NAIL DISORDERS

Diagnosis and Treatment of Infectious, Inflammatory, and Neoplastic Nail Conditions

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Nail problems (Table 1) are common complaints among patients. The physician treating nail disorders should have a thorough understanding of the anatomy of the nail and its growth pattern.

NAIL ANATOMY AND TERMINOLOGY

The nail bed lies beneath the nail plate and contains the blood vessels and nerves. The nail matrix is the root of the nail, and its distal portion is visible on some nails as the half-moon-shaped structure called the lunula. The nail plate is surrounded by the perionychium, which consists of proximal and lateral nail folds and the hyponychium, the area beneath the free edge of the nail.

NAIL GROWTH AND KINETICS

Nails grow at a rate of approximately 0.1 mm per day, which means it takes about 4 to 6 months to regenerate a fingernail and 8 to 12 months to replace a toenail. The nail matrix is the germinative portion of the nail and is responsible for the formation of the nail plate. Damage to the matrix usually causes an abnormal nail plate, which may result in a permanent nail dystrophy, such as a split nail. Conversely an injury to the nail plate or nail bed usually allows for regrowth of a normal nail.

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### Table 1. DIFFERENTIAL DIAGNOSIS OF NAIL DISORDERS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Physical Examination/ History</th>
<th>Laboratory</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onychomycosis</td>
<td>Hyperkeratosis of nail bed, yellow-brown discoloration, onycholysis. Usually chronic</td>
<td>KOH positive, culture positive</td>
<td>Systemic or topical antifungal therapy</td>
</tr>
<tr>
<td>Paronychia, acute</td>
<td>Red, warm, tender nail. Often follows injury to nail fold</td>
<td>Positive bacterial culture, usually <em>Staphylococcus</em></td>
<td>Systemic antibiotic</td>
</tr>
<tr>
<td>Paronychia, chronic</td>
<td>Boggy, swollen, red inflamed nail folds. Usually occurs in people who have wet work jobs</td>
<td>Pus is KOH positive and culture positive for <em>C. albicans</em></td>
<td>Anti-candida therapy, topical or systemic</td>
</tr>
<tr>
<td>Psoriasis</td>
<td>Usually associated with cutaneous psoriasis. Pitting, onycholysis, splinter hemorrhages, nail bed hyperkeratosis</td>
<td>KOH negative</td>
<td>Topical or intralesional steroids</td>
</tr>
<tr>
<td>Lichen planus</td>
<td>Ridging early. Can eventuate in scarring and pterygium formation</td>
<td>KOH negative</td>
<td>Systemic, topical, or intralesional steroids</td>
</tr>
<tr>
<td>Melanoma</td>
<td>Pigmented band in the nail that widens or darkens</td>
<td>Biopsy nail bed or matrix depending on site of pigment</td>
<td>Wide excision</td>
</tr>
<tr>
<td>Squamous cell carcinoma</td>
<td>Hyperkeratosis, onycholysis, melanonychia</td>
<td>Biopsy lesion</td>
<td>Excision, sometimes Mohs surgery</td>
</tr>
<tr>
<td>Habit tic</td>
<td>Usually thumbs, horizontal parallel grooved lines on nail plates. History of manipulating nail folds</td>
<td>KOH negative</td>
<td>Explain cause to patient, occasionally wrapping nail</td>
</tr>
<tr>
<td>Mucous cyst</td>
<td>Occurs on proximal nail fold, and over DIP joint</td>
<td>Mucin expressed from punctured lesion</td>
<td>Excision, repeated liquid nitrogen, intralesional cortisone</td>
</tr>
</tbody>
</table>

KOH = Potassium hydroxide; DIP = distal interphalangeal.

## INFECTIOUS NAIL DISEASES

### Onychomycosis (Fungal Nail Infection)

Onychomycosis includes tinea unguium, caused by dermatophyte fungi; candidiasis of the nail, caused by *Candida albicans*; and infections caused by other yeast and nondermatophyte fungi. Fungal infections of the nails are common worldwide without racial predilection. Some per-
sons may have genetic predisposition to the development of chronic onychomycosis. Other factors that may increase the development of onychomycosis are humidity, heat, trauma, diabetes mellitus, and underlying tinea pedis.

Onychomycosis is the most common nail disorder representing 40% of all onychopathies and 30% of all cutaneous fungal infections. It is frequently overdiagnosed, however. Nonfungal nail conditions, such as psoriasis, can be indistinguishable from onychomycosis; therefore it is important not to rely on clinical inspection alone to diagnose fungal infections of the nail. A potassium hydroxide (KOH) preparation or fungal culture should be performed to substantiate the diagnosis.

Physical Examination

The various subtypes of onychomycosis are based on their pattern of involvement of the nail unit.

1. Distal subungual onychomycosis (Fig. 1) is so named because the site of invasion is the distal nail bed, and progression is distal to proximal. Nail bed hyperkeratosis and yellow-brown discoloration are usually present, with eventual crumpling and disintegration of the nail plate. The most common dermatophytes are *Trichophyton rubrum* and *T. mentagrophytes*, although others also can be seen. Distal subungual onychomycosis of the toenails is usually associated with tinea pedis. When it occurs in fingernails, it is often associated with scaling of the palm of the affected hand and both feet. The organism on the hands is usually *T. rubrum*.

2. Proximal subungual onychomycosis (Fig. 2) is quite rare in people with intact immune systems. It occurs when the organisms invade the nail plate proximally. The causative organism is usually a dermatophyte. The clinical presentation is that of white or yellow discoloration on the ventral surface of the nail plate beginning at the proximal nail fold and extending distally.

3. White superficial onychomycosis (Fig. 3) is characterized by white
Figure 2. Proximal subungual onychomycosis.

Figure 3. White superficial onychomycosis.

Figure 4. Candida onychomycosis in chronic mucocutaneous candidiasis.
discoloration on the surface of the toenail that can be easily scraped away with a blade. Because it is superficial in location, it can be treated topically. The causative organism is *T. mentagrophytes* in most of the cases.

4. True *Candida onychomycosis* (Fig. 4) occurs in a rare condition called *chronic mucocutaneous candidiasis*. Normally, *Candida* is not a good invader of nail plate keratin but can involve the nail folds and nail bed (see chronic paronychia [Fig. 5] and onycholysis [Fig. 6]).

**Differential Diagnosis**

Psoriasis is the most common nail disorder that can be mistaken for onychomycosis. Usually other signs of psoriasis are present on the body. In uncertain cases, confirmation by KOH examination of nail debris and fungal culture for identification are required.
Onychomycosis from Molds

Nondermatophyte molds are a rare cause of onychomycosis and their role in the pathogenesis of onychomycosis is somewhat controversial. The most common mold isolated from diseased nails is *Scopulariopsis brevicaulis*.

Management

Treatment of onychomycosis must be tailored to the type of infection and individual patient needs. Because onychomycosis is frequently over-diagnosed, it is important to demonstrate fungus by KOH preparation or culture before initiating systemic antifungal therapy. Except in the case of white superficial onychomycosis, topical antifungal therapy is rarely curative. Two new oral antifungal medications have been approved by the Food and Drug Administration for the treatment of onychomycosis: itraconazole (Sporanox) and terbinafine (Lamisil). Fluconazole (Diflucan) is awaiting FDA approval for onychomycosis. All shorten treatment duration and minimize side effects in the treatment of onychomycosis. It is incumbent on the physician treating onychomycosis with systemic antifungal medications that the proper diagnosis has been confirmed. In addition, the physician should be aware of potential drug-drug interactions and monitor for medication side effects (Table 2).

Paronychia

*Paronychia* is defined as infection or inflammation of the nail folds. It can be acute or chronic based on the pathogenesis and organism.

Acute Paronychia

Acute paronychia results from a bacterial infection of the nail folds. It usually follows some kind of trauma to the nail folds, such as overaggressive manicuring or injury. The most common bacterial agents in acute paronychia are *Staphylococcus aureus* and *Pseudomonas* species.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Brand Name</th>
<th>Dose</th>
</tr>
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<tbody>
<tr>
<td>Itraconazole</td>
<td>Sporanox</td>
<td>Continuous—200 qd for 90 d</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pulse—200 bid 1 week per month for 3 mo</td>
</tr>
<tr>
<td>Terbinafine</td>
<td>Lamisil</td>
<td>Continuous—250 mg qd for 90 d</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pulse—250 bid 1 week per month for 3 mo</td>
</tr>
<tr>
<td>Fluconazole</td>
<td>Diflucan</td>
<td>300 mg every week until nails are clinically clear (not FDA approved)</td>
</tr>
</tbody>
</table>

qd = every day; bid = twice a day.
Treatment is similar to that of other bacterial infections of the skin and includes draining and administering a systemic antibiotic.

**Chronic Paronychia**

Chronic paronychia (see Fig. 5) causes swollen, red, tender, boggy nail folds. It occurs most frequently in people with wet work jobs or in those whose hands are exposed to solvents and chemicals. The first occurrence is separation of the cuticle and nail folds from the nail plate, followed by the formation of a potential space for various microbes to invade, especially *C. albicans*.

**Management**

Treatment includes drying the area and applying anticandidal agents. In cases of severe inflammation, topical or intralesional steroids can be used. It is important to educate the patient about excessive water and chemical exposure.

**DERMATOLOGIC DISEASES THAT AFFECT THE NAILS**

**Psoriasis**

Psoriasis occurs in 2% to 3% of the population, and between 10% and 50% of psoriatics have nail involvement. Psoriasis of the nails is an unsightly condition, which can have a serious emotional impact on people who work with their hands.

**Physical Examination**

Psoriasis of the nails (Fig. 7) can have a variety of clinical manifestations depending on the site of the nail unit involved. Nail plate pitting is due to involvement of the matrix; onycholysis, subungual hyperkeratosis, and yellow discoloration (*oil drop sign*) are due to involvement of the nail bed. Psoriasis of the nail is often indistinguishable clinically from fungal infection of the nail. Clinical inspection of other areas of the body that are psoriasis prone (elbows, knees, scalp, gluteal cleft) and negative KOH examination and fungus culture can provide clues to the diagnosis of psoriasis of the nails. Approximately 5% of psoriatic patients have psoriasis limited to the nails, a situation that poses a diagnostic challenge.

**Management**

Treatment of psoriasis of the nails can be challenging and at times frustrating. Often as cutaneous psoriasis clears, the nails clear as well. Topical steroids may be helpful in some mild cases; however, results
Figure 7. Psoriasis of the fingernails showing pitting, onycholysis, splinter hemorrhages, and oil drop discoloration.

are usually disappointing in severe psoriatic involvement of the nails. Intraleisional steroid injections (triamcinolone acetonide 3 mg/mL) to the nail folds overlying the nail matrix are generally more helpful, although not always welcomed by the patient. Psoralen plus ultraviolet A (PUVA) and grenz ray are sometimes beneficial in severe cases. A dermatologist should be consulted for these treatments.

Lichen Planus

Lichen planus is a relatively uncommon disorder that can affect the skin, nails, or both. When it occurs in the nails, it can rapidly destroy the nail matrix, leading to onychorrhexis (longitudinal ridges) and eventual destruction of the nail plate (Fig. 8). The end stage of lichen planus of the nails is destruction of the matrix so that portions of the nail fail to

Figure 8. Lichen planus of the nails with onychorrhexis (longitudinal ridging).
Figure 9. End stage lichen planus of the nails with total destruction of the nail unit.

grow (Fig 9). The resultant defect is called a pterygium and is characterized by areas of the nail where the proximal nail fold adheres to the nail bed where the nail is missing.

Management

Potent topical corticosteroids can be tried, but systemic steroids are sometimes necessary for the treatment of rapidly destructive lichen planus of the nails.

NEOPLASTIC NAIL CONDITIONS

Pigmented lesions of the nail are the most significant nail condition and need to be taken seriously. It is impossible to know without a biopsy whether a pigmented band in the nail is a benign melanocytic nevus, reactive melanocytic hyperplasia, or a melanoma.

Malignant Melanoma

Malignant melanoma of the nail unit is rare, accounting for only 1% to 4% of melanomas. Although 20% of these are amelanotic, containing little or no pigment, most start as a solitary longitudinal pigmented band in the nail. The band usually widens and darkens over time, and frequently there is leaching of pigment into the proximal nail fold (Hutchinson’s sign). The most commonly involved nails are the great toe and thumb. More than 25% of patients give a history of prior trauma to the digit, which, in some cases, is the cause of a delay in seeking medical attention. There are many benign causes of longitudinal pigmented bands in the nail, including melanocytic nevus (Fig. 10), certain medications (Fig. 11), and even as a normal occurrence in patients with deeply pigmented skin; but any solitary pigmented band that widens,
darkens, or otherwise alters the nail plate needs further evaluation. The onus is on the physician to be certain that a pigmented band or spot on the nail is not a melanoma.

**Management**

Early detection and wide surgical excision are essential. When there is doubt about the diagnosis, referral to a dermatologist and biopsy of nail bed, nail matrix, or surrounding tissue are indicated. Once the diagnosis of malignant melanoma is confirmed, referral to an oncologic surgeon experienced in the management of malignant melanoma is mandatory.

Other cutaneous neoplasms occasionally are seen in the nail unit.
Both basal cell carcinoma and squamous cell carcinoma (Fig. 12) occur rarely in the nail bed. A benign painful tumor that is often seen in a subungual location is a glomus tumor, an encapsulated tumor of the arteriovenous anastomosis in the nail bed. These tumors may be seen beneath the nail as a red or blue discoloration, but the main distinguishing feature is pain, which may be spontaneous or associated with cold. A benign bony growth called an exostosis can occur subungually, usually beneath the toenail, and often after trauma to the digit.

**OTHER COMMON NAIL DISORDERS**

**Habit Tic Disorder**

Habit tic disorder (Fig. 13) is a common disorder self-induced and characterized by horizontal parallel ridges in the nail plate. It results from frequent repetitive manipulation of the cuticle and nail fold overlaying the matrix. The thumb is the most commonly involved digit. Once
Table 3. NAIL SIGNS OF SYSTEMIC DISEASE

<table>
<thead>
<tr>
<th>Nail Sign</th>
<th>Nail Appearance</th>
<th>Systemic Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clubbing</td>
<td>Increased unguophalangeal angle</td>
<td>Cardiopulmonary (80%) and gastrointestinal disorders</td>
</tr>
<tr>
<td>Half-and-half nail</td>
<td>Proximal half is brown, distal half is white</td>
<td>Renal failure</td>
</tr>
<tr>
<td>Nail fold telangiectases</td>
<td>Dilated vessels in proximal nail fold and cuticle</td>
<td>Dermatomyositis and systemic lupus erythematosus</td>
</tr>
<tr>
<td>Splinter hemorrhages</td>
<td>Longitudinal brown streaks under the nail</td>
<td>Trauma most common cause but also may be seen in subacute bacterial endocarditis</td>
</tr>
<tr>
<td>Mees' lines</td>
<td>Transverse white lines</td>
<td>Arsenic poisoning</td>
</tr>
<tr>
<td>Muehrcke's lines</td>
<td>Double white transverse lines</td>
<td>Chronic hypoalbuminemia</td>
</tr>
<tr>
<td>Koilonychia</td>
<td>Thin everted distal edge</td>
<td>Anemia, Plummer-Vinson syndrome</td>
</tr>
<tr>
<td>Azure lunula</td>
<td>Blue lunula</td>
<td>Hepatolenticular degeneration (Wilson's disease)</td>
</tr>
<tr>
<td>Terry's nails</td>
<td>Milky white nails with prominent onychodermal band</td>
<td>Cirrhosis, chronic congestive heart failure</td>
</tr>
<tr>
<td>Plummer's nails</td>
<td>Onycholysis</td>
<td>Thyrotoxicosis</td>
</tr>
</tbody>
</table>

Figure 14. Digital mucous cyst.
the cause of the problem is explained to the patient, the cure is simply a matter of leaving the nail alone.

**Digital Mucous Cyst**

Mucous cysts (Fig. 14) are the most common tumor of the digit and usually occur on the dorsal surface of the finger between the nail folds and the distal interphalangeal joint. They are not a true cyst because they lack a cystic lining but are more accurately called *focal mucinosis*.

**Nail Changes in Systemic Disease**

Some nail findings provide helpful clues for the diagnosis of systemic disorders. A few nail signs are specific for underlying medical problems. Nail fold telangiectases are associated with connective tissue disorders, such as systemic lupus erythematosus and dermatomyositis. Clubbing is associated with pulmonary and gastrointestinal disorders. Other much less specific nail signs, such as splinter hemorrhages, may be seen in subacute bacterial endocarditis but are more commonly seen in trauma to the nail (Table 3).

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