THE INGROWING TOENAIL

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Ingrowing toenails (also known as onychocryptosis) are a common and painful pathological nail condition which, if left untreated, may lead to serious infection (Bostanci et al, 2001; Bostanci et al, 2007; Brearley, 1958; Weaver et al, 2004). This paper sets out to describe the aetiology, diagnosis and management of this common condition, focusing on the chemical ablation (phenolisation) technique.

KEY WORDS

Ingrowing toenail (IGTN)
Onychocryptosis
Partial nail avulsion
Incisional wedge resection

Epidemiological & aetiological factors

Although ingrowing toenails (IGTNs) may occur at any age, they are most prevalent among young males producing a prolonged period of discomfort and/or pain, which is normally sufficient to interfere with work and social activities. A plethora of aetiological factors have been described including excess nail curvature, trauma, poor nail care, hypertrophic nail sulcus and even excessive foot pronation. Less commonly IGTNs may be associated with concurrent pathologies such as subungual exostoses, which may disrupt local nail tissues and render diagnosis more difficult *(Figure 1)*.

Pathology

The underlying pathological process is in some ways straightforward with impingement of the nail plate into local soft tissues leading to a typical foreign body inflammatory response. The nail plate, being composed largely of keratin, is however resistant to dissolution through the production of inflammatory mediators. Consequently chronic inflammation is often complicated by secondary infection. Chronic inflammation frequently results in the production of hypergranulation tissue, which further complicates the presentation *(Figure 2)*.

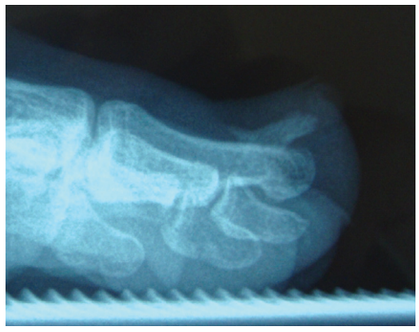

Figure 1. X-ray showing subungual exostosis.

Diagnosis

The clinical diagnosis in most circumstances is straightforward. The patient presents with a painful toe, most frequently the hallux. Pain is centred to one or both of the nail folds with maximal tenderness to apico-lateral pressure, which represents the site of nail impingement into the periungual tissues. The degree of associated inflammation can vary from minimal to florid with associated infection *(Figure 3)*.

Figure 2. Typical hypergranulation tissue in association with IGTN.

Treatment

Most patients present with acute pain and secondary infection at their GP practice, where antibiotics are typically prescribed. Unless infection is serious, antibiotics can however be safely avoided in favour of more definitive treatment. A key message is that antibiotics are ineffective in the treatment of IGTNs and typically only dampen down infection and inflammation while doing nothing to combat the underlying cause. Despite this, many patients continue to present late after receiving several courses of antibiotic therapy. This not only represents a waste of clinical resource

Figure 3. Varied presentation of IGTNs.

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but also adds to the problems associated with inappropriate antibiotic prescribing, namely the development of bacterial resistance.

Effective treatment necessitates removal of the offending nail spicule(s) and advice on local wound care. Nail removal mandates some form of anaesthesia, typically a digital block in an outpatient setting. Care should be taken to assess the patient's psychological and medical suitability for local anaesthesia with careful consideration in the paediatric population who may be better served with treatment via a specialist centre. Failure to adequately assess children for local anaesthetic suitability can lead to serious child and parental distress with negative lasting effects. Application of topical anaesthetics such as EMLA™ cream in advance may have some psychological benefits but do little to mitigate the pain of digital anaesthetic blocks.

Having determined the appropriate anaesthetic options the next step is to decide upon which regions of the nail plate require removal. Typically only the offending nail spicule(s) require removal, though occasionally it is necessary to remove the entire nail rather than one or both of the nail edges. Indications for total rather than partial nail avulsion are:

- Severe nail infection
- Where the residual nail following partial nail removal would be cosmetically unacceptable
- Nail dystrophy
- Nail infection, eg, onychomycosis.

The next step is to decide whether the nail bed should be left to allow the nail to regrow or whether ablation of the nail matrix by either chemical or surgical means is appropriate. Ablation of the nail matrix will prevent the portion(s) of removed nail from re-growing, thus affording a definitive treatment. Simple avulsion without matrix ablation is indicated in specific circumstances *(Table 1)* where regrowth of nail plate is desirable or where infection or healing capacity preclude more aggressive procedures.

In some circumstances a step-wise approach may be necessary, involving a primary nail avulsion followed by ablation. The primary clinical circumstance for this is a patient in whom a surgical ablation is required (also known as an incisional nail procedure), but active infection precludes this immediate intervention because of the risk of inciting deeper infection. In these circumstances one can proceed with an initial nail avulsion allowing resolution of infection beforeproceeding with incisional nail procedure.

Table 1.

Indications for nail avulsion without matrix nail bed destruction.

Singular IGTN event with no underlying nail pathology
Removal of fungal nail in preparation for antifungal treatment
Poor healing capacity
Presence of severe infection contra-indicating more definitive treatment

In terms of definitive treatment, both chemical ablation of the nail matrix and surgical excision of the nail bed are well described in the literature. Of the two techniques, surgical wedge resection is reported as having greater complications and regrowth rates compared with chemical ablation, which remains the gold standard (Bostanci et al, 2007; Bos, 2007; Morkane et al, 1984).

However, it should be remembered that phenolic compounds are caustic chemicals known to cause skin rashes, dermal inflammation, contact dermatitis, burns, ulceration and necrosis and, while common in nail surgery, cannot be considered an innocuous substance (Shvedova, 2000). Phenol ablation creates a chemical burn requiring healing by secondary intention (Mizumoto et al, 2003). Secondary intention healing places greater metabolic and vascular demands upon the individual than those associated with primary healing processes. This is particularly important, as surgical ablation may be preferable in those patients with reduced healing capacity. The Winograd matrixectomy, as a surgical technique, offers a useful and alternative staged approach in the management of this condition for those with a poor healing capacity.

Putting this into a clinical context, in the absence of concerns over healing as a result of vascular insufficiency or immunosuppression, nail ablation with phenolisation remains the gold standard with predictable outcomes and re-growth rates between 2-5%. As the safety of phenolic compounds during pregnancy and breast feeding has not been established an incisional approach may be more appropriate in these patients. Finally, a small proportion of patients present with IGTNs in association with other lesions such as extensive hypergranulation tissue,

Figure 4. A subungual exostosis mimicking an IGTN.

periungual fibromas and subungual exostoses *(Figure 4)*.

In these circumstances application of caustics such as phenol is contra-indicated. Incisional techniques are thus mandatory in such circumstances.

Phenolisation technique

The phenolisation procedure is considered a 'clean' rather than 'sterile' procedure and therefore full operating facilities with laminar airflow are not necessary. Informed consent should properly disclose the risks of nail surgery, which are summarised in *Table 2* below. Subject to suitability, a simple digital nerve block with medium acting local anaesthetic agent such as prilocaine or mepivacaine is appropriate. Digital anaesthesia is easily achieved by administration of an amide local anaesthetic which must not contain a vasoconstrictor due to the risk of digital ischaemia. The procedure is conducted as follows:

1. Confirm consent and mark the toe(s) to be operated on.
2. Prepare the equipment on a clean trolley ready for use.
3. Position the patient in a semi-recumbent position and check the anaesthetic.
4. Place a sterile towel under the foot to be operated on and prep the local skin with a suitable agent such as Betadine®.
5. Apply a digital tourniquet after checking the anaesthetic *(Figure 5a)*. Free the eponychium and nail section to be removed (*Figure 5b)*.
7. Using a Thwaites nail cutter cut the minimum section of nail to resolve the IGTN *(Figure 5c)*.
8. Next grasp the free nail section with an artery forceps and gently rotate while lightly pulling once you feel the nail section is almost completely free *(Figure 5d)*.
9. Finally, carefully apply no less than 80% concentration phenol using a fine probe or cotton stick. Commercially available phenol sticks are also available. Application times vary but in the authors' experience the 2-3 minutes is reasonable with lower limits being more appropriate to younger patients. The critical factor for this procedure is to have a blood-free zone during the tourniquet application *(Figure 5e)*.
10. Finally the toe is dressed. The authors see no practical value in the so-called 'flushing' technique, simply because on tourniquet removal any excess phenol will be inactivated by the blood entering the area.
11. A clear operative note should be provided indicating the individual operative steps and especially the tourniquet release and return of circulation.

Postoperative care

Postoperatively there are two factors to consider. Firstly analgesia and secondly wound management. In the authors' experience this procedure results in minor levels of postoperative pain and 24 hours of paracetamol 1gm qds is sufficient for the vast majority of patients.

Table 2.

Risks of nail surgery to be disclosed.

Risk	Avulsion	Phenolisation	Incisional
Nerve injury from injection	✔	✔	✔
Local anaesthetic failure	✔	✔	✔
Nail re-growth intended	✔		
Re-growth rate	100%	5%	5-10%
Post-op pain/discomfort despite analgesia	Rare	Rare	Likely
Infection minor/severe	<2%	2-3%	<2%
Loss of nail plate partial/total	All	All	All
Bleeding	Rare	Rare	Common with Zadek's

Figure 5a. Apply digital tourniquet.

Figure 5b. Free the nail section to be removed.

Figure 5c. Cut the nail to resolve the IGTN.

Figure 5d. Lightly rotate the nail section free.

Figure 5e. Apply phenol concentration.

The first dose should be taken before the local anaesthetic wears off.

Postoperative care differs entirely from the typical surgical wound. As phenol generates a chemical burn, patients should be instructed to remove their dressing after 24hrs and soak their foot in bowl of salty, lukewarm water. This will promote removal of wound slough and prevent the development of wound eschar at the site of nail removal, which can then lead to trapping of necrotic tissue. After this brief foot soak the toe is dabbed dry with sterile gauze and redressed. Dressings of any non-adherent contact layer and gauze secured with Tubinette™ is acceptable. Patients are encouraged to wear open sandals and repeat this process daily. A formal inspection of the wound is advised after 5-7 days. Healing times with phenolisation techniques are typically slow, often running into weeks rather than days. Expect total nail ablations with phenol to take longer to settle, a consequence of the increased wound volume. Inflammation localised to the eponychium usually represents phenol flare rather than actual infection. The typical course is for a near linear improvement in wound appearance with reduced ooze on the dressing with time.

Where infection is suspected normal principles apply. Wound swabs and sensitivities are advised to ensure appropriate antibiotic therapy, although initial blind therapy should target gram-positive cocci such as *staphylococcus aureus*, a common culprit.

Complications of phenolisation technique

Despite the simplicity of the technique complications can and do arise from it. One of the worst recorded was the development of MRSA septicaemia, which ultimately led to partial paralysis secondary to a spinal abscess. A reminder perhaps that even the most innocuous of interventions can have catastrophic consequences.

More typically complications are of a more minor nature. Transient neuritis following digital block is common but self-limiting over three to four weeks. Temporary circulation impairment can occasionally occur as a result of vasospasm and/or over-zealous tourniquet application. In the authors' experience a short period of limb dependency and a few minutes lead to restoration of patent flow. Re-growth rates of up to 5% are reported, though this may be an underestimation in some circumstances. Without doubt, technique plays an important part and common errors leading to regrowth include:

1. **Inadequate bloodless field**

a. Phenol chemically cauterises the exposed nail bed but in the presence of blood the phenol molecules are effectively diluted, reducing the degree of nail bed cauterisation.

2. **Phenol concentration**

a. Phenol is available in a range of concentrations. Solutions of less than 80% concentration are not effective in nail bed cauterisation and should not be used for this purpose.

b. Nowadays dedicated phenol swabs (Phenol EZ Swabs™, DLT Podiatry Ltd, UK) are recommended for this application to reduce the risk of inadequate exposure and contact.

3. **Phenol time of application**

a. Most authors agree that an exposure time of between 2.5-3 minutes is adequate and balances the need for nail bed cauterisation against excessive tissue destruction.

b. The authors would suggest that in children where tissues are more delicate an exposure time of 2 minutes is adequate.

Onycholysis *(Figure 6)* may be seen in some cases following partial nail ablation. This is typically a transient problem which will resolve with natural nail plate growth.

Regrowth of all or more commonly fragments of nail represent a failure of the phenolisation procedure and may not manifest for several months after the surgery due to the relatively slow rate of growth of toenails.

Summary

Nail avulsion/ablation techniques are indicated for several pathologies including ingrowing nails, nail dystrophy and as part of treatment for fungal infection. Of the techniques available, phenolisation is technically simple and affords reliable outcomes. Clinicians should however keep in mind the absolute and relative contraindications for phenolisation techniques and give consideration to incisional techniques which, though more technically challenging, impose a lesser burden in terms of wound healing. DN

Figure 6. Onycholysis with nail dystrophy following partial nail ablation.

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