

REVIEW

Management of Ingrown Nails

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Abstract

Ingrown nails mainly affect the great toes, much less frequently lesser toes and rarely fingers. There are many speculations as to their etiology and pathogenesis; however, at the end, there is almost always a imbalance between too wide the nail plate and too narrow the (distal) nail bed. Ingrown nails occur at all age periods, from newborns to the over-100s though with different frequency, clinical characteristics, and management options. In recent years, conservative treatment options – taping, packing, gutter, braces, and many more - were developed avoiding the often disfiguring results of inadequate surgery. However, they require consistent and long-term therapy. Surgery is either aimed at narrowing the wide nail plate or reducing the hypertrophic lateral nail folds. The number of operation methods is vast; already 150 ago, more 75 different surgical techniques had been known, and there is virtually a new one published every week. Despite ingrown nails being a matter of concern for medical doctors since antique, new aspects continue to be detected, such as retronychia. Further, it was found that orthopedic foot abnormalities are very frequently seen in association with ingrown nails. Their treatment is often necessary to prevent recurrences.

Key words: *Ingrown nails; etiology; pathogenesis; conservative treatment; surgery; recurrence risk*

Introduction

Ingrown nails belong to the frequent and painful conditions affecting predominantly youngsters in their most active physical phase. They may considerably decrease the quality of life and, in extreme cases, even cause suicide ideation. They are typically chronic and the patients' and other lay persons' efforts to get relief usually aggravates the signs and symptoms. There is still an ongoing dispute on the etiology, particularly whether the wide nail plate or the hypertrophic nail folds are primarily to blame; this is also reflected by the terminology of unguis incarnatus vs. onychocryptosis.

Types of ingrown nails

Nails may grow into their surrounding soft tissue at any age; newborns may be delivered with ingrown nails and even 100-year-old persons may experience a painful ingrown nail.

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Neonatal ingrown nail

During intrauterine development, the big toenails usually have reached the tip of the toe, which is then overlapped by the nail at birth. However, occasionally, the great toenail has not overgrown the distal bulge and abuts it growing into the distal bulge causing erythematous inflammation and pain. This may be a short self-healing phase or require gentle treatment, usually by the mother. A bit of petrolatum or a similar fatty ointment is applied on the nail and then gently massaged in distal direction to push the distal bulge away while the baby is in a warm bath and held by the mother. The problem is usually solved within a few days. Another variant of neonatal ingrown nail is the bilateral distal ingrown nail (Fig. 1); here again, the nail has not yet overgrown the toe tip but is pinched distally from both sides. The treatment is analogous by gentle massage in a warm bath.

Figure 1. Neonatal ingrown big toenails



Infantile ingrown nail

There are two different types of ingrown nails in infants: the hypertrophic medial lip and congenital malalignment.

The medial nail fold, rarely the lateral one, is hypertrophic and overlaps a part of the nail plate, sometimes more than the half. This creates a deep crypt with accumulation of cellular debris and foreign material that degrade and cause an inflammation, a so-called cryptitis. Although this is rarely painful the mother may be scared and look for medical help. Usually, the overlapping nail fold can be massaged away as described above; however, if this is not effective it may be taken away with an electrical loop,

which is an operation taking a few seconds.

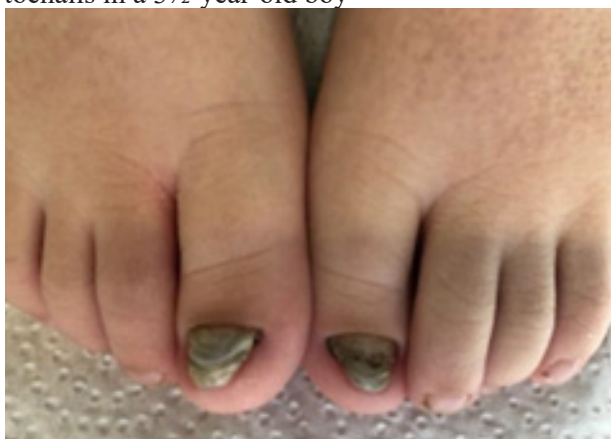
Congenital malalignment is seen at birth or in the first months of life; however, it may also develop later if there is a genetic predisposition. Often a preceding trauma is then the precipitating event. Originally, the disease was called congenital dystrophy of the big toenail until Baran recognized that the underlying abnormality was a lateral deviation of the long axis of the nail relative to the axis of the distal phalanx.³ In the last 25 years, more and different types of congenital toenail dystrophy have been observed, such as upward growing, congenital pincer nails or medial deviation.⁴ Very often, congenital lateral malalignment is associated with a hallux valgus or particularly hallux valgus interphalangeus. The nail is thick, dirty yellowish, triangular, medially overcurved, with many transverse furrows and a slightly laterally curved longitudinal axis.

Close inspection reveals a high degree of onycholysis, which is indeed the most important prognostic factor.⁵ The detachment of the nail plate from the nail bed leads to loss of counterpressure of the toe pulp during crawling and gait, which therefore becomes distorted dorsally thus forming a distal bulge with shortening and disappearance of the nail bed (Fig. 2). This is clearly seen after cutting away the onycholytic nail, which also reveals an impression of the nail margins into the soft tissue.⁶ As the bone is not yet fully developed it tends to become curved upwards aggravating the distal bulge. The condition is apparently genetic as it is seen in monozygous twins, siblings and sometimes unilaterally; this also happens in twins.

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The exact pathomechanism is not known. We believe that the tendency to hallux valgus interphalangeus leads to an asymmetric distal phalanx bone with a higher medial condylus that potentially pushes the matrix in medial-distal direction directly leading to the lateral deviation. However, this hypothesis is not yet proven. A hypertrophy of the dorsal-lateral ligament of the distal interphalangeal joint was forwarded as another explanation;⁷ however, surgical elongation of this ligament did not cure the condition.⁸

Figure 2. Congenital malalignment of the big toenails in a 3½-year-old boy



Adolescent ingrown nail

This is the most frequent type of ingrown nail. It often starts at school age and may last into young adulthood. One or both nail folds of one or both big toes become red and inflamed, are swollen and painful upon touch and pressure. This is generally called grade one (Fig. 3).

Figure 3. 11-year-old boy with imminent ingrowing nail, grade 1. Note the marked hallux valgus interphalangeus and hyperextension of the interphalangeal joint



With time, swelling, inflammation and redness increase, oozing and sanguino-purulent discharge develop; this is grade two. Finally, granulation tissue develops, which is sometimes mistaken for pyogenic granuloma (Fig. 4).

Figure 4. Ingrown toenail grade 2 in a 6-year-old girl



In long-standing ingrown nails, swelling and granulation tissue may reach enormous dimensions rendering daily activities difficult to impossible; this is grade three (Fig. 5).⁹

Figure 5. 21-year-old man with chronic ingrown toenail, grade 3



Many youngsters with ingrown big toenails are tall, sub-diabetic, have sweaty feet and the nail is markedly curved.¹⁰ The nail is often cut too short, particularly at its corners, but the corners may also have broken spontaneously.¹¹ This allows the distal nail bed to be pinched together making it narrower so that the regrowing nail has not enough space and grows into the distal lateral sulcus. Quite often, the lateral nail plate margin has a saw-like appearance as the patient tries to cut the offending margin, which aggravates the condition.

Adult-type ingrown nail

In adults, the ingrown nails are usually thick, strongly curved or asymmetrically kinked, the affected nail fold is thick and fibrotic (Fig. 6). Inflammatory changes may be less marked or like those in adolescents. Pain is usually less intense. Often, a precipitating single trauma is remembered or repeated trauma is found out.

Figure 6. Adult type ingrown big toenail with sharply bent nail, a pointed spicule is seen at the medial margin of the nail



Overcurvature

Nail overcurvature is a frequent condition. It may be entirely painless or cause excruciating pain, which is – curiously – independent from the severity of the curvature; in contrast, nails that show a curvature of 360° or even more are commonly symptomless. The condition is known under several terms, such as pincer nail or *unguis constringens* as the nail bed is pinched together, trumpet nail as it may look like the funnel of a trumpet, omega nail as the frontal view of the nail and pinched nail bed resemble the Greek capital letter omega.¹² The genetic form is apparently an autosomal dominant trait, it is symmetric and virtually always associated with lateral deviation of the nail and distal phalanx of the big toe. Lesser toenails may also be involved and show a medial deviation. Systematic X-ray examinations always showed a lateral deviation and asymmetry of the distal phalanx with marked bony appositions on the condyli of the base of the distal phalanx which were always bigger on the medial side and often had a hook-like appearance with the tip showing distally.¹³ This leads to an increase

of the width of the base of the distal phalanx with a consecutive widening of the curvature of the matrix. The proximal uncurving causes the distally increasing overcurving of the nail.¹⁴ This phenomenon is bilateral-symmetric in the genetic form of pincer nails (Fig. 7).¹⁵

Figure 7. Pincer nails in a 40-year-old woman; note the lateral nail deviation of the big toenail and the medially pointing nail axis of the 2nd toe



Distal ingrowing

When the big toenail is too short over a longer period or has been avulsed the tip of the toe's soft tissue is slowly dislodged dorsally as the nail plate is lacking and cannot exert counterpressure during gait. With each step, the entire body weight is on the toe tip, but the weight is increased by a factor of 2.5 due to the kinetic energy of the forward thrust during walking; this factor is even higher during running and other similar sports activities.

The distal bulge thus developing is a physical obstacle for the growing nail. In addition, after avulsion, the distal edge of the regrowing nail is usually slightly bent downward digging into the flesh.¹⁶⁻¹⁷ This may lead to the appearance

of granulation tissue or, more frequently, cause an arrest of forward growth of the nail with consecutive thickening of the plate and yellow discoloration (Fig. 8).

Figure 8. Distal nail ingrowing in a 20-year-old soccer player who had lost his big toenail seven times



Retronychia

Retrograde ingrowing of the nail is called retronychia. Although only described in 1999 for the first time it is not a rare condition, particularly considering the frequent non-inflammatory chronic forms that we have termed compression nail in accordance with D. Lubach. The etiology of retronychia is not yet fully understood although the pathomechanism is known: a heavy acute or chronic repeated trauma leads to subtotal onycholysis. As the nail is not firmly attached to the nailbed, which is in fact the stable support for the nail on the dorsal aspect of the distal phalanx, any compression movement of the nail is directly transferred to the matrix, which is a very fragile tissue. This leads to shearing off the nail plate from the matrix with microscopically visible horizontal splits in the nail. The nail is no longer transported forward although the matrix produces new nail substance. Thus, a new layer is formed under the old one raising the proximal margin of the old one.

With each new compression trauma that pushes the nail backward another horizontal rupture is caused leading to a further new nail. The proximal edge of the old nail is hardening and cuts into the overlying proximal nail

fold's undersurface that reacts with swelling, inflammation and granulation tissue finally emerging from under the free margin of the nail fold (Fig. 9).¹⁸ This is a painful condition and unfortunately rarely diagnosed correctly but erroneously treated with antibiotics as a primary infectious paronychia. Ultrasound examination of the proximal nail fold may help to make the correct diagnosis.¹⁹ The chronic form of retronychia usually remains without heavy inflammation and has still a certain potential of the nail to grow forward (Fig. 10); however, there are usually many layers of nail similar to onychogryposis that are formed under the old nail, which is eventually seen as an obliquely downward showing nail digging into the distal bulge that had developed because of the long-standing onycholysis. Another chronic form was called the horseshoe crab nail²⁰ or shrimp nail²¹ because of the clinical aspect (Fig. 11).

Retronychia is one of the very rare conditions where nail avulsion is indicated²² although in light cases topical steroids and in moderate cases steroid injections into the nail fold are often helpful.²³ For chronic retronychia, conservative dermatologic-podologic treatment is highly efficient.²⁴

Figure 9. Acute retronychia in a 20-year-old girl. (A) Clinical aspect with swelling and redness of the proximal nail folds. (B) The avulsed nail seen from its proximal shows the V-shaped apical portion with the hard and very sharp superficial margin

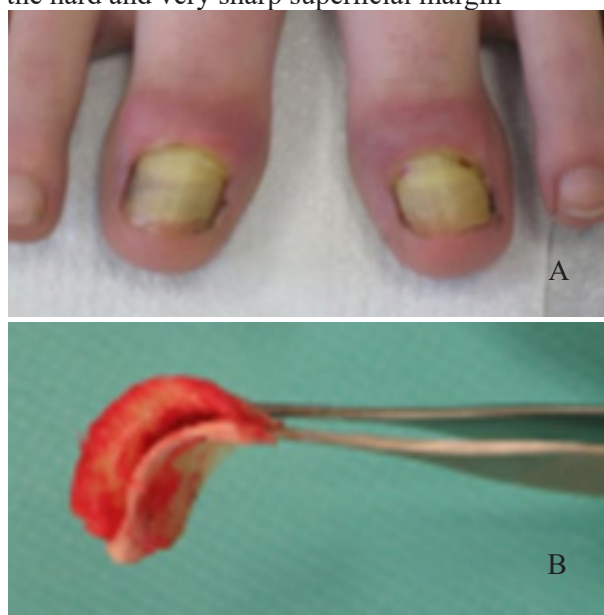


Figure 10. 43-year-old woman with chronic retronychia



Figure 11. Compression nail also called horseshoe crab or shrimp nail as a chronic repeated form of retronychia



Frequency

Ingrown nails are frequent conditions, particularly between the ages of 6-25 years. Exact numbers of the incidence are, however, lacking. Sports activities, tight shoes, foot maceration, inadequate foot hygiene are all contributing factors. Ingrown toenails are less frequent in populations walking barefoot.²⁵ About 20% of those presenting to general practitioners with foot problems suffer from ingrown toenails and a survey from the Netherlands gave a prevalence of 54/10,000 in Dutch general practice.²⁶⁻²⁷

Localization

The great toe is by far the most common localization. The lesser toes, particularly 2 and 3, may rarely be involved. Ingrowing fingernails are mainly seen in patients under treatment with epidermal growth factor receptor inhibitors during targeted cancer therapy, retinoids, HAART for acquired immunodeficiency syndrome and some other rare conditions that soften the epidermis in the lateral nail sulcus (Fig. 12).

Figure 12. Ingrown fingernail in a 65-year-old man with colon cancer under targeted cancer treatment with cetuximab



Etiology

The cause of neonatal ingrown nails is the incomplete length of the toenail in relation to the nail bed (Fig. 1).

In congenital malalignment, the medial condylus of the distal phalanx bone is higher pushing the medial matrix horn forward and thus leading to an obliquely oriented matrix. The medial and sometimes also the lateral margin of the triangular nail are bent downward and press on the soft tissue. In addition, there is usually a disappeared nailbed with a receded hyponychium and a large distal bulge (Fig. 2).²⁸

The most frequent type seen in school children, adolescents and young adults has a disbalance of a distally too narrow nail bed and a wide

nail plate. Additionally, the nail is usually markedly curved, and the lateral margins press into the lateral nail sulcus. Particularly when the nail edges are cut too short or broken the continuously growing nail will then dig into the skin and pierce it. This is painful and the patient tries to cut away the offending nail corner aggravating the condition.

Pathogenesis

The nail is a continuously growing keratin plaque. It is embedded on both sides in the nail sulci. When the distal nail corners overlap the toe, they can slide out without complication. However, when they are cut round the nail bed is compressed laterally, and the regrowing nail has not enough space and pierces into the soft tissue. Inflammation, serous and putrid exudation, granulation tissue and finally fibrosis follow (Fig. 13).

Figure 13. Long-standing ingrown big toenail with granulation tissue and massive fibrotic swelling of the distal portion of the lateral nail fold



Clinical Features

They are already briefly outlined with the description of the various forms and shall only be given in more detail for the most common, the adolescent type.

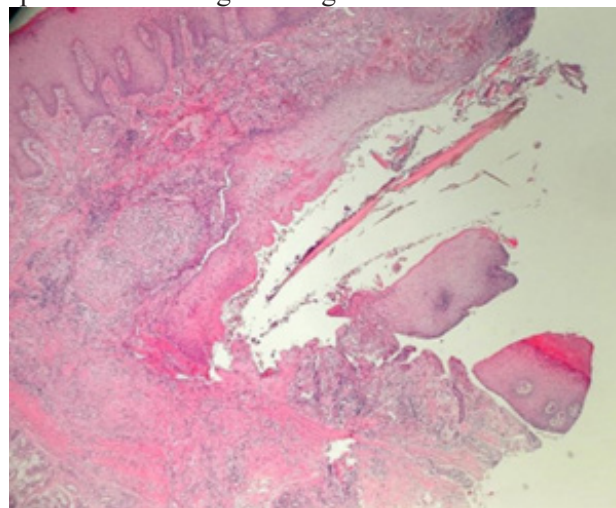
In grade 1, the distal portion of the nail fold is swollen, red and tender. In grade 2, seropurulent secretion is seen in addition and there is spontaneous pain. In grade 3, the toe is swollen,

red on one or both sides, the nail corner is hidden by the nail fold tissue, and granulation tissue has developed (Figs. 3-5). In long-standing severe cases, the inflammation has turned into fibrosis and all the signs mentioned are very pronounced.⁹ Extreme cases demonstrate overgrowth of granulation and fibrotic tissue (Fig. 13). The patients usually have stopped their physical activities because of pain.

Histopathology

Histopathologic examinations are rarely performed.²⁹ They show a very dense inflammatory infiltrate by lymphocytes with an enormously high percentage of plasma cells. The epidermis of the lateral nail fold is often hyperplastic. Specimens of wedge excisions with nail show the direct contact of the nail plate with the dermis and a considerable neutrophilic component attacking the nail keratin. The nail keratin is slowly digested by the neutrophils rendering it soft and fragile (Fig. 14).³⁰

Figure 14. Histopathology slide of a wedge excision specimen of an ingrown big toenail



Treatment

The management has to be divided into general, conservative and surgical measures.

General measures

Foot hygiene with daily washing and drying, wearing of adequate shoes and socks, as well as changing socks daily are self-evident. The

most important is cutting the nail square and leaving the corners of the nail overlapping the toe tip. Routine antibiotics although often given are of no use as it is the nail that causes the inflammation and not a primary infection. It also appears that “prophylactic antibiotics” do not prevent post-operative infections.³¹⁻³²

Conservative treatment

There are many ways to treat an ingrown nail without surgery. However, this usually requires patience and compliance, which many persons do not have. On the other side, skilled caretakers can achieve phantastic results with taping, packing, insertion of a gutter, dental floss, orthonyx braces, or artificial nails.³³

Taping is the simplest way, particularly in the early stage. A tape is firmly applied on the dry skin of the distal portion of the lateral nail fold in order to pull it away from the offending nail margin (Fig. 15). Although this may hurt during tape application the pain disappears almost immediately once the tape is in place. If possible, the tape should be moved under the corner of the nail making the procedure more effective and additionally bringing a buffer between the nail and the soft tissue. The tape is applied daily with increasing pull. Several layers of tape may be applied to anchor the first one.³⁴

Figure 15. Early but painful ingrowing. (A) Before; (B) after applying a tape to pull the soft tissue away from the offending nail corner



Packing is the technique of inserting a whisp of cotton under the corner or lateral margin of the nail to keep it away from the soft tissue (Fig. 16). Again, it may hurt when the cotton is inserted but the pain is immediately gone afterwards. This must be repeated until the corner of the nail has overgrown the toe tip. Packing and taping may be combined.

Figure 16. Packing as a treatment for chronic ingrown nail with fibrosis of the lateral nail folds in an 18-year-old man



A “cotton cast” may be inserted on the lateral aspect of the toenail and pressed from the nail to the lateral nail fold thus distancing the fold from the lateral nail margin.³⁵⁻³⁶ Gutter treatment comprises the insertion of a gutter over as much of the nail margin length as possible. Usually, a local anesthesia is necessary for this procedure.³⁷ The gutter may be tailored from the tube of a drip infusion, which is cut lengthwise and moved over the lateral nail margin. It is then fixed by tape, a stitch or acrylic resin.³⁴

Artificial nails may be used alone: a thick and long lateral nail margin is modelled so that this overlaps the toe and cannot cut into the sulcus skin anymore.³⁸ As most ingrown nails have a considerable transverse curvature flattening the curved nail is another approach. There are innumerable different types of nail braces, from plastic bands that are glued on the nail to steel braces that can be readapted. The simplest brace consists of a narrow band of an elastic polymer that is glued onto the lateral margin and then pressed on the medial to lateral third of the opposite side of the nail. Other plastic

bands cover the entire width of the nail. As their force is relatively small, they must be worn for many months to slowly uncurve the nail. More force can be exerted with steel braces. They are hooked under the lateral nail margin and screwed together over the middle of the nail.³⁹⁻⁴⁰ In the course of months the nail will be flatter; however, as the cause of the overcurvature is not tackled the curvature returns within a few weeks to its original shape.

Shape-memory alloy clips are a new approach to uncurve nails.⁴¹ The nail must be cut straight and the clip is pushed over its free margin. In order not to lose the clip it may be fixed with acrylic glue. It slowly unbends the nail. This method has the advantage that the application is not painful.⁴²

Ideally, conservative therapeutic measures are combined thus enhancing the success rate.³⁴⁻⁴³ All these conservative methods require a skilled person to demonstrate the technique and therapy adherence from the side of the patient. Whereas some groups have excellent results¹¹⁻³⁴ many others soon gave up and resorted to surgery. Apparently, it is also a question of mentality whether patients are willing to adhere to the noninvasive treatment.⁴⁴

Surgical treatment

Surgery has been the mainstay of ingrown nail therapy since many centuries and innumerable articles deal with a vast variety of different surgical techniques. According to the opinion on etiology and pathogenesis either the nail is made narrower when a wide nail is thought to be responsible for the condition, or the hypertrophic nail fold is reduced or excised if this is thought to be cause. Most of the countless variations of wedge excisions, which excise both a part of the nail bed and the lateral nail fold are wrong in their design and should absolutely be abandoned.

The terminal Syme operation was advocated for chronic ingrown nails. It comprises the amputation of the distal half of the big toe with removal of the matrix and nailbed (Fig. 17).⁴⁵ This is a totally inadequate and mutilating

method of treating a benign condition for which extremely efficacious, minimally invasive methods exist.¹

Figure 17. Late result after the terminal Syme operation



Another kind of overtreatment is the Zadik procedure in which the nail matrix is completely excised and the proximal nail fold sutured over the defect as an advancement flap.⁴⁶ Both the terminal Syme and the Zadik procedures may leave nail spicules, which is proof of poor surgery (Fig. 18).

Figure 18. Several spicules after Zadik operation *alio loco* in a 14-year-old girl



Nail narrowing methods

As there is a discrepancy between too wide a nail plate and too narrow a nail bed, reducing the nail's width is a logical consequence. Whichever method for the selective lateral/medial matrix horn removal is used is not critical. It is important to excise, ablate, or cauterize the matrix horn in a manner that no matrix remnants remain, which would give rise to a nail spicule or a recurrence.^{1,47} Nail narrowing should not be combined with nail fold excision, thus wedge excisions should not be performed.

Selective nail matrix narrowing

In order to render a wide nail narrower, the lateral or medial matrix horn should be removed. We do not advocate to routinely operate on both sides as this leaves a very narrow and unsightly nail. If one side is narrowed the entire nail has more space and after a short period of conservatively cushioning the lateral nail margin, this will neither be offending nor grow in anymore.

Surgical matrix horn resection is done under sterile conditions and truncal or distal anesthesia. If there is considerable infection an antibiotic prophylaxis may be indicated. The foot is thoroughly disinfected and prepped for the surgery. A tourniquet is applied. Excess granulation tissue is removed with a curette or scissors. The ingrowing lateral nail strip is detached from the nail bed back to the blind end of the matrix, cut longitudinally and avulsed. An oblique or L-shaped incision is made from the junction of the proximal and lateral nail folds in proximal-lateral direction to allow the space of the matrix horn to be opened. An incision is carried out down to the bone at about 5 mm medially from the lateral matrix border and the entire lateral matrix horn is dissected. This is often challenging as it reaches far laterally and proximally.

Care has to be taken to remove the entire matrix horn from the bone. Finally, the incision of the nail fold is closed with either two stitches or suture strips. A bulky padded dressing is applied, and the foot kept up to minimize

bleeding and swelling. Postoperative pain is minimal to moderate, but analgesics may be given according to the patient's needs. Healing is fast and the patient can usually return to school or work after 3 days to a week.⁴⁹

The lateral matrix horn may also be destroyed by electrodesiccation. Some radiofrequency device manufacturers offer special insulated spade-shaped electrodes for destruction of the matrix.⁵⁰ Conventional electrosurgery is not recommended as it generates too much heat that may damage the underlying periosteum and lead to long-term pain.

Laser is another option to ablate the matrix. Most commonly, CO₂ lasers were used, however, the 1064 nm neodymium-YAG was also used to heat-damage it.^{51,52} Chemical matrix horn cautery is now generally used. Which product - phenol, trichloroacetic acid, bichloroacetic acid, sodium hydroxide - is used is not critical provided it is able to necrotize the full thickness of the matrix epithelium. Liquefied phenol is the most widely used nowadays.⁵³ Phenol has four advantages: It is a strong protein coagulant thus able to necrotize the matrix epithelium; it is a strong disinfectant; it has a neurolytic action; and it is inactivated by blood. This means that we do not need to give antibiotics even in severely inflamed toes, postoperative pain is minimal, and as soon as the tourniquet is opened phenol is "neutralized" rendering "alcohol neutralization" unnecessary.

Phenol matrix horn cauterization, also called phenolization, is a simple, time-honoring method with the lowest recurrence rate of all surgical methods. After complete anesthesia and application of a tourniquet, the lateral nail strip is avulsed. Excess granulation tissue may be curetted. A small cotton ball dipped into liquefied phenol is vigorously rubbed into the bloodless matrix horn under the proximal nail fold for 3 to 4 minutes; we use a fresh cotton with phenol 4 times for a minute each. Excess phenol is wiped away. The tourniquet is opened after the 4-min phenol application. If available small tapered antibiotic tablets containing

framycetin (Leukase®-Kegel) may be inserted into the wound cavity; they keep the wound open and allow the postoperative drainage to escape (Fig. 19). A circular dressing with a petrolatum-based ointment is applied for 24 hours, which is changed after a day.

The patient is asked to elevate the foot for 48 hours as this minimizes postoperative swelling, bleeding, and pain. The postoperative care consists of once – or if in hot climate – twice daily rinsing the wound under a jet of tap water. This considerably shortens the healing time, prevents postoperative infection, and oozing. The patients can resume their daily activities within a few days as there is no risk of wound dehiscence. Rubbing the phenolized matrix with 20% ferric chloride at the end of the procedure shortens the period of drainage.⁵⁴

Figure 19. (A) Right big toenail with broken lateral distal nail corner causing considerable pain though inflammation is barely visible. (B) Immediately after phenolization. (C) End of the phenolization procedure with Leukase® tablets put into the lateral matrix horn and the small wound. (D) 24 hours postoperatively. (E) 3 weeks post-op. (F) 8 weeks post-op



Another option is to use 85 -100% trichloroacetic acid for 1 - 3 minutes.⁵⁵ It is said to cause even less postoperative pain and oozing; however,

a comparative study did not show a more rapid healing than phenol.⁵⁶ Recently, also bichloroacetic acid was used instead of TCA.⁵⁷ However, bichloroacetic acid continues to penetrate if its action is not stopped by either rinsing or neutralizing it.

Sodium hydroxide is another chemical to cauterize the matrix horn; in contrast to the aforementioned substances, it is an alkaline chemical. It is used for either 2 min or 1 min after curettage of the matrix. Both regimens were well tolerated and yielded the same good results.⁵⁸ A recent literature meta-analysis, however, found that there was no significant difference in the recurrence rate between NaOH and placebo.⁵⁹

Reduction of periungual soft tissue

Some nail surgeons consider a narrow nail plate a cosmetic disadvantage. They propose to reduce or completely excise the lateral nail fold. Depending on the amount of surplus soft tissue this may be done as a limited excision or as a radical removal.⁶⁰

If the nail fold hypertrophy is mild to moderate a fusiform excision from the lateral aspect of the distal phalanx may be performed. Upon suturing the fold is reduced and pulled away from the offending lateral nail margin.⁶¹ Another possibility is to do a large and deep excision to remove a big volume of the soft tissue; the wound may then be sutured.⁶²

Quite often, the lateral distal portion of the nail digs into the soft tissue, which forms a bridge from the lateral fold to the hyponychium. This is usually the result of a nail corner cut too short. A small banana-like excision may pull this false extension of the lateral nail fold down. The small defect may be stitched with 2-0 sutures that are knotted up to ten times. This maxi-knot is placed under the nail corner elevating it and allowing the nail to grow over this obstacle.⁶³

The Vandembos technique removes both nail folds starting about 5 mm in the lateral aspect of the proximal nail fold and excising the lateral

fold as a large soft tissue wedge down to the middle of the lateral distal phalanx and distally to the hyponychium including one third of it. This is done on both sides thus about one third of the toe's circumference is removed and only the central third of the hyponychium is left. The large wound heals by secondary intention, which may take 4 – 6 weeks. The aesthetic result is usually good. The recurrence rate is lower than that of Winograd's wedge resection.⁶⁴

Similar though even more radical is the super U technique. The lateral nail folds and the hyponychium are generously cut away freeing three sides of the nail. The wound is left for second intention healing, which takes several weeks. There is a risk of a parrot beak nail deformity because of shrinking of the hyponychial scar.⁶⁵

It is beyond the scope of this short review to mention all reported variations of the methods described in the literature. The understanding of the pathomechanism is the basis for all treatments. Radical surgeries like the terminal Syme operation, Zadik procedure or most wedge excisions are obsolete and demonstrate that the surgeon does not understand the condition.

Complications

Complications of ingrown nails are infection, pain, disability to walk and serious impairment of all physical activities.

Postoperative complications may be wound infection, particularly after scalpel surgery. This is the reason why many general surgeons routinely administer antibiotics. It is usually not necessary for phenol matrix horn cauterization. This method is also blessed by minimal postoperative pain.

Potential long-term and permanent complications of ingrown nail surgery are nail dystrophy, deviation of the nail toward the operated side, and toe mutilation (Figs. 20 & 21).

Figure 20. Result of bilateral wedge excisions with nail avulsions for ingrown nails in a 39-year-old woman



Figure 21. Nail dystrophy after bilateral wedge excisions



Recurrence

Recurrences after treatment of ingrown nails are common. Unfortunately, ingrown nail surgery is delegated in many surgery departments to young and inexperienced staff.⁶⁶ They do their surgical operations often without surveillance of experienced specialists and thus believe it is correct what they do. This poor surgery is then taken as routine with both poor to catastrophic results and very high recurrence rates. Even textbooks of “minor surgery” display wrong incision lines for wedge excisions that virtually invite recurrences as the authors of such books apparently do not know the anatomy of the matrix of the big toe.

With properly executed phenolization the recurrence rate is between 1 – 3% whereas publications on wedge excisions mention recurrences in 25 – 50% or even more.⁶⁷

Ingrown nail patients should not be left alone after surgery. A follow-up after 3 – 6 months and another one after a year is important to recognize any imminent recurrence or complications and demonstration of what to do in such a case are crucial.

Conclusion

Ingrown toenails are frequent conditions, particularly in youngsters. They may considerably impair the quality of life due to pain and restrictions of physical activities. Their treatment should be initiated as soon as possible as early stages are usually amenable to conservative therapy. Prevention is often easy with correct nail trimming, avoidance of inadequate footwear and prevention of soggy feet. Conservative modalities are varied with taping, packing, gutter placement, orthonychia braces, shape-memory alloy clips, and many more methods. They require some dexterity and above all compliance.

If conservative methods are not successful surgery is indicated. Of the many approaches, selective matrix horn removal, either surgically or by chemocautery, is the treatment of choice. Soft tissue resection takes weeks to heal but usually gives good results.

Conflict of Interest Declaration

The author have no conflict of interest to declare.

Acknowledgement

Nil

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