbing, longitudinal ridging, onychomycosis, subungual hyperkeratosis, koilonychias, total leukonychia, splinter haemorrhage, pincer nail deformity (fig. 3) and pitting (Table 3). Sometimes, two or more changes were present simultaneously in the same patient (e.g. onycholysis with onychomycosis and onycholysis with subungual hyperkeratosis).

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Table 1 Characteristics of the studied groups

	Group A (Cases) *N* = 100		Group B (Control) *N* = 100			
	No.	**%**	**No.**	**%**	***T***	***P***
Age (years) $\bar{x} \pm$ SD	46.5 ± 11.1		44.26 ± 12.0		1.15	0.2
Range	20–73		21–65			NS
Gender						
Male	61	61.0	64	64.0	3.44	0.06
Female	64	39.0	36	36.0		NS

NS, non-significant.

Table 2 Frequency of Nail changes among both groups A and B

	Group A *N* = 100		Group B *N* = 50			
	No.	**%**	**No.**	**%**	X^2	***P***
Nail changes						
Absent	24	24.0	70	70.0	29.56	0.001
Present	70	76.0	30	30.0		HS

HS, highly significant.

Table 3 Various types of Nail changes in group A

Nail changes	No	%
1. Half and half nails	20	20.0
2. Absent lunula	17	17.0
3. Onycholysis	7	7.0
4. Brittle nail	5	5.0
5. Beau's Lines	5	5.0
6. Clubbing	4	4.0
7. Longitudinal ridging	4	4.0
8. Onychomycosis	4	4.0
9. Subungual hyperkeratosis	3	3.0
10. Koilonychia	3	3.0
11. Total leukonychia	2	2.0
12. Splinter haemorrhage	2	2.0
13. Pitting	2	2.0
14. Pincer nail	2	2.0

NB: In some patients more than one nail change were present.

The mean ± SD of duration of haemodialysis, haemoglobin level and albumin level in patients of group A are shown in Table 4. It was observed that there was non-significant correlation between the nail changes and age of the patients, duration of haemodialysis and either haemoglobin or albumin levels (Table 5).

Table 4 Various types of Nail changes in group B

Nail changes	No	%
1. Beaus Lines	5	5.0
2. Longitudinal ridging	4	4.0
3. Onychomycosis	3	3.0
4. Brittle nail	3	3.0
5. Absent lunula	3	3.0
6. Clubbing	2	2.0
7. Onycholysis	2	2.0
8. Koilonychia	2	2.0
9. Pitting	2	2.0
10. Subungual hyperkeratosis	2	1.0
11. Half and half nail	1	1.0
12. Splinter haemorrhage	1	1.0
13. Pincer nail	0	0.0
14. Total leukonychia	0	0.0

Table 5 Mean ± SD and range of haemodialysis duration, haemoglobin (Hb) level and albumin level among patients (group A)

	$\bar{x} \pm$ SD (Range)
Haemodialysis duration (years)	4.4 ± 3.4 (0.5–15)
Hb level	9.6 ± 0.98 (7.9–12.4)
Albumin	3.87 ± 0.3 (3.2–4.5)

Discussion

Chronic renal failure is associated with skin and nail changes. The aetiology of nail pathologies remains unclear: some of them are apparently directly related to the renal conditions, and others claimed to be related to complications or therapy.[9]

On reviewing the nail pathology in 100 end-stage renal failure patients under haemodialysis in comparison with 100 normal persons, we found that there was at least one

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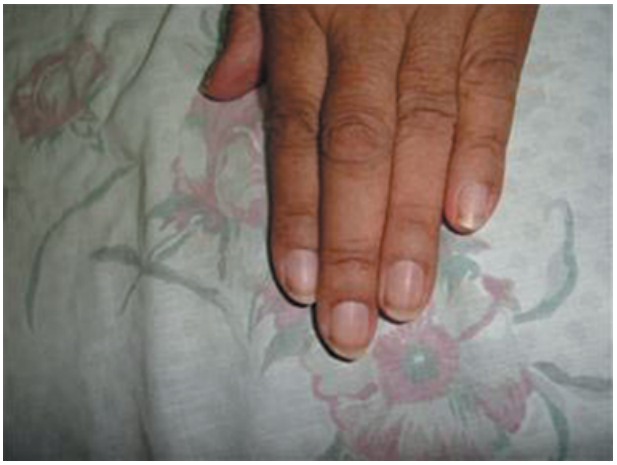

fig. 1 Half and half nail.

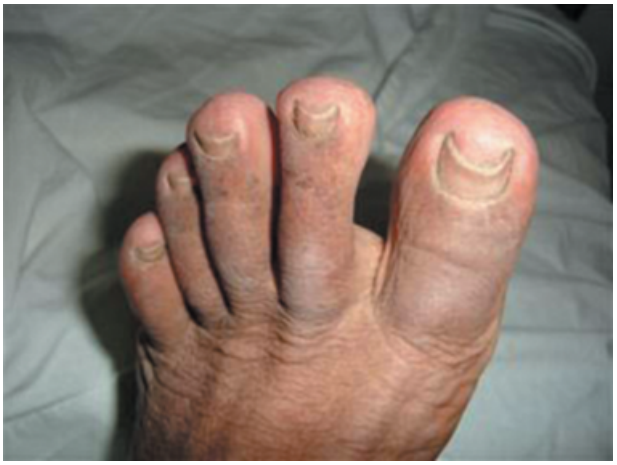

fig. 3 Pincer nail.

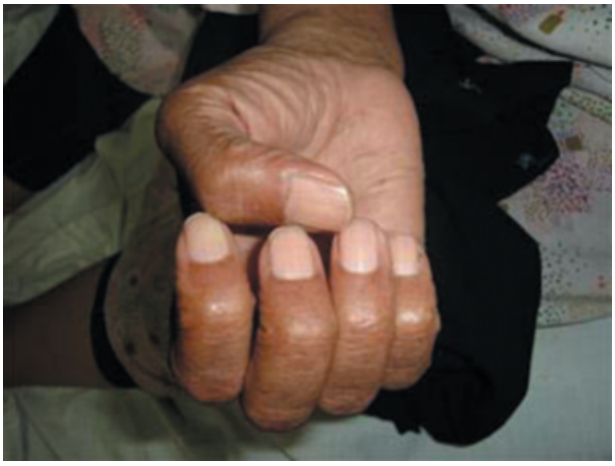

fig. 2 Absent lunula.

type of nail pathology in 76% of patients compared with 30% of the control. The overall frequencies of nail abnormalities in earlier studies were also significantly higher than normal populations and ranged from 52%[10] to 71%.[6] Our results provide no evidence of significant relation between nail changes and the age of the patients or the duration of haemodialysis. This was also the case in previous reports.[5,11] On the contrary, other authors[6] had found that the prevalence increases with haemodialysis duration.

Approximately, one in three haemodialysis patients were found to have micronutrient imbalance, and the trophic changes that have been identified in and around their nails may be suggestive of protein, vitamin or mineral imbalance.[12–14]

Anaemia is an important aetiological factor in nail pathology.[15] However, our study and others'[13,16] proved no evidence of significant relation of haemoglobin level with the nail changes.

Hypoalbuminaemia is a well-known complication of chronic renal failure and is suspected to be an aetiological factor of nail changes.[17] Nevertheless, no significant relationship was observed between serum albumin and the frequency of nail changes in the patient group, and this was the case in previous reports.[5,11]

The commonest nail abnormality observed in 20% of the patient group was the half-and-half nail. Half-and-half nail was recorded to range from 14% to 50% of patients on regular haemodialysis.[5] It was originally considered a specific nail change that is pathognomonic of uremic patients and disappears rapidly after renal transplantation. In addition, half-and-half nail received considerable attention in differentiating chronic from acute renal failure.[6,9]

On the other hand, half-and-half nail is seen in other conditions as Kawasaki's disease, liver cirrhosis, zinc deficiency, and Crohn's disease and also reported in a case of pellagra. Sometimes, no definite relation could be find with a particular disease.[18]

The exact aetiology of this type of pathology remains unclear, but histological studies revealed melanin pigment in the nail plate in some cases. However, in other cases, no melanin was noted but increase in the capillary density under the nail plate. This increase in the capillary density of the nail bed with remarkable thickening of the capillary walls might account for the band of discoloration.[14,19]

As we mentioned, the half-and-half nail frequency did not increase with haemodialysis duration. This could confirm the finding that some patients might develop it often before the need for dialysis, and that it is not due to haemodialysis specifically, but to chronic renal failure.[16]

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Visible lunula is dependent on the size of the matrix. The matrix size is directly proportional to the appearance of lunula as it is an extension of the distal matrix. Thus, visible lunula is a good sign as it may reflect matrix size in healthy cases. It also expresses the nature and extent of nail matrix involvement in the disease process in diseased nails. Absent lunula was observed in diseases characterized clinically by onycholysis, dystrophic nail, nail shedding, trachyonychia, lateral, and distal subungual hyperkeratosis[20,21] and sometimes found in normal persons.[5]

Absence of lunula was identified in 17% of our patients. However, in other studies,[5,6] absent lunula was the most frequent nail change in haemodialysis patients. This pathology can manifest at any time during the course of haemodialysis.

It was reported that absent lunula is attributed to anaemia in chronic renal failure.[15] However, this was not confirmed in our patients. It is possible that absent lunula reflects a variety of complex factors in haemodialysis including metabolic changes in addition to anaemia.[11]

Onycholysis was found in 7% and subungual hyperkeratosis in 3% of patients. In normal conditions, the nail plate adheres strictly to the nail bed especially in the onychocorneal band. This area represents an anatomical barrier and its disruption produces nail plate detachment with onycholysis.[22,23]

Onycholysis is a very common nail change that may result from different local and systemic causes.[7] Certain medications causing photosensitivity can induce photo-onycholysis. Photo-onycholysis was reported in haemodialysis patients in some patients receiving large doses of cephalordine or cloxacillin,[24,25] but in the present study, the patients didn't have a sure history of intake of drugs inducing photo-onycholysis.

We recorded alteration in nail surface in 11% (Beau's lines 5%, pitting 2% and longitudinal ridging in 4%) of the patient group. These alterations are associated with transient defect of the function of the nail matrix and could occur after severe illness.[26]

Alteration in nail consistency as in brittle nails was found in 5% of patients. It was stated that malnutrition, peripheral circulatory diseases, and low level of iron and zinc may be aetiological factors of brittle nail, and these disorders are common in haemodialysis patients.[27]

Clubbing of the nails was seen in 4% of patient group. Specific pathophysiologic mechanisms of clubbing remain unclear. It may be due to increased platelet derived growth factor and hepatocyte growth factor at the nail bed causing periosteal changes.[28,29] It was suggested that clubbing is associated with hyperparathyroidism in the patients under haemodialysis.[30]

It is well established that skin infections occur more frequently in uremic patients than in healthy control due to impaired cellular immunity, but onychomycosis was only reported in 4% of the studied patients. This was considered low when compared with the rates in previous reports (52%[5] and 19.2%).[10]

Splinter haemorrhage was another nail disorder present in 2% of our patients, but it was documented in a range of 11–12%.[6,10] Splinter haemorrhage in haemodialysis patients is widely considered to result from microtrauma, and it was reported that splinter haemorrhage is not a haemodialysis-related but a chronic renal failure–related nail disease. The exact pathogenesis remains unclear, but capillary fragility and thrombocyte dysfunction are common in these patients and may contribute to the development of splinter haemorrhage.[3]

True leukonychia was found in 2% of patient group. It has been described in patients with acute and chronic renal failure, hepatic cirrhosis, patients under chemotherapeutic agents and was the most common nail pathology in renal transplant recipients.[5] It can also occur secondary to increased blood strontium concentration.[31] Strontium accumulation may originate from the oral intake of aluminium containing phosphate binders in patients on prolonged dialysis therapy.[32]

We recorded the pincer nail deformity in 2% of patients. It is most probably due to venous hypertension induced by the iatrogenic arteriovenous fistula done for the dialysis procedure. Altered venous hydrostatic and hydrodynamic conditions may interfere with local microcirculation resulting in some degree of ischaemia. It is relatively common and could be recognized as a specific sign of circulatory disturbance. Regrowth of nails with normal contour is observed after ligation of the fistula.[33]

Conclusion

Frequent nail changes are observed on systematic nail examination of uremic patients, under regular haemodialysis, with half-and-half nail as the most common. Nevertheless, none of these nail changes is associated with haemodialysis specifically. It seems that chronic renal failure itself; not the procedure, may play a role in the development of these pathologies. However the pathogenesis of these alterations remains obscure and could not be traced to a particular abnormality in the renal condition, and further investigations could clear up the actual mechanism of their occurrence.

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