

Paronychia and ingrown nail

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Abstract

Paronychia and ingrown nail are both diseases of the nail folds. They can be either associated or isolated. They both begin with breaches of the protective nail barrier, which lead to inflammation of the surrounding tissue of the nail. The inflammation produces edema, congestion, pus or in severe cases abscess that in need of drainage in paronychia patients, while for patients suffered from ingrown nails, the inflammation results in granulation and overgrowth of the adjacent soft tissue. Pain and discomfort are always accompanied with paronychia compared with ingrown nails remaining asymptomatic until co-onset of acute paronychia. For both diseases, the treatment may differ depending on disease severity and characteristics of individual cases, but overall, treatment choices should be made under the principle of avoidance of relapse and attainment of good cosmetic results.

1. Introduction

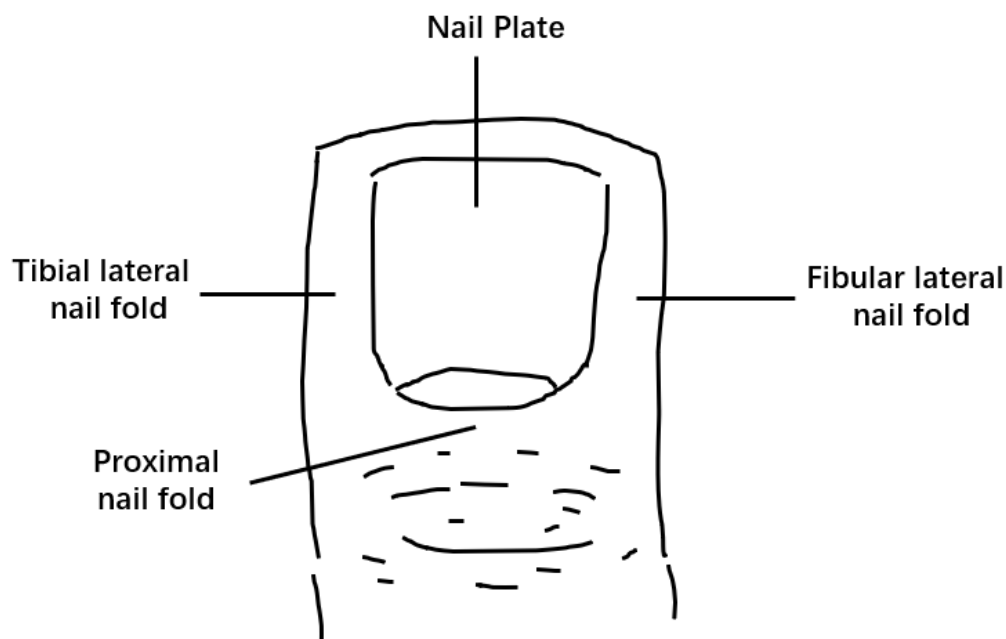
Paronychia is an inflammatory condition of tissues surrounding the nail of fingers or toes. This process can be acute or chronic, with chronic paronychia proceeds after 6 weeks. Theirs etiologies are different with infection causing most acute cases whereas irritants responsible for chronic ones [1], therefore treatments may differ.

Ingrown nail, also known as onychocryptosis, is a common disease mostly affecting the great toenail of young men. It has a great economic impact secondary to decreased mobility and work absenteeism [2]. In addition to that, ingrown nail may have a negative psychological impact leading to behavioral changes such as refraining from toe-nail-exposing footwear in public.

Paronychia occurs more frequently on fingers whereas ingrown nails are most commonly found on toes. Moreover, acute paronychia of the toe often arises from ingrown nails.

2. Anatomy of the nail unit

The nail unit is consisted of nail plate, proximal and lateral nail folds, nail bed, and nail matrix. The tissues involved in paronychia are generally the lateral nail folds (tibial and fibular) as well as the proximal nail fold (also named as eponychium). In ingrown nail, the nail plate and nail bed can be distorted due to over growth of the lateral and/or proximal nail folds.



2.1. Definition

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2.2 Causes

Acute paronychia is most likely to be the result of infection after trauma. The most common pathogen is *Staphylococcus aureus*. But *Streptococcus*, gram-negative bacteria, *Pseudomonas* species, and *Candida albicans* have also been found. Chronic paronychia is generally caused by irritative reaction, contact allergy, food hypersensitivity, candida hypersensitivity and true candida paronychia [3].

Common causes of ingrown nail are improper nail trimming, tight or narrow footwear, onychomycosis and repetitive trauma. Hyperhidrosis and poor foot hygiene, abnormally shaped nail plates or nail folds, family history of ingrown nails, diabetes, obesity, and other underlying diseases (thyroid, cardiac and renal disorders), as well as intake of certain medications, such as oral antifungals, retinoids and ciclosporin may also be contributing factors. But for whatever reason, the mechanical imbalance caused by destruction of normal cutaneous structure of nail plate and surrounding soft tissue is believed to be the precipitating factor of ingrown nail.

2.3 Clinical features

Acute paronychia has a rapid onset (2-5 days), with presence of inflammation, erythema, swelling of nail folds. Depending on severity, pus discharge and abscess may occur. Beau lines and onychomadesis may appear on the nail plate as a consequence of damage

to nail matrix. Patients with chronic paronychia typically present with mild erythema and swelling. Beau lines, and less commonly, onychomadesis may happen. Sometimes, the lateral margins of the nail plate may be stained green due to *P aeruginosa* colonization. Secondary infection with bacteria and/or *Candida albicans* is also possible, resulting in self-limited acute inflammatory episodes.

Ingrown nail most commonly present with pain, erythema and swelling of nail folds, the severity of which depends on the stage of the ingrown nail and whether any infection coexists. In severe stages, abscess formation, granulation and/or deformity of both lateral nail folds and nail plate may occur.

2.4 Staging

Acute paronychia is often classified into two stages: Stage 1 (inflammation) with erythema, swelling and tenderness and Stage 2 (abscess) with further pus discharge and abscess formation. Though generally present with slight erythema and swelling, chronic paronychia has long disease course with waving and lingering symptoms.

Classical classification of ingrown nails was developed and expanded as follow: Stage 1 (inflammation), Stage 2 (abscess), Stage 3 (granulation and chronic hypertrophy of the nail fold), and Stage 4 (deformity of both nail folds and distal fold), with stage 1 deemed as mild, stage 2 moderate and stage 3&4 severe [4, 5]. It is widely accepted that conservative measures are suitable for mild cases while more advanced ones call for surgical interventions*. However, over the past decade, this author has successfully treated several moderate to severe cases using cotton wisp, one of the conservative techniques [6]. Thus, it is deduced that theoretically, ingrown nail at any stage can be successfully treated with cotton wisp technique. As a result, a novel classification system based on the length of remaining nail plate may be useful. Because the ideal endpoint of ingrown nail treatment is for the nail plate to return to normal length, the remaining length of nail plate on affected nail can help evaluate disease severity and give guidance to treatment choices.

*It should be noted that there exists a special condition: some pedicure workers in China remove the lateral portion of nail plate embedded in the soft tissue regularly to ensure that there being no inflammatory changes to the nail unit. But the nail unit is always kept under abnormal condition.



2.5. Differential diagnosis

Paronychia: the most common differential diagnosis of paronychia are eczema, herpetic whitlow and psoriasis. Dermatomyositis, granuloma annulare, hematomas from pulse oximetry, pyogenic granuloma and Reiter syndrome are less common. It should also be differentiated with food hypersensitivity, melanoma, pemphigus vulgaris and squamous cell carcinoma [1].

Ingrown nail: although ingrown nail does not usually demand diagnostic tests, underlying pathologies such as onychomycosis and exostosis should be investigated if suspected.

2.6 Treatment

Treatments vary according to acute and chronic paronychia, as well as disease severity. If acute paronychia only present with mild inflammation and erythema, and there is no apparent cellulitis, a treatment regimen of warm soaks, topical antibiotics with or without topical steroids, or a combination of topical therapies is recommended. Warm soaks are reported to help with spontaneous drainage. If an abscess is present, it should be opened to facilitate drainage. Treatment of chronic paronychia consists of stopping the source of irritation, controlling inflammation, and restoring the natural protective barrier. Topical anti-inflammatory agents, steroids, or calcineurin inhibitors are the mainstay of therapy. If a medication is the cause, the physician and patient must decide whether the adverse effects are acceptable for the therapeutic effect of the drug.

The treatment of ingrown nail also differs pursuant to disease severity, patient expectation and preference. As the course of this disease is always prolonged and disfigurement may occur at the end stage, cosmetic result should also be a concern. Part 3 of this chapter will address at length the cosmetic procedures of ingrown nail treatment.

2.7 Prevention

Preventive measures of relapse of paronychia include applying moisturizing cream after hand washing, avoiding any kind of nail trauma, avoiding chronic exposure to moisture and contact irritants (including detergent and soap), avoiding trimming cuticles, keeping affected areas clean and dry, keeping nails short, using rubber gloves, preferably with inner cotton layer when possible exposure to moisture and/or irritants is expected and improving glycemic control in diabetic patients.

Preventions of ingrown nail include cutting nails either straight across or with a gentle curve, using a nail file after nail cutting to create a smooth, rounded edge, avoiding cutting too deeply down into the corners of the nail, keeping good hygiene, avoiding repetitive traumas, choosing comfortable footwear, treating onychomycosis, and managing underlying diseases such as diabetes and avoiding obesity.

3. Cosmetic procedure

3.1. Non-invasive procedures

Cotton wisp (packing) method is one of the major non-invasive procedures for ingrown nail, and is suitable for most cases. For a small portion of patients with severe deformity of the nail plate, such as pincer nail, nail brace is an effective tool.

3.1.1. Cotton wisp method (Du's method)

- Definition: it refers to packing with cotton wisp under the edge of nail plate of the affected nail, with an emphasize on changing the cotton wisp twice daily and gradually increase volume of the wisp.
- Merits: the material and tools needed for this method are highly accessible. In addition, the method is easy to perform at home under the instruction of physicians. Most importantly, it is proven efficient as the ingrown nail patients in need of surgical intervention in our clinic has decreased by 70% since the employment of this method in 2009.
- Functions of the wisp: a. the wisp can assist with secretion discharge, b. the wisp can function as a buffer between nail plate and nearby soft tissue, thus diminishing direct mechanical stimulus from the nail plate, c. the wisp can help keep the distal end of the nail plate at its correct growing direction.
- Indication: most ingrown nail patients
- Contraindication: patients with severe nail deformity such as pincer nail, patients with no access or time to change cotton wisp on a daily basis.
- Procedure:

Step 1. Preparation: cotton ball, toothpick



Step 2. Gently tear the cotton ball apart, and select a thin slice.



Step 3. Twist the thin slice of cotton into a cotton wisp. The wisp should be fine enough to be able to inserted into the edge of the ingrown nail. The initial volume of cotton is sufficient if opportune insertion can be achieved causing only tolerable pain.

Increase the volume of inserted cotton wisp gradually with time.



Step 4. Gently packing the cotton wisp into the affected nail groove with toothpick. The cotton wisp also serves as drainage because the siphon action of cotton can help drain the purulent secretion of nail groove.



Step 5. Insert the cotton wisp from the proximal end of the nail groove (the end close to the heel) to the distal end, until the cotton is in place under the top end of nail plate.





Step 6. Remove excess cotton with scissors after insertion.



Change the cotton wisp twice a day in the morning and evening, that is to say, change after getting up in the morning and after warm soaking the affected nail in the evening.

- Key points:

1. Mild to moderate pain is common at first, but it is generally tolerable and will improve with time.
2. The cotton should be changed twice daily. It is advised to use dry and clean cotton, with sterility not required.
3. Warm soak and elevation of the affected limb can assist with the treatment.
4. Unless accompanied with severe acute infection, oral or intravenous antibiotics are contraindicated.
5. Nail growth is not a rapid process. Nail plate generally grows about 2 ~ 4 mm per month, so full recovery takes 1-4 weeks using this method. The recovery time needed is longer than surgery.
6. If the patient wants to recover as soon as possible, surgery is a good choice.

3.1.2 Nail brace method

- Definition: This method uses a small metal brace to pull the lateral edge of the ingrown nail away from the embedded soft tissue [7].

- Merits: For patients with severe deformity of the nail plate, such as pincer nail, nail brace is an effective tool. The patients are able to return to work immediately after initiation of nail brace application because this method alleviates pain [8].

- Functions of the brace: The braces are made from steel wire. It can hold the nail plate away from the inflamed soft tissue, thus immediately relieves pain and in the long run make the over-curvature return to normal.

- Indication: cases with nail over-curvature leading to pincer nail.

- Contraindication: severe cases in need of rapid recovery and patients unable to come in for nail brace exchanges.

- Procedure: As there are several nail brace devices described by different authors now, variations of procedures happen. But generally speaking, this method does not require local anesthetics. We recommend to foam the affected nail fold with hydrogen peroxide and pack it several times with 1- to 2-mm-wide gauze, which is removed afterward, in order to create space for the insertion of the brace. Only lateral nail spikes are necessary to be removed. The wire of brace is applied over the dorsal surface of the nail and hooked under its lateral edges. By tightening it, for example, by screwing, and wearing it for a period of time, the curvature is decreased. Whenever necessary (eg. loss of brace tension), a new brace is applied.

- Key points: This method works better with nail plate relatively intact. If large portions of nail are removed, or substantial nail defect is present, an onycho-plastic procedure (application of artificial nail material) is proposed to lengthen or widen the nail plate [9].

2. If the nail bed injury or atrophy does not ameliorate after early correction of the nail plate, severe onycholysis, which facilitates relapse, is commonly encountered. For this condition or in patients with other factors predisposing them to early relapse, a nail brace should be worn until complete recovery [8].

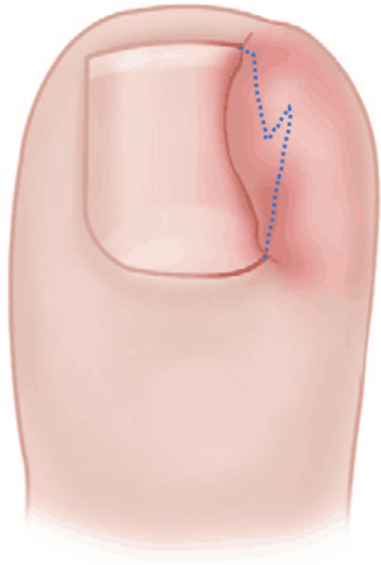


nail brace

3.2 Invasive procedures

According to the classic classification of ingrown nails, when the disease evolves over mild stage, nonsurgical treatments are generally reckoned time-consuming and doubtful to achieve lasting beneficial results. Some physicians consider partial or total nail plate removal a treatment option of ingrown nail. But they only provide temporary pain relief and provisional resolution of suppuration and granulation. In addition, it would take a long period of time for the nail to grow back to its normal length. Not to mention that relapse is almost inevitable, even resulting in further deformity. Hence, the risk-benefit of these procedures should be well taken into consideration.

Some practitioners believe the breach of the mechanical balance between the nail plate and surrounding soft tissue to be the causal factor of ingrown nail. This author theorizes that ingrown nail is caused by the in-situ foreign body (nail plate) response secondary to the structural abnormality between the nail plate and nearby soft tissue. As the nail plate continues growing along normal direction, it is blocked by soft tissue under the circumstance of structural abnormality, thus serves as mechanical stimuli, leading to inflammation manifested as erythema, swelling, tenderness and pain. Therefore, for surgeries of hypertrophic lateral nail folds of ingrown nails, the principle is to remove the soft tissues that hinder the normal growth direction of the nail plate to create space for its normal growth.



Ingrown toenail

3.2.1. Surgery of the nail plate

3.2.1.1 Total nail plate removal [10]

- Anesthesia: Distal digital ring block
- Tools: Straight, thin hemostat or small, flat nasal elevator; basic surgery tray; a tourniquet is preferred.
- Surgical procedure: After anesthesia, insert a straight, thin hemostat or small, flat nasal elevator in the midline beneath the nail plate, push several millimeters towards lunula, then withdraw. Do not shift the tool back and forth. Insert and withdraw it in the same longitudinal manner until loosening up the whole nail plate, including each lateral

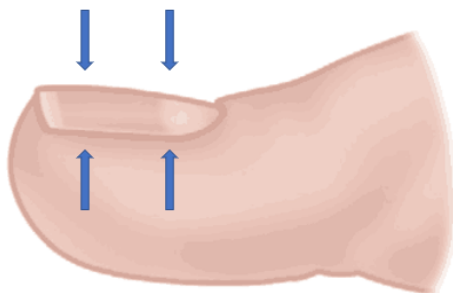
margin adjacent to the nail folds. Try extract the nail plate with a gentle distal pull at this point. If the nail root still adheres to the proximal nail fold, don't forcefully pulling the nail plate off. Sharp dissection with a small blade between the nail plate and the proximal nail fold would minimize the chance of germinal matrix damage and bleeding. Another option is to use a wide, flat nasal elevator to remove the last moorings of the nail.

- Key point: During the procedure, take care not to damage the germinal matrix.

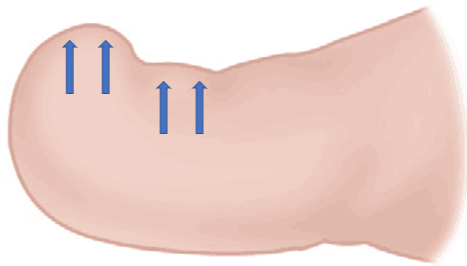


Deformity of nail bed after laceration of nail matrix

- Postoperative care: Postoperative pain is little and generally tolerable. The following measures should be taken: cover the nail bed with a large amount of antiseptic ointment and a single layer of nonadherent dressing; apply above the dressing several layers of gauze, both for protection and absorption of wound secretion; elevate the foot for 24 hours, then remove the dressing and begin warm soaks; avoid wearing constricting hosiery or shoes for a week.
- Complications and management: An upward-turned deformity of the distal nail bed and pulp may occur, especially when the patient has had multiple nail plate removal.



A



B



C

A and B, Turned up pulp deformity after multiple nail avulsions for treatment of ingrown toenail. **C**, Turned up deformity after several nail avulsions.

Often this reaction will lead to relapse of ingrown nail. If the patient is asymptomatic or only present with minor discomfort, conservative treatment is indicated: reducing the hypertrophic pulp in front of the distal nail. Consistent taping or packing can be useful alternatives. If accompanied with severe pain, surgery of the nail fold should be considered. An acrylic nail can be affixed to the new nail plate [11] when it has reached one-third of normal length to prevent such a complication. However, the upward force exerted by the pulp often leads to detachment of the artificial nail [12].

3.2.1.2 Partial nail plate removal [10]

- Anesthesia: Distal digital ring block; proximal ring block or transthecal block when acute paronychia coexists.
- Tools: Straight, thin hemostat or small, angled probe; basic surgery tray; a tourniquet is not mandatory.
- Surgical procedure: It is performed in the same manner as total nail plate removal, but restricted to the lateral fourth of the nail plate. This portion is freed from its bed attachment by inserting the elevator under the plate and cut longitudinally using straight scissors.
- Key point: The nail should be cut to its proximal end beneath the proximal nail fold without damaging the germinal matrix.
- Postoperative care: The aftertreatment is the same as for total nail plate removal except that the patient can wear wide toe shoes on 3rd or 4th day after procedure.

- Complications and management: The germinal matrix can be damaged, which would lead to permanent deformity.

3.2.2. Surgery of the lateral nail fold

- Anesthesia: Proximal or distal digital ring block.
- Tools: Tourniquet is mandatory. Basic surgery tray.
- Surgical procedure:

Vandenbos' procedure [13]

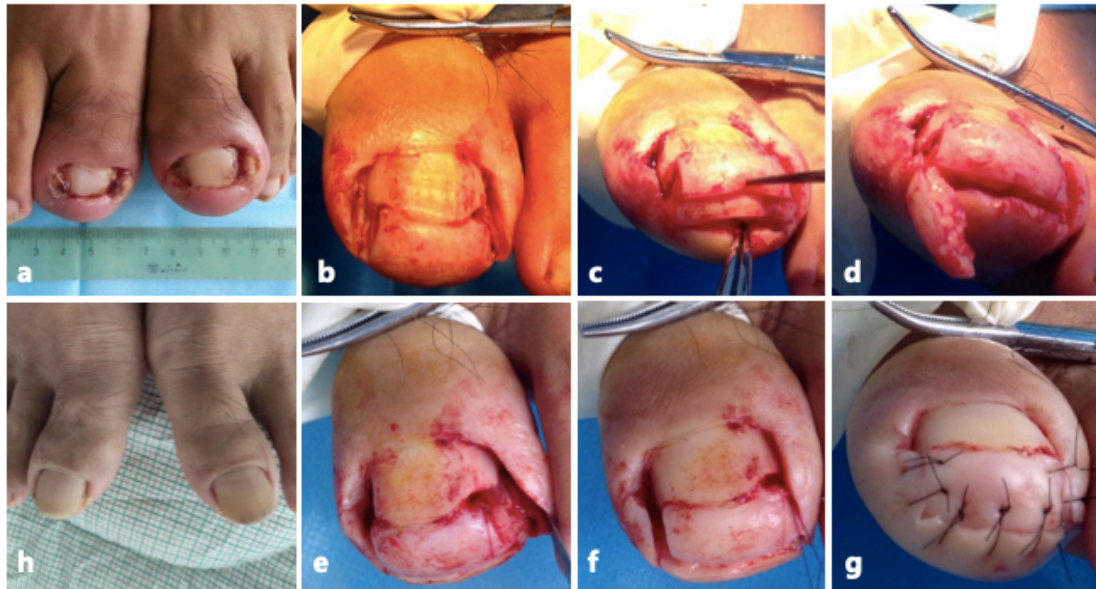
The first incision extends through the proximal nail fold, about 5 mm medially from the junction of the proximal and lateral nail folds. A second incision is carried out longitudinally from the proximal end of the previous one nail edge. All soft tissues contained between the two incisions are very generously removed with the blade down to the bone, leaving a skin and soft tissue defect of environs 1.5 by 3 cm. Often, a portion of the lateral aspect of the distal phalanx bone is exposed. At any time of the procedure, neither the plate nor the bed or the matrix are touched. Light cauterization is performed along the procedure. The wound is healed by secondary intention.

Super U [14]

This technique developed by the Brazilian dermatologist Peres Rosa is very similar to the one of Vandenbos. It removes all the excess tissue very generously in a U-shaped manner. The only differences are that the most proximal part of the incision does not include the proximal nail fold and that hemostasis is obtained with either separate stitches or a running lock suture. Improvement is drastic.

Du's procedure

This procedure was adapted from Super U technique by this author. Du's procedure places emphasize on restoring the normal anatomical structure and mechanical balance between the nail plate and surrounding soft tissues, namely nail balance reconstruction theory. In the aspect of surgical procedure, the tissue excised in this procedure is designed to be an "H" shape, with soft tissue of both lateral nail folds removed to the periosteum, and a parallel incision about 5 mm below to the distal groove around the tip of the toe, reaching to both lateral grooves. The volume of tissues removed from the lateral nail folds should be adjusted to ensure normal growth of nail plate and that removed from below the distal nail groove should be 3-5 mm in width (Fig a-h).h. after operation 5-year.



- Key Point: It is important to remove a generous amount of soft tissues to avoid relapse.
- Postoperative Care: Pain is minimal to intermediate and can be managed with oral analgesics such as paracetamol and celecoxib. The following measures should be taken: use nonadherent dressing on the wound; pack the wound with bulky dressing as bleeding may be substantial. The dressing should be replaced after 24 hours, not later, as bleeding may make the dressing hard and uncomfortable. Antiseptic soaks twice per day, until complete healing. The limb should be elevated for 48 hours after the procedure.
- Evolution: Overall cosmetic results for these procedures are excellent. For Vandembos' procedure, healing by secondary intention may need up to 10 weeks.
- Complications and management: No overt complication has been reported for these procedures.

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