

The occasional removal of an ingrowing toenail

Harvey V. Thommasen, MD, MSc, FCFP

Clinical Associate Professor, Department of Family Practice, University of British Columbia Faculty of Medicine, Vancouver, BC

C. Stuart Johnston, MB ChB, MSc (Eng) Civil, CCFP

Clinical Assistant Professor, Department of Family Practice, University of British Columbia Faculty of Medicine,Vancouver, BC

Amy Thommasen, BSc(c)

2nd-year BSc Student, University of Northern British Columbia, Prince George, BC

Correspondence to: Dr. Harvey V. Thommasen, Associate Clinical Professor, University of British Columbia Faculty of Medicine, 4202 Davie Ave., Prince George BC V2M 4G7

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The ingrowing toenail is a painful foot condition that can be treated by most rural physicians. If it is not too severe, conservative management can be initiated first. If the situation is not improving or is worsening, removal of the nail plate with destruction of the nail matrix, by either surgical or chemical matricectomy, is indicated. Neither matricectomy technique is particularly complicated. Quick healing, minimal postoperative morbidity, high success rates and cosmetically acceptable results are the rule. Risks associated with the procedure include infection, chronic ulcer formation, pain, prolonged healing, irregular nail regrowth and recurrence. Patients should be aware of these risks before the matricectomy is performed.

L'ongle incarné est un problème de pied douloureux que la plupart des médecins ruraux peuvent traiter. Si le cas n'est pas trop grave, on peut commencer par un traitement conservateur. Si la situation ne s'améliore pas ou se détériore, l'ablation de la tablette unguéale conjuguée à la destruction de la matrice, par matricectomie chirurgicale ou chimique, est indiquée. Les deux techniques de matricectomie ne sont pas particulièrement compliquées. En règle générale, la guérison est rapide, la morbidité postopératoire est minime, les taux de réussite sont élevés et les résultats sont acceptables sur le plan esthétique. Les risques associés à l'intervention comprennent l'infection, la formation d'ulcères chroniques, la douleur, le temps prolongé de guérison, la repousse irrégulière de l'ongle et la récidive. Il faut informer les patients de ces risques avant de pratiquer la matricectomie.

Introduction

Onychocryptosis, more commonly known as "ingrowing toenails," is a relatively common foot problem that typically manifests as inflammation of tissue along the side of a toenail. The big toe is most often affected, and it is the lateral border adjacent to the second toe that is the side that is most commonly involved.[1–3] The presenting complaints are inflammation-related — pain, swelling, erythema (with or without discharge) and granulation tissue formation. The condition can affect walking and lead to absenteeism from work. A variety of treatment options exist, ranging from advice on how to keep pressure off the area to removal of the entire nail with ablation of nail bed to ensure the nail plate never grows back. This article will review the most popular treatment options for ingrowing toenails.

Toenail terminology

The nail unit consists of the nail plate, nail bed, nail matrix, the proximal and lateral nail skin folds (Fig. 1, Fig. 2). The nail plate is the conspicuous, hard, smooth, rectangular shaped structure which is commonly referred to as the nail. The nail plate covers, and is adherent to the nail bed. The nail matrix is the site where the nail plate originates and from which it grows out distally. The distal half of the nail matrix is visible through the proximal border of the nail plate as a whitish, half-moon shaped area known as the lunula. The proximal half of the nail matrix is covered over by the proximal nail skin fold. The toenail plate typically grows

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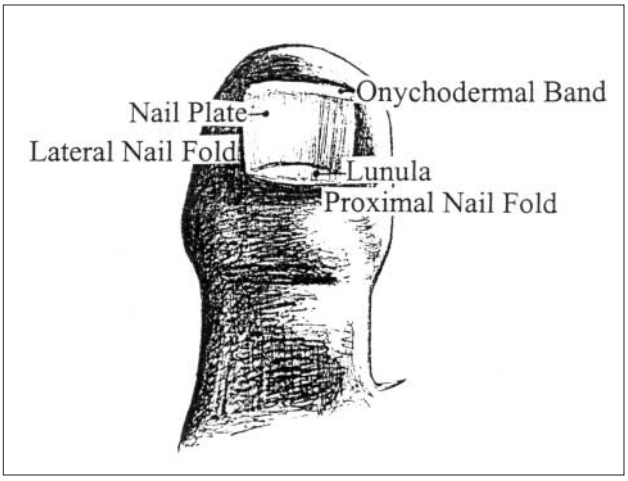


Fig. 1. Dorsal view of great toe.

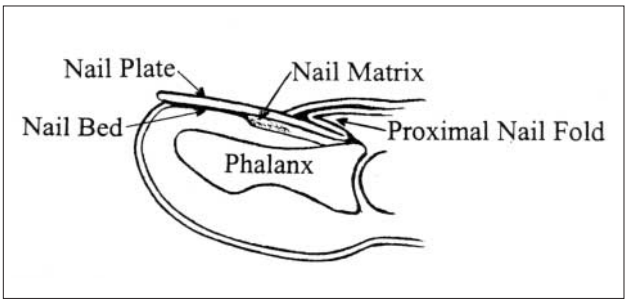


Fig. 2. Lateral view of great toe.

out over the nail bed at a rate of about 0.2 mm per week. This means that it takes 12 to 18 months for a toenail to move from matrix to distal free edge. Total destruction of the nail matrix results in an inability of the digit to produce a nail plate. Partial destruction results in variable nail plate generation. The free distal edge of the nail plate is visible as a whitish-yellow line at the end of the nail — the onychodermal band.[4]

Pathophysiology of ingrowing toenails

The inflammatory changes associated with ingrowing toenails arise because the nail plate punctures or traumatizes the skin at the side of the nail. The nail-damaged skin attempts to heal itself by producing highly vascular granulation tissue, which, over time, becomes heaped up over the ingrowing toenail plate. The site is at high risk of developing cellulitis because microbes gain access through the traumatized skin. The goal of treatment is to stop the nail from pressing/piercing into the soft tissue.[1–3]

A staging system has been developed to grade severity of ingrowing toenails.[3,5–7] Ingrowing toenails associated with slight erythema, edema and pain are in stage 1. The lateral and medial nail borders will be mostly clear of inflamed skin in stage 1 ingrowing toenails. Ingrowing toenails associated with obvious erythema, edema, pain and discharge are stage 2. There may or may not be co-existing cellulitis in this stage. In stage 3, there is erythema, edema, pain, discharge, as well as skin hypertrophy with or without granulation tissue in the area of the lateral skin fold (Fig. 3).

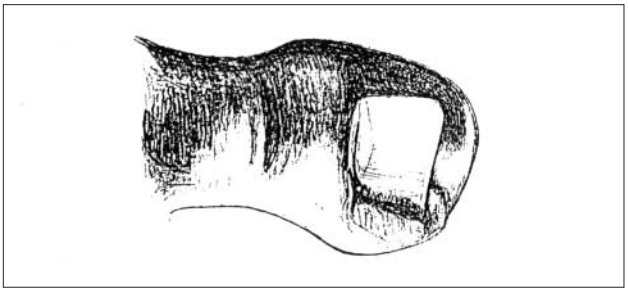


Fig. 3. Stage 3 ingrowing toe nail.

Risk factors for ingrowing toenails

A number of risk factors are associated with the development of ingrowing toenails. These include poor or tight-fitting shoes, abnormally curved nails, improper nail trimming, congenital mal-alignment of the nail and abnormally thickened nails (onychogryphosis) resulting from infection (e.g., onychomycosis), ischemia or trauma.

Tight-fitting shoes result in the tissue adjacent to the nail being forcefully squeezed and rubbed against the nail plate for long periods of time. Adolescents and young adults are affected more often than other age groups. It is believed that nails in this age group become softened by excessive perspiration and are more prone to split and crack, producing flesh-piercing spicules. Older people also develop ingrowing toenails, and it is believed that the problem here is multifactorial. Older people are more likely to have thickened, abnormally curved and ingrowing toenails. They are also more likely to have poor vision and limited mobility, resulting in poorer ability to trim the nails in the recommended fashion.

Treatment options

A number of different methods have been described for the treatment of ingrowing toenails (Box 1).[3,5–10] The treatment chosen by a physician will vary according to the severity of the inflammation, the presence or absence of infection, the nature of the

ingrowing toenail, patient considerations, as well as physician skill, experience and preference.

Box 1. Treatment options for ingrowing toenails

1. Conservative measures — observe and / or push back lateral skin fold.
2. Cotton wad inserted under lateral edge of nail plate.
3. Removal (avulsion) of the entire nail plate.
4. Partial removal (avulsion) of the offending nail-border part of the nail plate.
5. Partial or complete removal of nail plate followed by destruction (ablation) of the nail matrix to prevent regrowth by using:
   a. caustic liquid (eg phenol, sodium hydroxide)
   b. surgery (wedge excision of nail matrix)
   c. cryotherapy
   d. laser
   e. cryotherapy.

Stage 1 ingrowing toenails can be treated conservatively. The patient is told to avoid wearing tight-fitting shoes; avoid trimming the nail plate so far back that the edge or corner presses into adjacent tissue; soak the toe in warm water daily and apply topical antibiotics to the inflamed area. They are also instructed to push back skin daily to allow the nail plate to grow out past the distal lateral skin-fold border. Packing or splinting of a thinly rolled wisp or wick of cotton into the involved lateral nail skin fold from the proximal nail base to the distal end of the nail plate can also be tried. To minimize discomfort, topical anesthetic (e.g., EMLA cream [AstraZeneca]) can be applied for 30 minutes before the splinting procedure. The cotton splint is left in place for up to 4 months. It is removed once the distal edge of the nail plate grows beyond the lateral nail fold. Done properly, nail splinting is said to have a cure rate of almost 80% for stage 1 ingrowing toenails.

Conservative measures are less likely to work for recurrent stage 2 ingrowing toenails, and not indicated for stage 3 ingrowing toenails. For these, surgical removal of the portion of nail plate that is damaging tissue and inciting inflammatory process is usually necessary. Total nail plate removal is rarely indicated. Obvious advantages of just removing a section of nail plate adjacent to inflamed tissue include 1) less tissue is traumatized, and 2) less nail bed surface area is exposed. An exposed nail bed can be quite tender.

Simply removing the nail plate is not a very effective way to manage ingrowing toenails because recurrence occurs in over 70% of cases. To prevent recurrence of the problem, destruction of the nail matrix (matricectomy) by either aggressive surgical excision or with chemical cautery is necessary after the entire or just the troublesome part of the nail plate has been removed. Chemical agents used for chemical matricectomy include phenol, ethanol and sodium hydroxide.

Of the 3, phenol matricectomy is by far the one most commonly used chemical matrix-ablating agent. In fact, it has been used for over 50 years.[10,11] Phenol, also known as carbolic acid, is an aromatic benzene compound. It is a weak organic acid that is both hydrophilic and lipophilic. Liquified phenol is a very stable compound that lasts for many years when stored in an airtight bottle. Phenol is highly soluble in organic solvents, which explains why isopropyl alcohol is commonly used in the immediate treatment of phenol burns on skin. Phenol is not absorbed systemically through the skin. Applied topically, phenol denatures and precipitates proteins within the upper skin layer. However, it does not produce full-thickness skin damage. The usual concentration used for chemical matricectomy is 80%–90%.

A recent Cochrane review[1] of surgical treatments for ingrowing toenails came to the conclusion that simple nail avulsion combined with the use of phenol is more effective at preventing symptomatic recurrence of ingrowing toenails compared with invasive excisional surgical techniques that do not employ phenol. However, the authors admit there is a need for more well designed trials to confirm that the use of phenol really is preferable to surgical excision.[1]

Reported[7] rates of nail plate regrowth after phenol matricectomy range from 16%–28%. Reported rates of nail plate regrowth after invasive excisional surgical techniques range from 18%–29%. Critics of phenol matricectomy state that it is associated with unpredictable tissue damage, prolonged healing and/or draining and prone to postoperative infections. This has led to recent reports exploring other techniques such as sodium hydroxide, cryotherapy, electrocautery and laser to ablate the nail matrix.[3,9,12]

These other techniques may eventually prove to be associated with faster healing times, less pain, less drainage, and less postoperative infection rates. Until then, phenol cautery and surgical excisional matricectomy will continue to be the most popular methods to ablate the nail matrix.

History and physical examination

A. History

Ask about allergies, particularly those to local anesthetics, immunizing agents, and to antibiotics. Ask

about tetanus status, and update appropriately. Ask about the presence or absence of diabetes, peripheral vascular disease, long-term steroid use, collagen vascular disease and HIV, because removal of a toenail in such patients is more likely to be complicated by development of chronic ulcers or serious infections due to poor healing ability.

B. Physical examination

Ensure the involved body part is in a secure resting position on top of a plastic-backed absorbent pad, and ensure there is good direct lighting of the wound site. Document the neurovascular status of the digit and foot by checking for a dorsalis pedis and posterior tibial artery pulsation. The absence of one or more pedal pulses or presence of dystrophic skin changes would make one suspect peripheral vascular disease. During examination, stage the severity of the ingrowing toenail problem. Sometimes excising the distal aspect of the offending nail border will provide immediate relief, especially if you can push away the lateral skin-fold tissue and cut away the nail plate that is obviously penetrating the skin. After examination, inform the patient whether or not surgical removal of the nail plate is indicated.

C. Informed consent

Review complications associated with removal of the nail plate and matricectomy, including allergic reaction to the anesthetic or medications to be used, infection of skin and, rarely, of bones of the foot, bleeding, pain, scarring and disfiguring of nail bed and lateral nail skin folds. Explain the procedure you plan to use to remove the ingrowing nail plate and destroy the nail matrix. Answer any questions the patient may have; and obtain written consent as per institution policy. Schedule the procedure appointment.

D. Decision to use antibiotics

Some authorities recommend daily soaking with dilute povidone–iodine, others recommend oral and/or topical antibiotics be started.[3,12] Antibiotics are commonly prescribed in the setting of stage 2 and 3 ingrowing toenails. How long one should be on antibiotics before the offending toenail is removed is contentious. How many people one must treat to prevent potentially serious infections like an osteomyelitis is unknown. Some people believe antibiotics are not necessary and that the problem will resolve once the nail is treated. Reyzelman and associates recently studied this issue.[13] One group of patients had immediate chemical matricectomy with phenol and received 1 week of antibiotics after the procedure was completed. The second group received antibiotics for 1 week and then had phenol matricectomy. The third group had matricectomy without antibiotics. Mean healing time was shortest for the first group (1.9 wk), and longest for the second group (2.3 wk). The difference in mean healing time between the first (1.9 wk) and third group (2.0 wk) was not statistically significant. This study suggests that you can book nail removal and matricectomy within a day or two of seeing the patient; and it also suggests oral antibiotics do not play a major role in decreasing healing time or decreasing post-procedure morbidity. Until more studies are available, most physicians will probably continue to prescribe oral antibiotics if the tissue surrounding the ingrowing toenail looks infected, or if the patient has significant risk factors for developing infection.

Microbes responsible for cellulitis include bacteria (e.g., *Staphylococcus aureus*), yeast (e.g., candidiasis), and fungi (e.g., *Trichophyton rubrum*). Staphylococcus is the pathogen most commonly cultured from infected ingrown toenails. Cephalexin (500 mg qid) and cloxacillin (500 mg po qid) are the most commonly prescribed oral antibiotics in the setting of infection associated with ingrowing toenails.[7,11–13]

Procedure

Equipment necessary for removal of toenail and phenol ablation is summarized in Box 2, and consists basically of a suture set plus the phenol.

A. Preparation

The patient is positioned so that the knee is flexed and foot is lying flat on the end of the bed or table. Using sterile technique, clean the wound and surrounding area with an antiseptic skin solution (e.g., chlorhexidine 2% with 4% isopropyl alcohol [e.g., Dexidin 2 Solution] or Betadine Surgical Scrub [7.5% povidone–iodine solution]) and then wash off the area with sterile sodium chloride solution (0.9%).

B. Technique

1. Removal of nail with phenol matricectomy[9,11–13]

A partial nail-border removal is preferred over a total nail removal. Total nail plate avulsion is rarely indicated.[11,13] It should be considered in cases where

Box 2. Equipment for removal of ingrowing toenails

- Sterile and non-sterile gloves
- Antiseptic skin preparation solution (e.g., povidone-iodine)
- Sodium chloride solution (0.9%)
- 4″ × 4″ (10 cm × 10 cm) sterile gauze sponges
- Anesthesia equipment:
  - 3-mL syringe
  - 10-mL syringe
  - 18-gauge needle for drawing up anesthetic
  - 30-gauge 0.5″ needle for infiltrating skin
  - 27-gauge 1.5″ needle for deeper infiltration
  - Local anesthetic of choice
- Suture set
  - Fenestrated drape
  - Iris scissors
  - Bandage scissors
  - 2 straight hemostats
  - Sterile rubber band (if desired)
- Sterile cotton-tipped swabs
- Scalpel with #11 blade
- Sterile elastic tourniquet
- Dressing materials
  - Telfa pad
  - Antibiotic ointment
  - Sterile 2 × 2 gauze
  - Kling dressing material
- ≥ 80% phenol (carbolic acid)

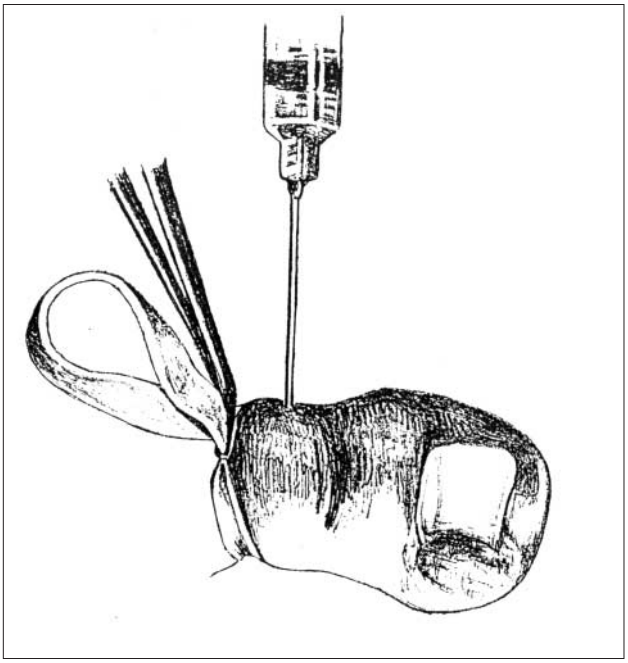


Fig. 4. Digital ring block.

both sides of the toenail are covered with heaped up granulation tissue indicating significant ingrowing bilaterally.

1. Anesthetize the toe with standard digital nerve block ("ring" block) technique using 1% or 2% lidocaine solution without epinephrine (Fig. 4). Epinephrine is to be avoided because it is purported to cause ischemia and gangrene via digital artery vasospasm. Infiltrate 0.5 mL of local anesthetic subcutaneously at the base of the involved toe using a 30-G needle and 3-mL syringe, into the dorsum, the medial and lateral aspects of the digit. Change to a larger 27-G needle and 10-mL syringe and deposit up to 2–4 mL of local anesthetic solution deeper into each of the above-mentioned 3 sites — aspirating first, to ensure a blood vessel has not been entered. Children would, of course, require smaller amounts of local anesthetic.

2. Since blood inactivates phenol, minimizing bleeding is desired. This can be accomplished by wrapping a rubber band tourniquet (e.g., a penrose drain or glove finger) around the base of the toe. Some authorities state a tourniquet is not required, but others say the use of a tourniquet prolongs local anesthetic effect, and aids in maintenance of a blood-free field. Unfortunately, prolonged application of a tourniquet can cause distal toe ischemia and necrosis. Therefore, the tourniquet should be used for as short a period as possible. Most people seem to agree that 20 minutes or less will not cause any problems in a healthy young adult, particularly if the tourniquet is not on too tightly. Wrap the rubber band around the digit and hold it in place with a hemostat directed away from the toe nail area. Others recommend exsanguinating the digit before applying the tourniquet, by wrapping a half-inch Penrose drain from the tip to base of the toe in a winding, overlapping fashion and then securing it at the base of the toe with a hemostat. Wait 10 minutes or so for the anesthetic to take effect. If the toe remains tender, inject a little more local anesthetic. Apply a fenestrated drape over the foot and position it so that the involved toe is protruding out through the drape.

3. Once the digit is anesthetized, slide the flat side of the scissors or some other kind of flat dissecting instrument (e.g., a nail elevator) under the nail plate and lift up gently as you advance proximally all the way back to the base of the proximal nail skin fold. This breaks up the adhesions that exist between the nail and undersurface of the nail plate.

4. Using the smallest blade of scissors available so as to avoid unnecessarily cutting the tender underlying nail bed, cut the nail plate longitudinally one-quarter or so of the distance from the lateral margin, back to the base of the proximal nail skin fold (Fig. 5). If the entire nail plate is being removed, this step is not necessary.

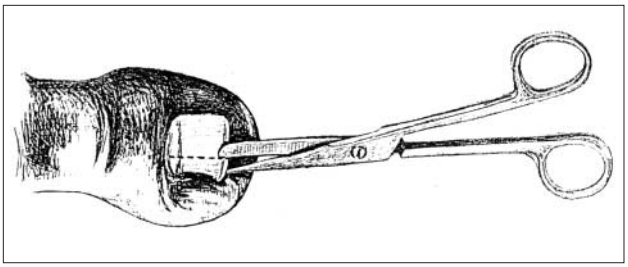


Fig. 5. Cut nail plate to base of nail.

5. Again, insert the flat side of the scissors all the way back to the base of the nail plate under the proximal nail skin fold. Now, lift up the involved nail plate section until there is a definite sensation of giving way, as the nail plate separates from the nail matrix.

6. Grasp the nail as far proximally as possible with a needle driver or hemostat, lift and move side to side, and then pull it out (Fig. 6). The base normally has a somewhat irregular appearance. Normally the nail is discarded. Send off the nail if fungal infection (onychomycosis) is suspected, for fungal culture and potassium hydroxide preparation. Send the nail for pathology if you are worried about malignancy or some other rare condition.

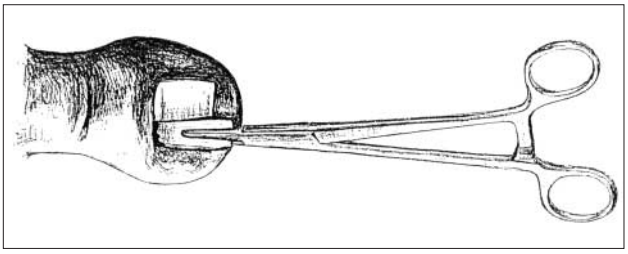


Fig. 6. Remove nail plate wedge.

7. Carefully check under the lateral and proximal nail skin folds to ensure there are no nail spicules, or nail-plate fragments remaining attached to the nail matrix.

8. Control bleeding with pressure and then mop up the area until there is a relatively dry field.

9. Dip a sterile cotton swab into a bowl containing liquefied ≥80% phenol, saturate the cotton bud, allow the excess to drip away, and then put it under the proximal nail fold. Vigorously massage the phenol-soaked cotton bud into the nail matrix area (Fig. 7).

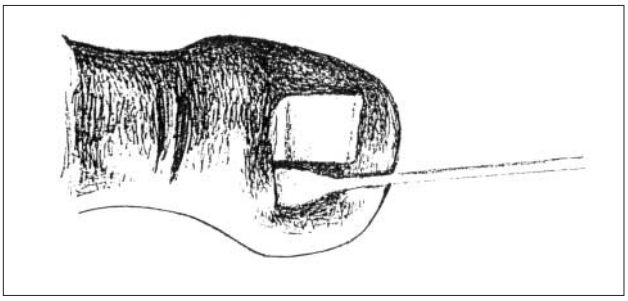


Fig. 7. Apply phenol-soaked swab.

10. Take care not to let excess phenol drip onto normal adjacent skin because it can traumatize that tissue as well. Quickly mop up any liquefied phenol that overflows onto normal skin. Some authorities recommend applying petroleum jelly (e.g., Vaseline) to surrounding good tissue to protect and minimize chemical burning of surrounding skin.

11. Roll the cotton swab back and forth across the exposed nail matrix for about 30 seconds.

12. Remove the phenol-soaked swab and repeat the process with a new phenol-soaked sterile cotton swab. Try to ensure that each part of the nail matrix is exposed to phenol for at least 1 minute. Boberg and associates recently determined optimal times and concentrations necessary to destroy the germinal matrix without causing further soft-tissue damage.[11] They found that the application of 89% phenol solution for as little as 1 minute was enough time to cause full-thickness necrosis of the epithelium. Applying phenol beyond this time resulted in more intense necrosis of the underlying dermis. Their study suggests the 5-minute application suggested by most reports is too long, and may account for prolonged drainage associated with the use of phenol matricectomy.

13. The entire process should not last longer than 3–5 minutes. Blood typically turns black on contact with phenol. Remember that too much blood reduces the effectiveness of phenol by preventing it from coming directly into contact

with the nail matrix tissue. If there is a lot of oozing or bleeding, apply phenol for up to 5 minutes; if there is no bleeding, 3 minutes is long enough. A well cauterized nail matrix tissue should turn a whitish colour.

14. Cut away exuberant granulation / hypertrophic tissue along the lateral nail border with a scalpel or tissue scissors. Apply pressure with a gauze until the bleeding has settled, but some authorities recommend cauterizing the pared-down granulation tissue with phenol, electrocautery or silver nitrate.[7]

15. If the tourniquet is still on, release it now and apply compression with sterile 4" × 4" (10 cm × 10 cm) gauze until the bleeding stops. Bleeding is usually slight, but if there is a lot of granulation tissue bleeding, compression for 10 or more minutes may be required.

16. After bleeding has been controlled, re-cleanse the wound area with a saline-soaked sterile gauze, and copiously irrigate the base of the nail and area under the proximal and lateral skin folds with saline to dilute and wash away excess phenol. Some authorities recommend neutralizing the phenol further by lavaging the area with 70% isopropyl alcohol.[14]

2. Removal of nail with surgical matricectomy

Proceed as per removal of nail with phenol matricectomy above to Step 8.

9. Using a #15 scalpel blade, cut down vertically into the nail matrix from proximal to distal alongside the remaining nail. Then excise the matrix tissue that has been exposed by the removal of the nail plate strip. To access matrix tissue located under the proximal nail skin fold, a 0.5–1-cm incision is made from the corner of the paronychia and the skin fold is then elevated. A single 4/0 nylon suture can be used to close this incision (optional).

10. Irrigate the area with normal saline.

Some practitioners combine surgical matricectomy with phenol matricectomy; e.g., apply phenol to the surgically resected matrix area for less than 3 minutes. Whether or not combining the 2 techniques yields better outcomes is unclear as we were unable to find any publications that specifically addressed this methodology.

C. Postoperative wound care

Dry off the wound with sterile gauze, apply antibiotic ointment (e.g., Polytopic [Polymyxin B, Bacitracin] or Bactroban [mupirocin 2%]), and cover with a non-stick dressing (e.g., 2" × 2" Telfa), a sterile gauze dry dressing, and wrap in place with Kling dressing material. Amorphous hydrogel dressings (e.g., Intrasite Gel) should probably be avoided because a recent study showed that this dressing is associated with the development of hypergranulation.[15]

Elevate the foot for 20 to 30 minutes before discharging the patient home, and remind him or her to elevate the foot as much as possible for the first 24 to 48 hours.

The patient should be reminded about the risk of infection and told to return if signs of infection arise — erythema, discharge, pain and swelling. The patient should change the dressing daily. Apply topical antibiotic ointment with each dressing change and cover with non-stick and sterile dry dressing.

Systemic antibiotics started before removal of the nail are to be taken for a total of 10–14 days. Cloxacillin or cephalexin are commonly used prophylactic antibiotics in this situation. Unfortunately, there is little scientific data available on this aspect of wound care.

Ibuprofen (200–400 mg po tid), acetaminophen (325–650 mg po qid), or acetaminophen with codeine are usually all that is required for analgesia after removal of the nail plate. The duration of postoperative pain varies with initial stage of ingrowing toenails. People with stage 2 and stage 3 ingrowing toenails treated with phenol matricectomy have pain that lasts on average 5 and 17 days, respectively.[9]

A routine follow-up appointment to review the wound is recommended in the next day or two. Visits after that can be negotiated based on rate of healing and patient preference.The wound will look raw, but the erythema and serosanguinous discharge should remain localized to the operative nail bed area. Inform the patient that it may take up to 6 weeks for total healing to take place. The patient should be able to walk comfortably within a few days, and should be able to return to work and sports activities after a couple of weeks.

Sterile saline can be used to wash off the wound the first few days. After that the area can be washed with soap and water in a shower. Some recommend avoiding baths, swimming or soaking the toe for 2

weeks. Dilute povidone iodine used to be a popular wound care agent but its usage has declined due to concerns that it may interfere with tissue proliferation and wound healing.[15] The wound can be left open to the air after the first few days, as some authorities believe it will heal more quickly this way. Continue to apply topical antibiotic twice a day until healing is well underway. Last but not least, remind your patient about conservative measures they can take to prevent recurrences in the future.

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