Surgical treatment of ingrown toenails in children: what is best practice?

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INTRODUCTION Surgery for ingrowing toenails carries a significant re-operation rate. We reviewed our departmental figures to assess the optimal management of these patients.

PATIENTS AND METHODS We performed a 10-year retrospective review of all patients undergoing surgery for ingrown toenails (IGTN) in order to determine the operations most commonly used and the re-operation rate of each of these procedures.

RESULTS A total of 880 procedures were performed on 414 patients. The median age at operation was 8.5 years. About half (48%) of children underwent two or more procedures with wedge excision and phenol application being the most common initial and repeat procedure. Recurrent surgery was most likely following plain avulsion or wedge avulsion without phenol application. Excision of the nailbed with phenol application had the lowest recurrence rate at 18.4%.

CONCLUSIONS We recommend wedge resection with phenol application as first-line treatment with simple avulsion reserved for severely infected toes. Total nail bed excisions should be reserved for patients with significant on-going morbidity associated with IGTN. Families must be made aware of the likely outcome of IGTN surgery and the choice of operation must be tailored to the individual.

KEYWORDS

Ingrowing toenail – Phenol – Wedge resection – Nail bed excision

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Ingrown toenails (*unguis incarnates*) are an extremely common problem within the general population with around 10,000 cases seen every year in the UK.¹ It is a significant problem also within the paediatric and, in particular, the adolescent population.² The condition can cause considerable pain and discomfort and can have a detrimental effect on the daily activities of a child such as schoolwork and sporting activities.⁵

The aetiology of ingrown toenails (IGTNs) is not fully understood. There have been several theories as to the contributing factors, such as tight-fitting shoes, trauma, incorrect trimming of toenails and genetic susceptibility.^{2–4} The disease process of IGTNs consists of three stages – inflammation, infection and finally granulation.^{3,4} Treatment options depend on the stage of disease with which the patient presents and can be categorised into conservative and non-conservative. Several studies have shown that conservative treatments are highly successful when used appropriately in the initial stages of the disease. These treatments include education with regards to nail care and proper trimming, antibiotic use and soaking of the feet.^{4,5}

The non-conservative (surgical) treatment options for

IGTNs include: (i) avulsion of the entire nail, allowing time for the infection and inflammation to settle before the nail grows back; (ii) wedge excision of the affected edge of the nail, first described by Winograd (1929); and (iii) complete excision of the nail bed which prevents re-growth of the nail, described by Zadik (1950).^{4,6,7} Phenol (C₆H₅OH) was originally used for the sterilisation of the surgical field, before its toxic effect on tissue was noted. In its concentrated form, it causes a chemical burn by destruction of the tissue structure secondary to water absorption and protein coagulation. Otto Boll first described phenol as a chemical treatment for IGTNs in 1945.⁸ Since then, several studies have demonstrated its effectiveness when used alone or in combination with a surgical procedure for the treatment of IGTNs.^{1,8–11} In our own centre, the application of phenol is standardised as careful local administration for 2 min using either soaked cotton wool or an applicator stick.

Although most of the current literature focuses on the adult population, there has been increasing interest recently in defining this problem within the paediatric population.^{2,3,9} The high recurrence rate of IGTNs within our own single-centre paediatric setting was noted and, therefore,

we decided to assess the range of surgical treatment options for IGTNs and their effectiveness in children.

Patients and Methods

This was a 10-year retrospective cohort study within a single-centre, paediatric, tertiary referral centre. The aims of the study were to determine:

1. The variation of age of patients undergoing operations associated with ingrown toe nails.
2. Which procedures are most commonly used as first-line and second-line treatments within our centre.
3. The number of operations a patient has to undergo as a consequence of ingrown toe nails.
4. The failure rate of all operative treatments for IGTN as defined by the need for further surgery and examining the time between surgical procedures.

The surgical notes of patients undergoing surgery for IGTN were studied. These were identified by four different IGTN operation codes, relating to three surgical options and the inclusion of phenol within the operation. We determined whether these procedures were the first episode of patient care in our unit or a repeat episode. Follow-up to look for recurrent surgery was set at a minimum of 18 months. If a patient underwent surgery outwith this time period, but within our study period, the operations were counted. Inclusion criteria included patients treated at the Royal Hospital for Sick Children (RHSC) in Edinburgh over a 10-year period, from 1 January 1997 to 1 January 2007. Operations taking place outside of RHSC Edinburgh were excluded. Age cut-off for treatment in RHSC Edinburgh is below 15 years and, therefore, recurrences in children older than this were not examined. The rationale behind a particular choice of procedure or the use or exclusion of phenol was not examined.

The data were analysed in six treatment groups:

1. Avulsion of the entire nail (A).
2. Avulsion of the entire nail and chemical destruction of the nail bed with phenol (PhA).
3. Wedge excision of a nail edge (WE).
4. Wedge excision of a nail edge and chemical destruction of the nail bed with phenol (PhWE).
5. Excision of the nail bed (NBE).
6. Excision of the nail bed and further chemical destruction of the nail bed with phenol (PhNBE).

Operations were lateralized according to right or left procedures, and, in the case of wedge excisions, lateral or medial segments. Each segment of nail that was treated was counted as one individual procedure. A revised procedure was one that was associated with the same nail and, in the case of wedge excisions, the same aspect of the nail, operated on previously within the 10-year study period.

Statistical analysis

A two-tailed chi squared test without Yates correction was used to determine whether there was a significant difference between operations and whether or not the addition of phenol significantly reduced re-operation rates.

Results

Over the 10-year period, 414 patients were treated. There were 209 females and 205 males (no significant difference, $P = 0.077$). The patients underwent 686 episodes of operative treatment with 880 toes requiring operation. The median age of a patient at the time of operation was 8.5 years (range, 1–16 years).

The most common first procedure was a wedge excision with phenol (34.7%), followed by wedge excision without

Table 1 Procedure choice for first-line and subsequent surgical IGTNs treatment

Procedure	Number as first-line procedure	Percentage of total (%)	Number as revision procedures	Percentage of total (%)
Plain avulsions	141	28.4	34	8.9
Avulsions with phenol	16	3.2	47	12.3
Wedge excisions	151	30.3	29	7.6
Wedge excisions with phenol	173	34.7	171	44.8
Excision of nail beds	6	1.2	25	6.5
Excision of nail beds with phenol	11	2.2	76	19.9
Total	498	100	382	100

Table 2 Re-operation rates

Procedure	Number completed	Number of revisions	Percentage requiring revision (%)
Avulsion	175	104	59.4
Avulsion with phenol	63	14	22.2
Wedge excision	180	87	48.3
Wedge excision with phenol	344	73	21.2
Excision of nail bed	31	7	22.6
Excision of nail bed with phenol	87	16	18.4
Total	880	301	34.2

phenol (30.3%) and simple avulsion (28.4%). Of the 880 procedures performed in the 10-year study period, 57% (498) were the first operation and 43% (382) were a revision operation. The choice of revision procedure was most likely to be wedge excision with phenol (44.8%) followed by excision of the whole nail with phenol to the nailbed (12.3%) as shown in Table 1.

Some 52% of patients required only a single procedure but 33% required one further procedure and 15% required three or more procedures.

The overall re-operation rate was 34.2%. The re-operation rate was highest for plain avulsion at 59.4% but even excision of the nailbed with phenol application had a re-operation rate of 18.4% (Table 2). The re-operation rate was significantly lower for nailbed excision than plain avulsion of the nail ($P < 0.001$) but did not reach significance when avulsion and wedge excision were compared or when wedge and nailbed excision were compared. The addition of phenol to each of the basic procedures lowered the re-operation rate and reached statistical significance for both avulsion versus PhA ($P < 0.001$) and wedge excision versus PhWE ($P < 0.001$). However, there was no significant difference between any of the phenolised procedures (PhA, PhWE and PhNBE).

The median time between initial surgery and revisional surgery ranged from 7 months to 14 months. Patients with simple avulsions had a median of 7 months between surgical cases. This was extended to 14 months if phenol was used. Those undergoing a wedge excision, with or without phenol had a median of 8 months. Nailbed excisions without phenol had a median of 13 months, with phenol this was 14 months.

Discussion

Within our tertiary, paediatric, surgical centre, we have demonstrated that ingrown toenails are an extremely com-

mon presenting complaint. Within this cohort, the mean age at operation was 8.5 years, but the majority of patients treated were within the 11–13-year-old age range. The maximum age at referral of new patients to our department is 15 years, which may affect this. However, this majority is in agreement with other paediatric population studies, which have shown that the average age associated with IGTN operations is 12.5 years.²

IGTNs frequently require multiple procedures, a finding that is demonstrated in several other papers.^{2,11,12} Within our centre currently, the most common operation performed for the recurrence of an IGTN is a wedge excision with the addition of phenol, accounting for 44.8% of second-line procedures. Other studies have shown that plain avulsions or avulsion with chemical matrixectomy are the most popular choices as the management of recurrent IGTNs.²

Several previous studies have demonstrated that the addition of phenol significantly reduces the recurrence rate of IGTN within individual surgical techniques.^{1,8–11} A Cochrane review of IGTN surgery in adults found that avulsion with the use of phenol was more effective at reducing symptomatic recurrence than nail bed excision techniques.¹ Conversely, a recent study in 2007 showed that phenol used with wedge excisions significantly increases recurrence rates within the paediatric population.⁵ We found that the addition of phenol significantly reduced the recurrence rate when combined with avulsion or wedge excision technique. There are, however, risk factors associated with the use of phenol such as severe burns to patients^{9,15} and an increased risk of infection has been demonstrated previously.^{1,5,8}

Other centres have advocated that a plain wedge excision should be the primary treatment of choice for IGTNs in children.⁵ Taking into account both effectiveness and cosmetic outcomes, as described in previous studies,^{4,9} we recommend the use of wedge excision with phenol as a primary treatment for IGTNs. We disagree with Greig *et al.*,¹¹ who suggest that total nail bed excisions should be used

with patients who have failed conservative treatment and feel that this procedure should be reserved for those individuals who have either very significant, on-going morbidity associated with IGTNs or a strong personal preference for this treatment.

Within this study, we appreciate that follow-up and, therefore, the validity of results were limited by patients who re-presented to our clinical centre alone, which in turn required patients to fulfil specific age and geographical criteria. Furthermore, the effectiveness of a procedure was determined as the need for re-operation rather than symptomatic reoccurrence treated by conservative means. The lack of a standard treatment pathway and variable experience of the operating surgeons may also have affected our data.

Conclusions

Although we can say that over half of patients did not require re-operation within our centre, over one-third did require a second operation and over one in ten required three operations. These figures along with the individual procedure recurrence rates and their expected cosmetic end result are important details, which should be available to parents and patients prior to treatment and may influence their decision when discussing surgical options.

References

1. Rounding C, Hulm S. Surgical treatments for ingrowing toenails – Cochrane Review. *Foot* 2001; **11**: 166–82.
2. Yang G, Yanchar NL, Lo AYS, Jones SA. Treatment of ingrown toenails in the pediatric population. *J Pediatr Surg* 2008; **43**: 931–5.
3. Kaleel SS, Iqbal S, Arbuthnot J, Lamont G. Surgical options in the management of ingrown toenails in paediatric age group. *Foot* 2007; **17**: 214–7.
4. Zuber T. Ingrown toenail removal. *Am Fam Phys* 2002; **65**: 2547–50.
5. Lazar L, Erez I, Katz S. A conservative treatment for ingrown toenails in children. *Pediatr Surg Int* 1999; **15**: 121–2.
6. Zadik F. Obliteration of the nail bed of the great toe without shortening the terminal phalanx. *J Joint Bone Surg Br* 1950; **32**: 66–7.
7. Winograd A. A modification in the technic of operations for ingrown toe-nail. *J Am Med Assoc* 1929: 229–30.
8. Epensen EH, Nixon BP, Armstrong DG. Chemical matricectomy for ingrown toenails: is there an evidence basis to guide therapy? *J Am Podiatr Med Assoc* 2002; **92**: 287–95.
9. Islam S, McKean Lin E, Drongowski R, Teitelbaum DH, Coran AG *et al.* The effect of phenol on ingrown toenail excision in children. *J Pediatr Surg* 2005; **40**: 290–2.
10. Herold N, Houshian S, Riegels-Nielsen P. A prospective comparison of wedge matrix resection with nail matrix phenolization for the treatment of ingrown toenail. *J Foot Ankle Surg* 2001; **40**: 390–5.
11. Greig JD, Anderson JH, Ireland AJ. The surgical treatment of ingrowing toenails. *J Bone Joint Surg* 1991; **73**: 131–3.
12. Murray WR, Bedi BS. The surgical management of ingrowing toenail. *Br J Surg* 1975; **62**: 409–12.
13. Sugden P, Levy M, Rao GS. Onychocryptosis – phenol burn fiasco. *Burns* 2001; **27**: 289–92.