Nail Pathology I: Basics, infectious and inflammatory diseases

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DISCLOSURE OF RELATIONSHIPS WITH INDUSTRY

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DISCLOSURES
I do not have any relevant relationships with industry.

Nail pathology

• Nail unit sampling is an important component of the diagnosis of nail disease.
• The physical properties of the hard keratin nail plate make biopsy access, specimen submission and processing more complicated.
• These limitations can greatly affect the quality of the sections available for interpretation by the pathologist.
• Nail unit specimens tend to be relatively uncommon, leading to a lack of familiarity and diagnostic confidence.
Objectives

- Review nail unit anatomy/histology
- Examine specimen types and tissue submission
- Explore how to optimize tissue sections of the nail unit
- Discuss stains of special utility in this area, and pitfalls
- Examine select infectious and inflammatory diseases of the nail unit
- Examine non-melanocytic and melanocytic neoplasms (parts II and III)

Basic nail anatomy
Components of the nail unit

- Germinative (matrix, nail bed)
- Product (nail plate)
- Framing (nail folds and grooves)
- Sheaths (cuticles, eponychium, hyponychium)
- Supportive tissues, onychodermis


Lunula
Nail plate and bed
Onychodermal band
Hyponychium
Proximal nail fold
False cuticle
Lateral nail fold


Fig 6. The subdivisions of the nail matrix and how they contribute to be different layers of the nail plate.
Eponychial epithelium
Distal matrix
Proximal matrix
Dorsal matrix
Keratogenous zone
Distal nail matrix
Nail bed epithelium
True cuticle
False cuticle
Nail plate

A granular zone in the matrix or bed is abnormal
Which biopsy procedure?

- Nail clipping, avulsion
  - Onychomycosis versus nail inflammatory, some neoplastic disease
- Screening: blood, melanin, melanocytes
- Shave (tangential) biopsy
  - Great for most, especially large thin pigmented matrix lesions
  - Can visualize lesion
  - Technique dependent, leaves plate behind usually
- Punch
  - For small pigmented matrix lesions, often a "blind biopsy"
  - For nail bed inflammatory and neoplastic disease
- Longitudinal en bloc excision
  - Gold standard, retains all architecture, inflammatory and neoplastic disease


Courtesy of Monica Lawry, MD
Submission of nail unit specimens

- Supervise grossing of every complex nail specimen
- No ink unless margin assessment required...a big mess for melanonychia
- Submit separate nail plate and soft tissue specimens
- Section nail unit longitudinally
- Use softeners
- No decal solution!


**Processing Pearls for Nail Unit Tissue**

- Softeners are helpful
  - Use preproceasing and/or during cutting
  - Embed nail plate at right angle to microtomy blade
  - Soaking the block on water bath prior to cutting the tissue can minimize knife trauma
  - Albumin, glycerin can help sections stay on the slide
  - No automatic PAS staining
  - No automatic levels

**Nail softening techniques**

- NaOH, CaOH, KOH, thiglycolate or combinations
  - Nair depilatory (OTC)
  - Nail Prep Nail Softener (KOH, pH 9.5), StatLab
  - Fabric softener
  - Hand/dishwashing soap
  - Moliftex (ethanol, methanol, acetone, glycerin, 1,2-ethanediol, DMSO, Millipore
  - Tween 60
  - Phenol
  - TCA
To be avoided

- More than 20% NaOH: Reported to damage melanin and iron pigments
- STRONG ACIDS: Citric and nitric acids (decal solutions) destroy DNA
  - Cannot do molecular analysis
  - May quench stains for proliferation index such as Ki-67, PCNA
  - Not necessary for nails and falling out of favor even for bone

References:


Special techniques for sectioning

- Plastic embedding
  - A lengthy procedure (4 weeks)
  - Requires special equipment, reagents and hand-processing
  - Not practical except for research
- Cedarwood oil softening/processing
  - Also lengthy (several days)
  - Labor intensive, special reagents
  - Not as practical for routine histology

Helpful stains and pitfalls

- Fontana-Masson
  - Great for identifying subtle melanin granules in plate and epithelium
  - Will need to titrate for use in nail plate (often overstains)
  - Caution: air bubbles under coverslip (pitfall)
- 3,3'-Diaminobenzidine stain (DAB)
  - Less toxic alternative to benzidine stain
  - Identifies loculations of blood (hemoglobin and erythrocytes)
  - Typical iron stains for hemosiderin don’t work for nail hemorrhage

References:

Nail plate sampling

Nail plate sampling for diagnosis

- Onychomycosis
- Tinea unguium
- Candidiasis
- Molds
- Pseudomonas infection
- Psoriasis
- Subungual hemorrhage versus melanin
- Other...

Onychomycosis
Patterns of onychomycosis

- Subungual
- Superficial
- Proximal white
- Pigmented
- Dermatophytoma (severe recalcitrant)
- Combinations
Pigmented onychomycosis

- Usually due to dematiaceous molds, fungi
  - Sarcoidiopsis, Cryptodiophtalum, Trichophyton rubrum nigricans

Pigmented superficial onychomycosis
Perforating hyphae of molds

Sinuous hyphae, truncated spores, perforating hyphae
Pseudomonas

Courtesy of Phoebe Rich, MD
Dermatophytoma

- An example of a biofilm: an organism creates an environment that promotes growth
- Often presents as a loculated mass lesion within, or under the nail (or both)
- Fungi may be thick-walled and display spores; may contain bacteria as well
- May confer resistance to therapy (not absolute)
- May benefit from adjuvant therapies (avulsion, chemical destruction)
Inflammatory/non-neoplastic diseases of the nail unit

- Psoriasis
- Lichen planus
- Eczematous
- Trachyonychia ("toe nail dystrophy")
- Graft versus host disease

- Lupus erythematosus
- Lichen simplex chronicus
- Pityriasis rubra pilaris
- Pachyonychia congenita
- Lichen striatus
- ETC!
Psoriasis of the Nail
A Clinical-Pathologic Study

Psoriatic nail disease

- Nail pitting
- Leukonychia
- Subungual hyperkeratosis
- Splinter hemorrhages
- Onycholysis or oil spots
- Thickening

Nail unit psoriasis

Clippings for diagnosis

Courtesy of Elena Linos, MD
Nail pits in psoriasis

Onychomycosis


**Summary**

- Nails in patients with psoriasis may have abnormal histologic findings even in normal-appearing nails.
- Neutrophils are the most diagnostic feature, if onychomycosis eliminated from dx.
- Normal nails in patients without psoriasis do not have them, or rarely, NIA.
- Secondary colonization by bacteria and yeast is common, rarely dermatophytic hyphae.
Nail bed psoriasis
• Oil spots
• Hyperkeratosis
• Splinter hemorrhage
Pustular psoriasis with onycholysis (acrodermatitis of Hallopeau)

Courtesy of Janet Hickman, MD
Histologically difficult to diagnose psoriasis

Courtesy of Christine Miller, MD
Lichen planus

- Splitting, ridging, thinning

Graft versus host disease

- Erythema, telangiectasia, sclerosis
Lichen planus

Onychorrhexis

Hyperkeratosis

Courtesy of Monica Laery, MD

Onychorrhexis

Hyperkeratosis

Courtesy of Siegrid Yu, MD
Late LP with pterygium

Late changes, pterygium

Courtesy of Patrick Unemori, MD
Atrophic and late LP

Courtesy of Monica Lawry, MD
Late atrophic changes
Nail lichen striatus

- Rarely reported, more common in children
- Often accompanied by typical Blaschko cutaneous lesions but not always
- Presents with findings similar to LP, often lateral
- Histologically similar to LP when nail biopsied
- Tends to resolve spontaneously or with topical corticosteroid or tacrolimus treatment.
- May lead to pterygium (scarring) in rare cases

Eczematous dermatitis
Nail eczematous dermatitis due to acrylate gel manicure

Courtesy of Mark Holzberg, MD
Severe Onychodystrophy due to Allergic Contact Dermatitis from Acrylic Nails

Mattos Simoes Mendonca M, LaSenna C, Tosti A. Severe Onychodystrophy due to Allergic Contact Dermatitis from Acrylic Nails. Skin Appendage Disord. 2015;1(2):91-94.

Trachyonychia

"20 nail dystrophy"

Trachyonychia

Associated diseases:
- Alopeia areata
- Spongiotic/eczematous dermatitis
- Lichen planus
- Psoriasis

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