

NAIL CHANGES IN RECENT AND OLD LEPROSY PATIENTS

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Disclosure: No potential conflict of interest.

Received: 27.09.13 **Accepted:** 21.10.13

Citation: EMJ Dermatol. 2013;1:44-52.

ABSTRACT

Nails are elements of skin that can often be omitted from the dermatological assessment of leprosy. However, there are common nail conditions that require special management. This article considers nail presentations in leprosy patients. General and specific conditions will be discussed. It also considers the common nail conditions seen in leprosy patients and provides a guide to diagnosis and management.

Keywords: Leprosy, nails, neuropathy, multibacillary leprosy, paucibacillary leprosy, acro-osteolysis, bone atrophy, type 2 lepra reaction, anonychia, clofazimine, dapsone.

INTRODUCTION

Leprosy is a chronic granulomatous infection caused by *Mycobacterium leprae*, known since ancient times and with great historical connotations.¹ This infection is not fatal but affects the skin and peripheral nerves. The disease causes cutaneous lesions, skin lesions, and neuropathy, with secondary complications potentially resulting in deformity and disability. In fact, leprosy remains a stigmatising disease. In many parts of the world the prevalence of the disease is very low, while in others it is a major public health issue.² Since the generalisation of multidrug therapy (MDT) (or combination of fixed-dose drug treatments with a shorter duration) and early diagnosis of leprosy, there has been an observed decrease not only in prevalence across the world, but also in mortality and morbidity and functional damage.²⁻¹² The number of new cases of leprosy declared by the World Health Organization (WHO) has decreased from 620,000 in 2002, to 182,000 in 2012. Most cases occur in Southeast Asia, America and Africa, and particularly in India, Brazil, Indonesia, Bangladesh, Democratic Republic of the Congo, Ethiopia, Nepal, and Myanmar.^{2,13}

Leprosy can cause damage to the nails, generally indirectly. There are few reviews about the affectation of the nails due to leprosy. Nails are keratin-based elements of the skin structure that are often omitted from the dermatological assessment of leprosy. However, there are common nail conditions that require diagnosis and management. Therefore, we considered it interesting to show our experience obtained in a rural hospital in the southern region of Ethiopia.^{7,14-16} The Gambo General Rural Hospital is a referral institution in Ethiopia's Programme of Leprosy Care according to its Ministry of Health's guidelines for the Tuberculosis and Leprosy Prevention and Control Programme.¹⁷ It is located in the West Arsi zone, 250 km south of Addis Ababa. In 1960, the Leprosy Centre in Gambo was erected and, until 1986, it supervised 20 leprosy care stations in the Arsi Region. After that, it was transformed into the Gambo General Hospital where, in addition to leprosy, they also attend to other general medical conditions. During this period a leper village was built around the hospital. This hospital is a reference centre for the treatment of patients with leprosy.^{7,15,16}

PREVALENCE OF NAIL CHANGES IN LEPROSY

Limited studies have examined the prevalence of nail changes in leprosy patients. In the first study conducted in 1991 in India, Patki and Baran¹⁷ found a prevalence of nail changes of 64% among the 357 patients studied. Years later, Kaur et al.¹⁸ in a study conducted in 2003 with 300 patients with leprosy in India, found a prevalence of 77.3% overall, 56% in paucibacillary (PB) leprosy, 87.3% in the multibacillary (MB) leprosy, and 96% in former lepers living in the surrounding leper village. More recently in the study of El-Darouti et al.¹⁹

involving 115 leprosy patients in Turkey, the prevalence of nail changes found was 86% in both MB and PB leprosy. There are several reviews about nail problems in leprosy patients.¹⁸⁻²⁰

CAUSES OF NAIL DAMAGE

In leprosy nails can be affected in up to three out of four patients with the disease. Associated factors are many and they include repeated trauma, neuropathy, vascular insufficiency, infections, or drugs used in leprosy treatment.^{17-19,21} In [Table 1](#) the causes involved in nail damage in leprosy can be observed.

Table 1. Causes of nail changes and nail pathology in leprosy patients.

Cause	Nail problem
Neuropathy (sensitive, motor, autonomic)	Subungual haemorrhage Onycholysis Onychiauxis Onychogryphosis Pterygium unguis Onychoheterotopia
Injury (acute or chronic injury)	
Vasculopathy	Pterygium unguis Flag sign Pallor of nail
Acro-osteolysis	Brachyonychia Pseudoclubbing or Racket nail Anonychia
Infection (ulcer, osteomyelitis)	Onychomycosis Paronychia
Type 2 lepra reaction	Pterygium unguis
Drugs (clofazimine, dapsone)	Beau's lines Subungual hyperkeratosis Onycholysis
Multifactorial	Longitudinal melanonychia Pitting nails Pseudomacrolunula True leukonychia Hapalonychia Pallor of nail Terry's nails Flag Sign

Neuropathy

The main factor is neuropathy, which also facilitates the negative action of all other causes.¹⁷⁻¹⁹ In this context it can be assumed that, since one of the main causes is peripheral neuropathy, these changes would be similar to those seen in patients with diabetic neuropathy. But this is not so, and we have seen that nail pathology is more frequent and more florid in leprosy patients than in diabetic patients.¹⁹ As a result of neurological damage, there can be a loss of sensitivity and a deformity of the fingers and toes, and from autonomic neuropathy with anhidrotics, dryness and cracking of the skin, particularly of the hands and feet can be observed. Due to anaesthesia of distal areas of the fingers, as well as deformity thereof, any small thermal or mechanical trauma, especially if recurrent, is predisposed to wound or burn with repeated infections of the area, leading to osteolysis of the last phalanx with the tapering and the loss of the tips of the fingers and toes, and therefore of the nails.^{5,6,22}

Acro-Osteolysis

Acro-osteolysis refers to bony resorption of the terminal digital tuft. It is a well-recognised condition in leprosy patients. It is common in advanced stages and appears as a result of nerve disorders (motor, sensory and vasomotor).^{23,24} Acro-osteolysis also is facilitated by: 1) repeated trauma, 2) ischaemia occurring at type 2 lepra reaction endarteritis, 3) diffuse osteoporosis associated with testicular atrophy presenting in leprosy, and 4) bone damage granulomas due to direct specific lepromatous leprosy. Moreover, osteomyelitis can contribute to acro-osteolysis.^{23,24} During bone resorption, osteoclasts break down bone, release minerals, and transfer calcium from the bone fluid to the blood. Absorption of the trabecular (or spongy) bone and the development of bone atrophy (loss of bone density) are associated with impaired nerve function, male sex, grade of disability at diagnosis, and the occurrence of four or more leprosy reactions. The initial changes in the radiograph of the fingers are transverse lytic bands in the distal phalanx, and when damage evolves, this resorption can reach the terminal phalanges with deform destructive osteolytic changes causing dystrophic nails.¹⁸ These nail changes support Baran and Juhlin's hypothesis,²⁵

indicating that the evolution of the nail depends on underlying bone, therefore hyponychia and anonychia occur when the bone is hypoplastic or absent. In fact in leprosy, nail changes usually occur secondary to distal reabsorption of the phalanges.¹⁷

Leprosy Reactions

Another circumstance that has consequences for the nails is the presence of vasculitis, which occurs during type 2 lepra reaction (erythema nodosum leprosum (ENL) reaction). Type 2 lepra reaction is involved with the consequent production of immune complex.¹² Usually it is presented as erythematous subcutaneous nodules, neuronal damage and multi-organ involvement. In this process iridocyclitis, orchitis and other systemic manifestations such as fever, arthritis, lymphadenitis, neuritis or nephritis may appear.²⁶ In this leprosy reaction, peripheral vasculature is affected, precipitating distal tissue loss, sometimes including nails.²⁷ The type 2 lepra reaction may appear before the diagnosis of leprosy during treatment or at the end of treatment.^{4,5}

Drugs

Medications used in the treatment of leprosy, such as clofazimine and dapsone, have also been implicated in various nail changes such as Beau's lines, subungual hyperkeratosis and onycholysis as it is explained after.¹⁷⁻¹⁹

NAIL CHANGES IN LEPROSY

Nail changes are not specific to leprosy and may be observed in other peripheral neuropathies such as diabetes mellitus²⁸ as we have previously indicated. In leprosy patients, the sheet, the matrix, the bed and periungual folds of the nail can all be affected. The alterations may be varied, affecting the shape, size, thickness, surface area, consistency, colour, and relative bed, that is to say the sheet nail tissue in general. In **Table 1**, we can see the type of nail changes in leprosy patients, proposed by Patki and Baran,¹⁷ according to cause of nail damage.

Anonychia

The absence of nail or anonychia (**Figure 1**) is usually the result of disease progression and may be associated with the loss of the terminal

phalange. During this process the nails dry, gradually tarnish, and shrivel before disappearing.²⁹ The anonychia usually affects all nails. At this stage of mutilation with absence of phalanges and anonychia, sometimes the hand resembles the fins of the fish (Figure 1).

Beau's Lines or Transverse Lines

Beau's lines are transverse depressions in the nail plate that occur as a result of a temporary cessation in nail growth (Figure 2). The causes include trauma, nutritional disorders (especially minerals such as zinc and iron), febrile illness, and drug sensitivity.³⁰ In patients with leprosy, they appear after trauma or severe episodes of leprosy reaction or as the side-effect of treatment with dapsone and/or clofazimine.^{31,32}

Brachyonychia

The brachyonychia consist of micronychia (abnormal smallness of the fingernails or toenails) or decreasing the length of the nail, and in leprosy usually appear following the acro-osteolysis and subsequent tissue pad of the fingers (Figure 3).³³

Diffuse Lunula or Pseudomacrolunula

Diffuse leukonychia or pseudomacrolunula was described by Pardo-Castello as an early change in leprosy.³⁴ It produces a distal advancement of the lunula, giving a white appearance to the nail, so it is also known as apparent leukonychia. In these cases it holds the transparency of the sheet, being the matrix and the normal film (Figure 3). This alteration was more frequently found in the study of 118 patients by El-Darouti et al.¹⁹ than in others studies.^{17,18}

Flag Sign

Flag sign is the alternating transverse bands of pseudo-whitish and pinkish discoloration of the nail plate in the fingernail. This sign can be ascribed to peripheral vascular changes that are expected to occur more commonly in MB leprosy patients. It has been described recently in the study of El-Darouti et al.¹⁹ in 15% of patients with leprosy and in 5% of diabetic patients studied.¹⁹

Hapalonychia and Onychorrhexis

Hapalonychia (softened nails) and onychorrhexis (brittle nails) (Figure 4) are characterised by



Figure 1. Hand with absence of phalanges and anonychia, resembles the fins of a fish and also onychoheterotopia.



Figure 2. Nail with Beau's line with transverse depressions in the nail plate.



Figure 3. Nails of three fingers of hand with brachyonychia, diffuse leukonychia or pseudomacrolunula and splinter haemorrhage.



Figure 4. Nail of foot with onychorrhexis.

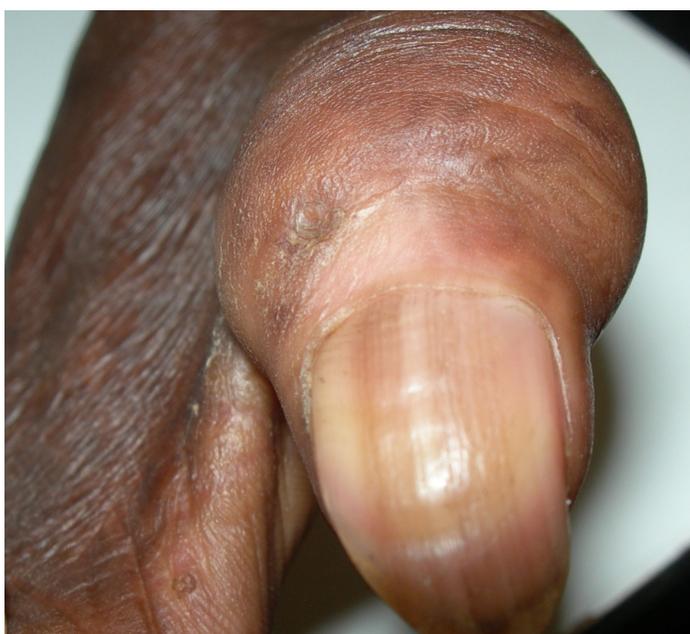


Figure 5. Nail with longitudinal melanonychia and pseudoclubbing with the preservation of the nail-fold angle.



Figure 6. Nails of three toes with onychogryphosis.

softened nails resulting from a defect in the matrix that makes the nails thin and soft so that they can be easily bent. They occur in old leprosy patients³³ and are more frequent in the advanced stages of the disease, especially in the 'crow hand'.^{17,35,36}

Longitudinal Melanonychia

Longitudinal melanonychia is characterised by the presence of longitudinal brown or black lines in the nail plate as a result of increased melanin deposits (Figure 5). They originate in the nail matrix and are the result of an increased production of melanin by matrix melanocytes or an increased number of melanocytes in the nail matrix.¹⁷ It has been associated with a range of drugs, especially hydroxyurea, doxorubicin or zidovudine.³⁷ The prevalence of melanonychia in the general population has been estimated to be 1%, increasing to 12% in hospitalised patients.³⁸ The longitudinal melanonychia is the most common nail manifestation in the study of Kaur et al.¹⁸ and also ranks second in the series of El-Darouti et al.¹⁹

Onychauxis

Onychauxis (localised hypertrophy of the nail plate) manifests as hyperkeratosis, discoloration, and loss of translucency of the nail plate, with or without subungual hyperkeratosis.²¹ It is often part of the nail dystrophy in patients with leprosy.^{18,19}

Onychoheterotopia

Onychoheterotopia (Figure 1) is a growth of nail tissue in any site other than the classical nail unit areas. It develops either after a single overwhelming trauma or after chronic repetitive injuries, which lead to both splitting and implantation of the germinal matrix or heterotopic inoculation of the oncocytes (nail bed cells). Osseous defects may occur from the contact of the ectopic matrix with the underlying bone. Such cases occur predominantly over the dorsal aspect of the hand.³⁹ It is a very rare entity in patients with leprosy³⁹ resulting in continued trauma, and it can be seen in patients with long-standing neuropathic damage.^{18,19}

Onychogryphosis

Onychogryphosis (Figure 6) refers to nail plate thickening with gross hyperkeratosis and

increased curvature of the nail plate, either downward (oyster-like onychogryphosis) or upward (known as ram's horn dystrophy).²¹ It usually occurs as a result of repeated minor injury to the nails as in the onychia. It is more common in toenails than in fingernails,⁴⁰ as it can be associated with poorly fitting footwear. In a series of 20 patients who recovered from leprosy in Japan, onychogryphosis was the most common nail disorder.³³ In patients with leprosy treatment, there was speculation about the possible involvement of clofazimine in its development.⁴¹

Onycholysis

Onycholysis is distal separation of the nail plate from the underlying nail bed and leads to a space where it accumulates subungual keratin and impurities.²¹ Nails with onycholysis are usually smooth, firm, and without nail bed inflammation. It is not a disease of the nail matrix, though nail discoloration may appear underneath the nail as a result of secondary infection, both bacterial and fungal.⁴² Onycholysis is associated with many systemic conditions, not only leprosy, although it is a common disorder in lepers.¹⁷⁻¹⁹ It is worth noting the so-called green nail, which shows a green colouration of the nail due to pyocyanin and pyoverdin pigment produced by *Pseudomonas aeruginosa* infection that often occur when onycholysis and humidity are present in leprosy nails.⁴³

Onychomycosis

Onychomycosis is a fungal infection of the nail. It has been observed in 20-30% of patients with leprosy as recorded by Pardo-Castello and Pardo,³⁴ however, in more recent series the prevalence was found to be <5%.^{18,19} In the general population the prevalence of onychomycosis is about 2%,⁴⁴ which means it is more common in patients with leprosy.^{45,46} The nail can be affected in the context of tinea corporis and results in tinea unguium caused by dermatophytes (*Trichophyton rubrum*, *Trichophyton mentagrophytes*, *Trichophyton tonsurans*, etc.), and at other times by *Candida albicans* ('thrush nail').^{44,46} This condition is characterised by asymmetrical nail discoloration and nail thickening with subungual hyperkeratosis. Infection may be superficial, proximal or distal and sampling for microscopy and/or culture may



Figure 7. Nails pallor with longitudinal striae.

involve nail plate scraping, punch biopsy or collection of subungual debris.

Pallor of Nails

It may occur in leprosy patients, as the result of the anaemia associated to chronic disease or to haemolysis caused by dapsone (haemoglobinopathy), or vascular insufficiency (Figure 7).^{18,19}

Paronychia

Paronychia, consisting of infection of the nail folds, presents in both acute and chronic leprosy forms. The former usually has a bacterial cause (often *Staphylococcus aureus* and/or *Streptococcus pyogenes*) secondary to injury. Patients will often present with a solitary painful distal finger. There may be pus evident on tender, brilliant erythematous nail folds. An important differential diagnosis is herpetic whitlow.³⁷ These repeated bacterial infections cause destruction of the nail matrix, loss of the sheet and finally scarring of the nail bed.⁴⁷

Pitted Nails

Pitted nails are described as pinpoint (or larger) depressions in an otherwise normal nail.

The pittings are staking shaped defects on the surface of the nail plate, which appear due to the presence of parakeratosis in the proximal matrix. Pitting is usually associated with psoriasis and affects 10-15% of patients with the disorder, and it has also been reported in patients with Reiter's syndrome, sarcoidosis, pemphigus, alopecia areata, and incontinentia pigmenti.²¹ In leprosy, it can appear up to 4% of the patients.¹⁸

Pterygium Unguis

Pterygium unguis appears as an extension of the skin of the proximal nail fold that expands distally to adhere to the nail bed. Although lichen planus is the most common cause of pterygium unguis, the lesion may be a consequence of nail matrix destruction caused by other conditions, such as trauma, digital ischaemia, and bullous disorders.⁴⁸ In leprosy it is related to injuries and/or vascular ischaemia in the nail matrix that occur in endarteritis obliterans of type 2 lepra reaction.⁴⁸⁻⁵⁰ No cases were reported in the study by El Darouti et al.¹⁹ but it was common in the study by Patki and Baran.¹⁷

Pseudoclubbing or Racket Nail

The pseudoclubbing or racket nail (Figure 5) appears due to the progressive regression of the pad of the finger with severe bone erosions of the terminal phalanges (brachyphalangia), which lead to the shortening and widening of the nail. Pseudoclubbing may be distinguished clinically from clubbing by the preservation of the nail-fold angle and bony erosion of the terminal phalanges on radiograph. The brachyonychia and pseudoclubbing are common in brachy-dactylia and support Baran and Juhlin's²⁵ hypothesis indicating that the evolution of the nail depends on subjacent bone.

Splinter Haemorrhage and Subungual Haemorrhage

Splinter haemorrhages are extravasations of blood from the longitudinally oriented vessels of the nail bed (Figure 3). These haemorrhages do not blanch with pressure. They are formed as a result of the nail plate-dermis structural relationship and tend to be seen in older patients. They are seen as a grey area and even blue-black through the nail. Trauma is the most common cause, and they may also occur in psoriatic nails or with fungal infection. In leprosy

patients, they occur after trauma, and the patient generally does not perceive them. They may be an early change and are usually followed by reabsorption or detachment of part or the whole nail, even to loss of the sheet. Interestingly, diseases which are similar in appearance, such as subungual nevi or melanoma, can also occur in patients with leprosy, and in these cases dermatoscopy could be very helpful.⁵¹

Terry's Nails

Terry's nails are a special type of macrolunula, yielding a white and opaque colour that reaches 1-2 mm from the distal edge, the distal region being pink or brown.²¹ Most of the nail plate is white, with a narrow pink distal band. All nails tend to be uniformly affected, with an appearance of ground glass. Terry⁵² described it in 1954 in a patient with liver cirrhosis, and it has been found in 80% of patients with liver cirrhosis. In 1987 in India, Singh et al.⁵³ reported Terry's nails in leprosy patients. In the study of El Darouti et al.¹⁹ up to 17% of patients with leprosy had this nail disorder.

True Leukonychia

In the true leukonychia the nails are strikingly white, opaque with smooth surface and normal strength. The nail beds, folds and edges were normal. The origin of the white nail plate is in the matrix. True leukonychia may be total or subtotal, temporary or permanent. Partial leukonychia can be punctate, transverse and distal. The common causes of these disorders of keratinisation of distal nail matrix include: local trauma, exposure to extreme cold, disturbed nutrition and hepatic cirrhosis.²¹

PERSONAL EXPERIENCE OF NAIL CHANGES IN OLD LEPROSY PATIENTS

A cross-sectional study was conducted in June 2011 in the Gambo General Rural Hospital.¹⁴ patients were collected from the 45 admitted to the hospital. Four patients were excluded because they were admitted for treatment of leprosy or they were diagnosed less than 2 years previously. From 10 patients, 5 cases were women; the median age was 50.5 years (range: 33-65) and the time to diagnosis was 20 years (range: 2-40). 20 hands and 15 feet were assessed (5 feet had been amputated); also, 3 fingers were amputees.

Table 2. Fingernail and toenail changes in 10 old leprosy cases.

	Percentage
Fingernails	
Any change	94.0
Longitudinal striatal	46.6
Pseudoclubbing or Racket nails	25.8
Longitudinal melanonychia	24.7
Brachyonychia	20.6
Pallor of nails	20.6
Onychauxis	18.6
Hapalonychia	11.3
Beau's lines	10.3
Onychorrhaxis	8.2
True leukonychia	8.2
Ectopic nail	7.2
Terry's nails	7.2
Onychogryphosis	5.2
Pterygium unguis,	2.1
Anonychia,	2.1
Pterygium unguis	2.1
Flag sign	1.0
Subungual haemorrhage	1.0
Toenails	
Any change	94.0
Onycholysis	49.3
Brachyonychia	49.3
Onychauxis	47.9
Pseudoclubbing or Racket nails	36.6
Onychogryphosis	22.5
Longitudinal striatal	19.7
Onychorrhaxis	16.9
Anonychia	12.7
Ectopic nails	8.5
Beau's line	4.2
Longitudinal melanonychia	2.8
Onychomycosis	1.4

Three patients had ulcers on their feet, and one hand was fin-shaped due to a severe acro-osteolysis. All patients had nail changes in the hands and/or feet. 94% of the fingernails and 95% of the toenails showed alterations. Changes in the fingernails and toenails are recorded in **Table 2**. The main changes in the fingernails were longitudinal striae, pseudoclubbing and longitudinal melanonychia, however the main changes in the toenails were onycholysis, brachyonychia and onychauxis.

TREATMENT OF NAIL PROBLEMS

The main focus for treating leprosy is in the early diagnosis, which allows the prevention of subsequent disabilities. Delay in the diagnosis is the main factor for a neuropathy, and peripheral neuropathy is the main cause of nail problems in these patients. Moreover, in the management of these patients it is important to adhere to correct hygiene of the hands and feet. A proper cleaning of hands and fingers with water and soap may prevent small injuries, and the use of petroleum jelly on the hands and feet may prevent friction and small lesions on the nails. Finally, proper rehabilitation of the disabilities on the hands and feet may reduce the prevalence of nail changes.

CONCLUSIONS

In conclusion, nail changes in leprosy are multifactorial and could be related to one or more of the following factors: neuropathy, endarteritis, trauma, drugs, or superimposed infections. Several diverse nail changes are known to occur in leprosy. Therefore it is necessary to consider the pathology of the nails as an important part of leprosy for a proper diagnosis and treatment of such a complex disease.

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