The purpose of this book is to guide the dermatologist and the general physician in the differential diagnosis and treatment of melanonychias. Melanonychia is a longitudinal pigmentation of the nail and it is considering a common presenting problem in general dermatology. The differential diagnosis varies from subungual hematoma to a fungal infection to a melanocytic lesion (hypermelanosis, lentigo, nevus, and melanoma) among others. Melanonychia may also indicate an early stage of nail melanoma, and its diagnosis remains a challenge among dermatologist. A recent publication on Dermatologists accuracy in early diagnosis of melanoma of the nail matrix showed that in situ melanoma of the nail matrix is very difficult for dermatologists to diagnose, regardless of the level of their experience.

On *Melanonychias* the reader will find a complete discussion about all the most important topics on this condition, since its basic aspects (such as nail anatomy and epidemiology) until applied topics (including clinical features, nail biopsy and treatment).

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Piraccini BM, Starace M. Nail disorders in infants and children. Dermatology. 2014;26:1–6.
Richert B, André J. Nail disorders in children: diagnosis and management. Am J Acad Dermatol. 2011;12:101–12.
Tosti A, Baran R, Morelli R, et al. Progressive fading of a longitudinal melanonychia due to a nail matrix melanocytic naevus in a child. Arch Dermatol. 1994;130:1076–7.
Tosti A, Baran R, Piraccini BM, et al. Nail matrix nevi: a clinical and histopathologic study of 22 patients. J Am Acad Dermatol. 1996;34:765–71.
Tosti A, Piraccini BM, Cadore de Farias D. Dealing with melanonychia. Semin Cutan Med Surg. 2009;28:49–54.
Tosti A, Piraccini BM, Cagalli A, et al. In situ melanoma of the nail unit in children: report pf two cases in fair-skinned Caucasian children. Pediatr Dermatol. 2012;29:79–83.
Uchiyama M, Minemura K. Two cases of malignant melanoma in young persons. Nippon Hifuka Gakkai Zasshi. 1979;89:668.

Non-melanocytic Melanonychia

9

Anna Q. Hare, Emily Bolton, and Phoebe Rich

Key Features

Nonmelanocytic causes of melanonychia include exogenous and endogenous factors.

Monodactylous versus polydactylous pathology is helpful in narrowing the differential diagnosis.

The presence of key findings on physical examination may point to a diagnosis.

Non-invasive diagnostic procedures can preclude the need for biopsy.

Caution is always warranted as multiple pathological conditions can coexist in the nail, and it is recommended to follow any nail pigmentation over time.

Introduction

Melanonychia is brown, black, or gray pigmentation of the nail of any cause. Most cases of melanonychia are the result of increased production of melanin by nail matrix melanocytes because of either melanocyte activation or melanocyte proliferation. In some cases, melanonychia is caused by substances other than melanin, such as blood, fungi, or pyocyanin produced from *Pseudomonas aeruginosa*. Often, these other

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pigments mimic the clinical features of nail melanoma; therefore, careful diagnosis and workup are important. If the cause of melanonychia is not clinically clear, additional measures must be taken to determine whether the pigmentation is derived from matrix melanocytes or from other sources. Knowledge of these diverse etiologies of melanonychia is important to thoroughly work up melanonychia in a patient. Discussions in this chapter focus mainly on nail pigmentation from causes not directly related to matrix melanocyte melanin production, although there is some overlap.

It is convenient to discuss melanonychia in terms of causes that are exogenous or endogenous to the nail. Exogenous causes include local infection, trauma, and staining; endogenous processes include medications, inflammation, and hormones.

Epidemiology

Melanonychia not caused by melanoma or melanocyte activation is very common. Although those with a darker complexion have a higher propensity toward melanocyte activation, exogenous causes such as trauma, infection with fungus or bacteria, or exogenous staining have no boundaries within the population. However, knowing the medical background, occupation, and hobbies of the patient may help to point toward certain etiologies. Patients with diabetes or HIV may be at a higher risk for fungal or bacterial infection, or may be taking medications known to cause melanonychia. Those whose occupations involve heavy metals or who frequently use staining products such as tobacco or hair dyes are obviously at a higher risk of nail pigmentation from those products.

Clinical Features

Organisms

The most common cause of exogenous nail pigmentation is fungal melanonychia. Dermatophytes are the most common organism responsible for onychomycosis

Table 9.1 Some common organisms causing fungal melanonychia

Dermatophyte molds
Trichophyton rubrum
Trichophyton soudanense
Yeasts
Candida albicans
Candida tropicalis
Candida parapsilosis
Nondermatophyte molds
Fusarium oxysporum
Chaetomium spp.
Scytalidium
Aspergillus niger
Cladosporium
Exophiala

(approximately 75% of all cases; yet, the causative organism can be yeast, dermatophytes, or nondermatophytic molds (Table 9.1) (Baran et al. 2012; Tosti 2015). In melanonychia caused by fungal infection, the organism itself is generally the source of the pigment. Many dermatophytes produce a soluble, nongranular melanin, either in their cell walls or excreted, that can stain the nail plate (Haneke and Baran 2001). It is hypothesized that there is an evolutionary advantage to melanin production among fungi, which may confer some resistance to some topical antifungal therapy (Baran et al. 2012). Dematiaceous fungi, which produce pigment, are increasingly common culprits in onychomycosis and are more resistant to treatment than typical dermatophytes. *Trichophyton rubrum*, a dermatophyte, and the dematiaceous nondermatophyte mold *Scytalidium dimidiatum* are the most common agents of fungal melanonychia (Tosti 2015). One helpful finding in melanonychia due to fungal infection is that the melanonychia typically spares the matrix, whereas a neoplasm producing melanin commonly originates in the matrix. Occasionally, fungal stimulation of matrix melanocytes may be seen, causing longitudinal melanonychia that can make differentiation difficult. Other clues to dermatophytes being a cause of melanonychia include surrounding nail yellow dyschromia or subungual debris noted in multiple nails (Figs. 9.1, 9.2, 9.3, 9.4, and 9.5). When a fungal cause is suspected, a positive potassium hydroxide (KOH) test on a nail clipping is the first and easiest step in diagnosis, followed by culture, nail clipping for histology, and periodic acid-Schiff (PAS) or in some cases polymerase chain reaction (PCR) (Gupta and Simpson 2013; Stephen et al. 2015; Finch et al. 2012).

Several Gram-negative bacteria such as *Pseudomonas* and *Proteus* can cause melanonychia as well, which can be dark and sinister appearing in some nails (Haneke and Baran 2001). This pigmentation typically occurs at the lateral nail fold. *Pseudomonas*, the most common of these, affects onycholytic nails and deposits a green black pigment called pyocyanin. Treatment in this case consists of topical anti-pseudomonal medications, including eye drops and drying topical medications,

Fig. 9.1 Fungal melanonychia

Fig. 9.2 Fungal melanonychia

Fig. 9.3 Fungal melanonychia with the overlying nail plate removed

Fig. 9.4 Nondermatophyte mold as a cause of pigmentation

Fig. 9.5 Candida and paronychia

Fig. 9.6 Fungal melanonychia with onycholysis and *Pseudomonas*

Fig. 9.7 Melanonychia due to *Pseudomonas* in an onycholytic nail

and treating any underlying onychomycosis and onycholysis of any cause is helpful (Figs. 9.6 and 9.7).

Trauma

Trauma can result in a dark nail, causing alarm among physicians and patients who worry that the black color is due to melanoma (Figs. 9.8 and 9.9). Trauma causes dark

Fig. 9.8 Subungual hemorrhage: notice the sharp demarcation

Fig. 9.9 Hemorrhage under the nail

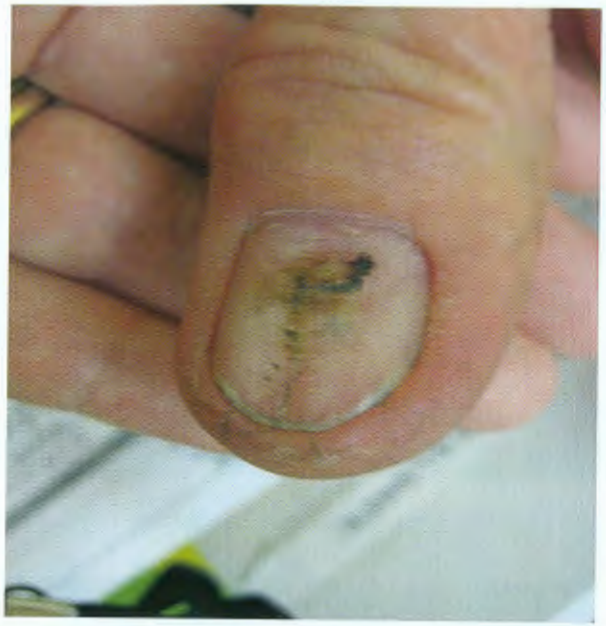

Fig. 9.10 Hemorrhage and habit tic dystrophy (chronic trauma)

Fig. 9.11 Hemorrhage, notice that where the blood has washed away, the nail becomes onycholytic

nails in two ways: (1) via subungual blood or (2) via melanocyte activation. In the case of subungual blood, it is incumbent on the clinician to prove that the pigment is blood. The cause of subungual blood includes both acute trauma in addition to chronic, minor, repetitive trauma, which the patient may not recall (Fig. 9.10). If the trauma occurs in the proximal matrix, the blood may be incorporated into the nail plate in the top layers. If blood occurs in distal matrix or nail bed, the blood may leave a space as it dries and results in nail plate lifting as the nail grows out. This can create onycholysis as the blood is eventually washed away (Fig. 9.11). Clipping the overlying nail and examining it via microscopy can often give the diagnosis (Stephen et al. 2015)

Fig. 9.12 Onycholytic nail painlessly clipped away to confirm the presence of hemorrhage

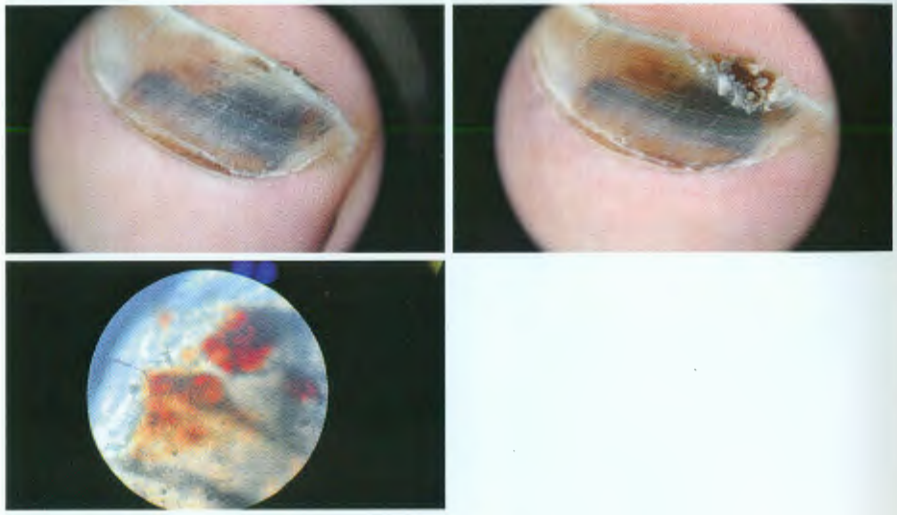

Fig. 9.13 Nail clipping revealing subungual blood

(Fig. 9.12). Dermoscopy of subungual blood is characterized by red–blue–black globules, longitudinal short streaks, and well-circumscribed blotches (Figs. 9.13 and 9.14). The pigmentation moves distally with nail growth and is replaced by normal colored nail at the proximal nail fold. This is in contrast to the dermatoscopic features of longitudinal melanonychia of melanoma, where longitudinal pigmentation that extends to the free edge of the nail is composed of multiple, irregular, brown–black lines within the broader area of pigmentation (Mun et al. 2013).

Fig. 9.14 Dermoscopy of subungual hemorrhage illustrating globules and streaks

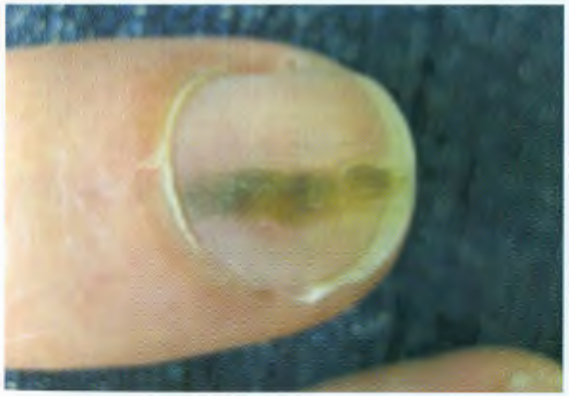

Fig. 9.15 Foreign body causing melanonychia: cactus spine

Trauma may also result in splinter hemorrhages, which are longitudinal collections of blood in the nail that appear black. These are rarely confused with melanoma or nevus because they do not span the length of the nail plate. Caution must be exercised, as blood does not exclude the presence of a tumor, as these can coexist (Fig. 9.15). Trauma may also result in the activation of matrix melanocytes, causing longitudinal melanonychia. This may occur with chronic nail tip trauma, friction, or picking.

Distinct from trauma is the presence of a foreign body under the nail plate, which can itself appear dark or may result in blood or infection under the nail plate that appears dark (Fig. 9.16).

Staining

A variety of external stains can cause melanonychia. Typically, multiple nails are involved. Silver nitrate, self-tanning creams, tar, iodine, and various other products can stain the surface of the nail and result in pigmentation (Baran et al. 2012). Although patient history and the involvement of multiple nails are keys to this diagnosis, one clue indicating an exogenous cause of pigmentation is that the proximal margin of the pigment remains in an arc shape parallel to the proximal nail fold as the nail plate grows (Baran et al. 2012) (Figs. 9.17, 9.18, and 9.19).

Some exogenous substances, when ingested, cause pigmentation in the nail. This can be due to matrix melanocyte activation, but may also be a direct effect of deposition into the nail plate. Chronic mercury exposure and other heavy metals can result in multiple bands of melanonychia. Some medications fall into this category, such as clofazimine, which deposits in the nail plate causing pigmentation (Piraccini et al. 2006; Piraccini and Tosti 1999). Antimalarial medications may also cause melanonychia via ferric dyschromia. The antiretroviral azidothymidine (AZT), chemotherapeutic agents, and treatment with psoralen or radiation are known to cause longitudinal melanonychia, likely via melanocyte activation (Baran et al. 2012; Piraccini et al. 2006). Topical application of hydroquinone can result in diffuse orange–brown pigmentation of the nails exposed (Piraccini et al. 2006). Anticoagulants can result in subungual hemorrhage and splinter hemorrhages in the absence of recalled trauma.

Fig. 9.16 Exogenous brown pigmentation. Notice that the proximal margin is parallel to the nail fold

Fig. 9.17 Staining from minocycline

Fig. 9.18 Longitudinal melanonychia from hydroxyurea

Fig. 9.19 Myxoid cyst with hemorrhage

Neoplasms

Several nonmelanocytic nail tumors can present as longitudinal melanonychia and simulate melanoma. Pigmented Bowen's disease, onychomatricoma, mucous cyst, subungual fibrous histiocytoma, subungual linear keratotic melanonychia, and verruca vulgaris have been documented to cause longitudinal melanonychia (Baran et al. 2012; Stetsenko et al. 2008; Wynes et al. 2015; Baran and Simon 1988). Onychopapilloma can appear as a red band (due to thinning of the nail plate) or a dark band (due to blood in the channel beneath the nail plate) and may have splinter hemorrhages. Onychopapilloma often has a verrucous subungual papule visible at the free edge of the nail plate, as a key to diagnosis (Tosti et al. 2015). Occasionally, the streak of blood appears alarming to the physician, in which case the nail can be removed and the diagnosis confirmed (Figs. 9.15, 9.16, and 9.20).

Diagnostic Clues

Subungual melanoma is the most concerning and most feared cause of melanonychia. However, there are many more common causes of melanonychia. Using clinical signs to identify likely pathology and to preclude the need for a biopsy is an important skill. The following simple algorithm is one model for assessing the aforementioned signs of nonmelanocytic causes of melanonychia before biopsy.

Summary for the Clinician

1. Longitudinal pigmented bands in the nail may be caused by melanocytic and nonmelanocytic processes.
2. The most common and most important causes of nonmelanocytic melanonychia are subungual hemorrhage and fungal melanonychia.
3. Distinguishing subungual hemorrhage from nail melanoma by clinical, historical, and dermatoscopic features is very useful.
4. Recognizing the clinical and diagnostic features of nonmelanocytic melanonychia may help the clinician to arrive at the correct cause of aberrant pigment in the nail and possibly avoid unnecessary nail biopsy.

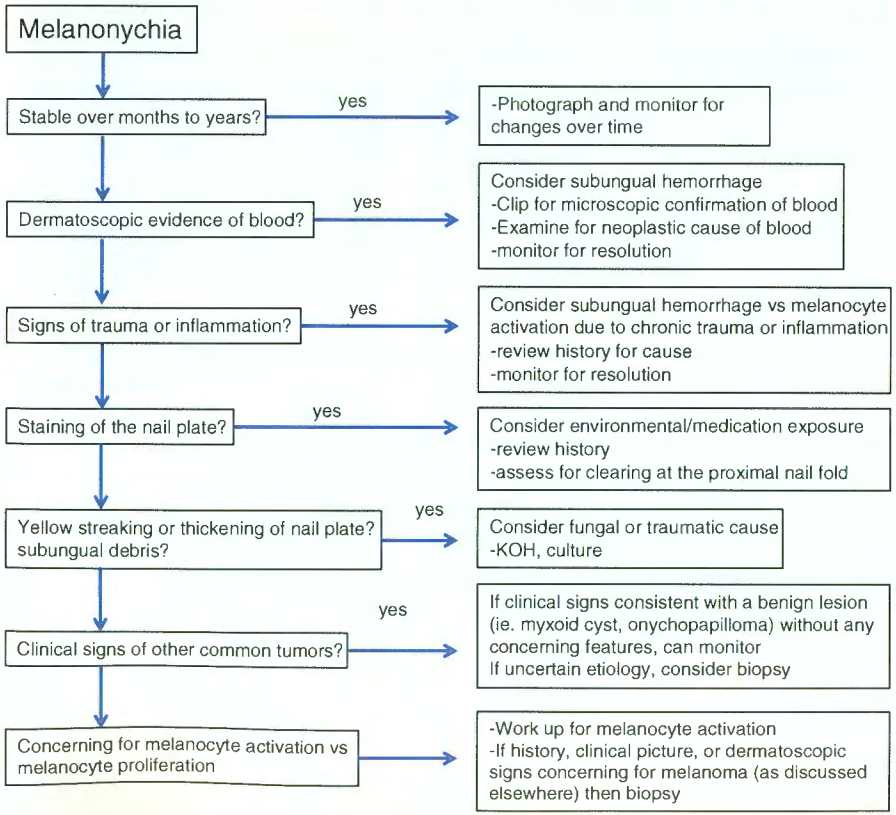

Fig. 9.20 Onychopapilloma with hemorrhage and with characteristic distal subungual hyperkeratotic papule

References

Baran R, Simon C. Longitudinal melanonychia: a symptom of Bowen's disease. J Am Acad Dermatol. 1988;18(6):1359–60.
Baran R, de Berker D, Holzberg M, Thomas L, editors. Baran and Dawber's diseases of the nails and their management. 4th ed. New York: Wiley-Blackwell; 2012.
Finch J, Arenas R, Baran R. Fungal melanonychia. J Am Acad Dermatol. 2012;66(5):830–41.
Gupta AK, Simpson FC. Diagnosing onychomycosis. Clin Dermatol. 2013;31(5):540–3.
Haneke E, Baran R. Longitudinal melanonychia. Dermatol Surg 2001;27(6):580–584.
Mun JH, Kim GW, Jwa SW, et al. Dermoscopy of subungual haemorrhage: its usefulness in differential diagnosis from nail-unit melanoma. British J Dermatol. 2013;168(6):1224–9.
Piraccini BM, Tosti A. Drug-induced nail disorders: incidence, management and prognosis. Drug Saf. 1999;21(3):187–201.
Piraccini BM, Iorizzo M, Starace M, Tosti A. Drug-induced nail diseases. Dermatol Clin. 2006;24(3):387–91.
Stephen S, Tosti A, Rubin AI. Diagnostic applications of nail clippings. Dermatol Clin. 2015;33(2):289–301.
Stetsenko GY, McFarlane RJ, Chien AJ, et al. Subungual Bowen disease in a patient with epidermodysplasia verruciformis presenting clinically as longitudinal melanonychia. Am J Dermatopathol. 2008;30(6):582–5.
Tosti A. Nail disorders: practical tips for diagnosis and treatment, an issue of dermatologic clinics. Amsterdam: Elsevier Health Sciences; 2015.
Tosti A, Schneider SL, Ramirez-Quizon MN, Zaiac M, Miteva M. Clinical, dermoscopic, and pathologic features of onychopapilloma: a review of 47 cases. J Am Acad Dermatol. 2016;74(3):521–526.
Wynes J, Wanat KA, Huen A, Mlodzienski AJ, Rubin AI. Pigmented onychomatricoma: a rare pigmented nail unit tumor presenting as longitudinal melanonychia that has potential for misdiagnosis as melanoma. J Foot Ankle Surg. 2015;54(4):723–5.

Histological Analysis of the Nail Plate in the Diagnosis of Melanonychia and Other Nail Pigmentation

10

Beth S. Ruben

Key Features

- Melanocytic activation is a common cause of pigmentation of the nail plate and consists of melanin production without a proliferation of melanocytes.
- Melanocytic proliferations (lentigo, nevi, and melanoma) often produce a solitary longitudinal pigmented band, while melanocytic activation can produce a single or multiple bands.
- Other causes of nail plate pigmentation: pigmented squamous cell carcinoma, pigmented onychomatricoma, onychocytic matricoma, pigmented onychomycosis, and nail plate hemorrhage.
- Nail clipping can serve as a less invasive screening procedure for identifying the cause of nail plate discoloration.
- Fontana–Masson staining is useful in identifying melanin.
- A modified benzidine stain can be used to identify hemoglobin.

Introduction

Pigmentation of the nail plate is often due to melanin (melanonychia) and often arises from a melanocytic lesion producing melanin in the nail matrix. Such lesions are discussed in more detail elsewhere in this book. Melanocytic activation is a common cause of pigmentation and consists of melanin production without a proliferation of melanocytes. It may occur in a reactive manner owing to many disruptions of the nail unit, or it may be a primary condition creating a pigmented band or bands. Melanocytic proliferations such as lentigo (melanocytic hyperplasia), nevi, and melanoma often

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