

Gutter treatment for ingrowing toenails

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Summary and conclusions

The gutter treatment for ingrowing toenails consists of introducing a small guard along the side of the toenail and requires only three outpatient attendances. The gutter is left in place for eight to 12 weeks and then removed by the patient. Two studies were carried out to establish the long-term results of the method. In one, a preliminary retrospective study, 13 out of 25 patients who had received the gutter treatment were cured after one year compared with five out of 15 patients in whom the toenail had been avulsed. In a randomised prospective study 20 out of 36 patients (56%) treated by the gutter method were cured after one year compared with 27 out of 32 (84%) in whom the wedge resection procedure had been used.

The gutter treatment demands little skill and may be carried out in general practice. It gives an excellent cosmetic result with immediate pain relief and does not compromise further surgery should this be required, thus fulfilling the main requirements for the primary treatment of choice.

Introduction

Ingrowing toenails are common, with 73% of cases occurring in people aged 12-30 years.¹ The incidence in the general population is not known, but 55 out of 275 police officers questioned² had symptoms of an ingrowing toenail. The condition causes discomfort, pain, and inconvenience and restricts activity. The patient usually attends his general practitioner complaining of pain in the big toe and may be treated by him or referred to a minor surgical clinic in the local accident and emergency department or to a general surgical, orthopaedic, or chiropody clinic, where long waiting lists are common.

Management varies from conservative treatment with antibiotics and dressings² to radical nail-bed ablation³ depending on the experience and interest of the attending doctor. Phenol cauterisation of the germinal matrix has recently become more popular.^{4,5} In many cases, however, the general practitioner does not have the necessary facilities or expertise for these surgical procedures.

In 1975 we developed the gutter treatment,^{6,7} which is a simplified method of treating ingrowing toenails that requires little or no supervision and may be carried out in general practice. Out of 61 patients treated by this method, 58 experienced total relief of pain within 12 hours. We have carried out two trials to assess the long-term efficacy of the method and report here our results.

The gutter treatment

Principles of treatment—The gutter treatment was designed to relieve pain and permit healing of the lateral nail groove by protecting it from the trauma it is subjected to by an irregular or ingrowing nail. In most cases of "ingrowing" of the nail the soft tissues grow around the nail, owing to local inflammation, and result in an embedded nail.^{8,9} With the gutter in place, the soft tissues of the nail groove are protected from further trauma and not only re-epithelialise but also tend to reform the nail groove, which may take eight to 12 weeks.

Indications—Indications for treatment are acute or chronic ingrowing toenails, particularly when a granuloma is present in the nail groove. Abnormal thickening of the toenails is a contraindication, as is onychogryphosis. Infection and mild cellulitis are not contraindications, but gross cellulitis should be treated with antibiotics for five days before gutter insertion.

Gutter treatment kit—The treatment kit (Portex Ltd, Hythe, Kent) is presterilised and comprises an introducer, a sleeve, and two polythene gutters. The introducer has a handle and shaft, with the shaft ground to form a C shape at its distal end where it engages the lateral edge of the toenail. The gutter is a 2-cm length of fine polyethylene tubing slit lengthwise, thus also forming a C shape, and able to slip over the shaft of the introducer.

TECHNIQUE

After routine surgical toilet the affected toe is anaesthetised using 2-4 ml of 2% lignocaine (plain) as a ring block (fig 1). When pin-prick sensation is lost, a tourniquet is applied and with a scalpel some of the proud flesh and all the granulation tissue is excised from the nail groove with a V-shaped incision (fig 2). Only a small wedge of tissue is excised (as most of the swelling is due to inflammation), and the remaining bulk shrinks quickly after treatment. With the gutter assembled on the introducer, the groove of the introducer is positioned along the lateral edge of the nail and the gutter advanced along the nail groove until it can be pushed no further. The proximal end of the gutter will then lie under the eponychium (fig 3). With the introducer still in place, one or two 3-0 silk sutures may have to be inserted through the distal nail fold or nail, or both, to stabilise the gutter for the first 10 days, but this was necessary in only 10-20% of cases. The introducer is then removed, still holding the gutter in place with the sleeve. Fig 4 shows the final position of the gutter engaged along the lateral edge of the nail.

The toe is finally dressed (after removal of the tourniquet) with tulle gras and a firm dressing to reduce oozing from the toe. On the

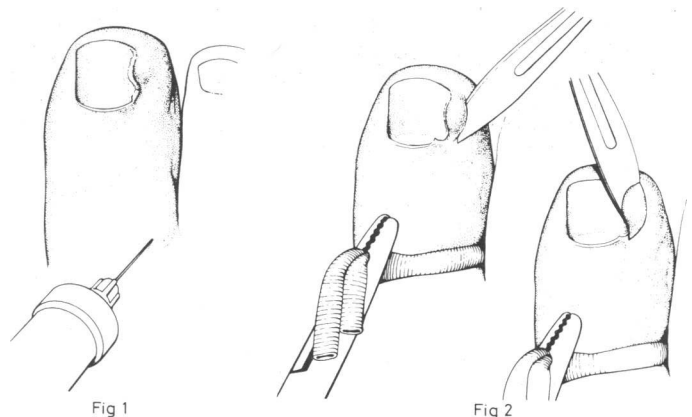


FIG 1—Toe is anaesthetised using a ring block. FIG 2—Minimal resection of soft tissues may be necessary to identify edge of nail and remove granulation tissue. In mild cases this is not required.

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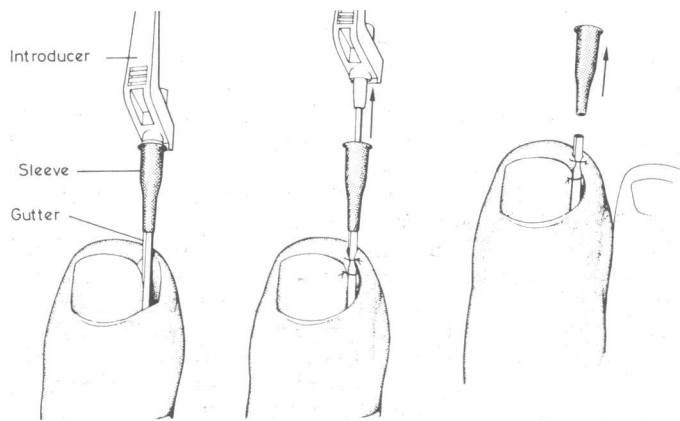


FIG 3—Gutter mounted on introducer is inserted down lateral nail edge. Sutures are rarely required when removal of soft tissue has been kept to a minimum. While introducer is removed gutter is kept in position by sleeve.

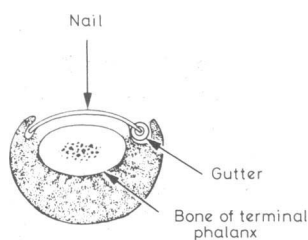


FIG 4—Final position of gutter shown in cross-sectional view of toe.

third day after insertion dressings are removed, a small plaster applied, and a final appointment arranged for 10 days after insertion. The toe is then exposed, any skin suture removed, instruction given on how to trim the toenail properly, and the patient discharged. The patient is instructed to remove the gutter between eight and 12 weeks later. No restriction is placed on normal activities while the gutter is in place.

We review patients at six to nine months after treatment, and if the ingrowing has recurred we advise phenol cauterisation of the germinal matrix⁴ or a wedge resection procedure.⁹

Methods

The incidence of surgically treated ingrowing toenails was established from the records of all patients treated in the accident and emergency departments of the two Newcastle hospitals during six-month periods between January 1975 and January 1976.

PRELIMINARY RETROSPECTIVE STUDY

In this study we compared the gutter treatment with toenail avulsion. Between October 1975 and April 1976 we treated 35 unselected patients with ingrowing toenails by the gutter method. In February 1977 we recalled all 35 patients for examination, of whom 25 attended, together with 15 patients who were treated during the same period by simple avulsion of the toenail. All patients were examined by one of us (WAW), photographs of the toes taken, and a questionnaire completed. Table I compares details of the two groups of patients. The

TABLE I—Details of patients treated by gutter method or avulsion of nail in retrospective study

| | Gutter treatment | Avulsion |
|----------------------------|------------------|----------|
| No of patients | 25 | 15 |
| Age range (years) | 11-34 | 15-36 |
| Mean age (years) | 21 | 22 |
| Follow-up period (months): | | |
| Range | 10-17 | 10-17 |
| Mean | 14 | 12 |

criteria for successful treatment were strict. The patient was considered to be cured only when (1) inspection of the nail showed no evidence of an ingrowing toenail; (2) there had been no discharge from the toe; and (3) there had been no pain or discomfort from the toe after the treatment period until the time of follow-up.

PROSPECTIVE STUDY

Between August 1977 and August 1978 we carried out a prospective randomised trial of the gutter treatment. The results were compared with those in a group of patients treated by a form of wedge resection operation—namely, segmental excision of the germinal matrix.⁹ Fig 5 summarises the operative steps in this procedure. The patients were selected using the following criteria: (1) they had a recent ingrowing toenail with pain, swelling, discharge, and obvious granulation tissue present in the nail groove; and (2) they had no history of surgery of any kind to the affected toe and no abnormal thickening of the nail. At the initial presentation a questionnaire was completed for each patient, and randomisation was carried out using prearranged sealed envelopes as designed by our statistical adviser (DW). All procedures were carried out by us as outpatient treatment. The patients were reviewed in December 1978 by an independent observer (TA), who had not helped to develop the gutter treatment. At review photographs were taken of all toes, a questionnaire completed, and cure assessed as for the previous study. Table II shows details of the two groups.

The statistical significance of the results was assessed by the χ^2 test or Fisher's exact probabilities test.

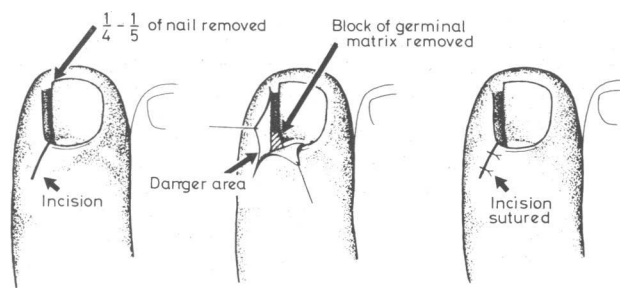


FIG 5—Summary of operative steps in segmental excision of germinal matrix (after Fowler⁹).

TABLE II—Details of patients treated by gutter method or wedge resection procedure in prospective study

| | Gutter treatment | Wedge resection |
|----------------------------|------------------|-----------------|
| No of patients | 36 | 32 |
| Age range (years) | 10-63 | 12-73 |
| Mean age (years) | 22 | 24 |
| Follow-up period (months): | | |
| Range | 7-15 | 6-15 |
| Mean | 11 | 11 |

Results

Table III shows the incidence of surgical treatment of ingrowing toenails in Newcastle over two six-month periods. As most of the patients were treated in the accident and emergency departments this fairly reflects the numbers treated for the area, which has a

TABLE III—Number of cases of ingrowing toenails treated surgically in accident and emergency departments in Newcastle hospitals

| Hospital | Simple avulsion | Wedge resection | Zadik's operation | Gutter treatment | Totals |
|--|-----------------|-----------------|-------------------|------------------|--------|
| Newcastle General Hospital (Aug 1975-Jan 1976) | 40 | 15 | 15 | 30 | 100 |
| Royal Victoria Infirmary (Jan 1975-Jun 1975) | 170 | 43 | 17 | | 230 |
| Totals | 210 | 58 | 32 | 30 | 330 |

population of about 300 000; thus the annual incidence is 660/300 000, or 2/1000 population.

GUTTER TREATMENT VERSUS TOENAIL AVULSION

Table IV summarises the results of this study, which was essentially a pilot study. The trend towards a better success rate using the gutter treatment led to the design of a prospective study. These two treatment methods were compared because both could be easily carried out by fairly inexperienced medical staff. Of the six failures in the gutter treatment group who did not undergo reoperation, two had completely normal nails on examination and complained only of intermittent discomfort. All of the five failures in the avulsion group who did not undergo reoperation had gross recurrence of the disorder.

TABLE IV—Results of retrospective study comparing gutter treatment with avulsion

| | Gutter treatment | Avulsion |
|--------------------------------|------------------|----------|
| No of patients | 25 | 15 |
| No (%) of successes | 13 (52) | 5 (33) |
| No of failures | 12 | 10 |
| No having no further operation | 6 | 5 |
| No (%) undergoing reoperation | 6 (24) | 5 (33) |
| Avulsion | 1 | 1 |
| Wedge resection | 2 | 1 |
| Zadik's operation | 3 | 3 |

Gutter treatment *v* avulsion—cure: $P > 0.3$; reoperation: $P > 0.2$. Not significant.

Most importantly, this study confirmed that not only was this procedure safe when the toe was infected but it also resulted in appreciable relief of pain, usually within eight hours and almost always within 12 hours. Two patients, however, both of whom had definite thickening of the toenail, suffered discomfort for a prolonged period after the gutter insertion. For this reason we excluded such patients from the prospective study. Six patients who received gutter treatment had ingrowing on both sides of the nail, and two gutters were inserted at the same time down both sides. In no patient did osteitis occur in the toe, and antibiotics were rarely used when the gutter was being inserted. Pain relief was also good in the avulsion group, but residual tenderness of the denuded nail bed remained.

GUTTER TREATMENT VERSUS SEGMENTAL EXCISION OF GERMINAL MATRIX

Table V summarises the results of this prospective study, which was designed to confirm the success rate of the gutter method and to compare the results with results of a sound treatment carried out by a surgeon with knowledge of the anatomy of the nail bed, as described by Lloyd-Davies.¹⁰ We found the wedge procedure to be much

TABLE V—Results of prospective study comparing gutter treatment with wedge resection procedure

| | Gutter treatment | Wedge resection |
|--------------------------------|------------------|-----------------|
| No of patients | 36 | 32 |
| No (%) of successes | 20 (56) | 27 (84) |
| No of failures | 16 | 5 |
| No having no further operation | 2 | 3 |
| No (%) undergoing reoperation | 14 (39) | 2 (6) |
| Wedge resection | 10 | |
| Avulsion | 4 | |
| Phenol cauterisation | | 2 |

Wedge procedure *v* gutter treatment—cure: $P < 0.05$; reoperation: $P < 0.01$.

superior to the gutter treatment in both cure and reoperation rates. Only one patient failed to achieve pain relief within 12 hours in the gutter treatment group. Most patients treated by the wedge procedure suffered discomfort for one to two weeks. In four patients the gutter fell out and needed to be replaced, but this was easily done, usually without anaesthetic.

Discussion

For some years concern has been expressed about the standard of treatment of ingrowing toenails. In 1975 Murray and Bedi¹

retrospectively reviewed 200 patients treated for ingrowing toenails in Glasgow. They commented that “despite the high recurrence rate following simple toenail avulsion (64–86%) its place in the initial management of the condition is justified.” Interestingly, our recurrence rate, though based on only 15 patients, was 67%, which agrees with these figures. After an editorial in the *Lancet* in 1975⁸ the primary treatment of choice for ingrowing toenails^{11–13} and the standard of surgery carried out for this condition were much discussed.

Our review of the incidence of surgically treated ingrowing toenails in Newcastle confirmed that the primary treatment in 1975 was avulsion of the nail, and we found a few patients in whom a third or even fourth procedure had been carried out. This pattern of management has altered greatly over the past few years, and avulsion is now rarely recommended. The principles behind the design of the gutter treatment are not new. In 1949 Newman¹⁴ described his method of treating ingrowing toenails with a steel nail plate, which was folded over the lateral edge of the nail to protect the nail grooves. In 1954 Mogull¹⁵ described using methyl methacrylate in a similar way. In 1960 Dagnall¹⁶ reported his experience with the Sulci protector, developed by Ross Fraser in Dundee, and in 1974 Ilfeld and August¹⁷ described using a plastic insert. These methods all appear awkward to carry out, and the long-term results have not been reported. We developed the gutter treatment from first principles without knowledge of any of these preceding methods.

The preliminary study of gutter treatment versus avulsion confirmed that relief of discomfort usually occurred within 12 hours after inserting the gutter and that this treatment may be used safely in the presence of infection. The higher success rate of the gutter treatment compared with avulsion, though not reaching significance because of small numbers, stimulated us to set up the prospective study. Comparison between results in all our patients treated by the gutter method (61 patients) and those of first-time avulsion in the Glasgow series¹ (95 patients), however, yielded a highly significant difference ($P < 0.001$) with respect to reoperation rate (33% *v* 64%), which remained significant ($P < 0.05$) when all patients in whom the gutter treatment failed were included and compared (46% *v* 64%).

Failure of the gutter treatment in our first study usually occurred shortly after the gutter had been removed—that is, at around six weeks—and the gutter was therefore retained for 10–12 weeks in the prospective study. The results did not improve significantly with this longer period of insertion.

In the prospective controlled trial the good success rate of the wedge procedure was probably not a fair comparison because the operations were carried out by experienced surgeons, which rarely happens in practice.¹¹ In contrast, the gutter treatment may be carried out with little expertise or anatomical knowledge. The higher reoperation rate for the failures in the gutter treatment group in this study resulted from our policy of reviewing patients six months after treatment and carrying out further treatment when indicated. The follow-up period for both the studies was at least six months, as most recurrences occur within this time. For any procedure that entails removing the whole nail the follow-up period should be greater than six months and preferably one year,¹⁸ but this is not applicable to the treatment regimens used in our studies.

The long-term results of phenol cauterisation of the germinal matrix have recently been clarified by a prospective study in Nottingham,⁵ with a success rate of 97%, but this must be attributed in part to the vast experience of the participating chiropodist and the time and scrupulous care that were taken. The technique has been best described by Ross,⁴ and we have also found this method to be of value.

We have radically changed our policy for managing toenail problems over the past four years, and the following is the present plan of management. (1) Acute ingrowing toenail—first presentation, non-thickened nail: use gutter treatment or (3). (2) Acute ingrowing toenail—subungual pus: use toenail avulsion followed by (3) at four to six weeks. (3) Recurrent ingrowing toenail or

chronic ingrowing toenail with thickened nail: use phenol cauterisation of lateral nail matrix⁴ or wedge procedure.⁹ (4) Onychogryphosis: use phenol cauterisation of whole germinal matrix.

Dr F B Wallace stimulated the initial design of the gutter treatment, and we are also indebted to Mr D E Cross, of Portex Ltd, for help with the prototype development and the production of a sterile kit. Our thanks go to Mrs D Weightman for statistical advice; and Mr D Hammersley, medical artist, Newcastle University, and Mr G Lythe, medical artist, Queen's Medical Centre, Nottingham, for the illustrations. Finally, we are grateful to the consultant surgeons in Newcastle for referring patients for treatment, and for their help.

References

- ¹ Murray, W R, and Bedi, B S, *British Journal of Surgery*, 1975, **62**, 409.
- ² Lloyd-Davies, R W, and Brill, G C, *British Journal of Surgery*, 1963, **50**, 592.

- ³ Zadik, F R, *Journal of Bone and Joint Surgery*, 1950, **32B**, 66.
- ⁴ Ross, W R, *Surgical Clinics of North America*, 1969, **49**, 1499.
- ⁵ Dumble, E, Pathakji, G S, and Weston, P A M, in preparation.
- ⁶ Wallace, W A, and Milne, D D, *Journal of Bone and Joint Surgery*, 1978, **60B**, 437.
- ⁷ Wallace, W A, paper read to the North of England Surgical Society, June 1978.
- ⁸ *Lancet*, 1975, **2**, 167.
- ⁹ Fowler, A W, *British Journal of Surgery*, 1958, **45**, 382.
- ¹⁰ Lloyd-Davies, R W, *British Journal of Surgery*, 1963, **50**, 44.
- ¹¹ Fowler, A W, *Lancet*, 1975, **2**, 453.
- ¹² Dagnall, J C, *Lancet*, 1975, **2**, 324.
- ¹³ Murray, W R, *Lancet*, 1975, **2**, 414.
- ¹⁴ Newman, R W, *Surgery, Gynecology and Obstetrics*, 1949, **89**, 638.
- ¹⁵ Mogull, P, *Journal of the National Association of Chiropodists*, 1954, **44**, 35.
- ¹⁶ Dagnall, J C, *British Chiropody Journal*, 1965, **30**, 100.
- ¹⁷ Ilfeld, F W, and August, W, *Orthopedic Clinics of North America*, 1974, **5**, 95.
- ¹⁸ Townsend, A C, and Scott, P J, *Journal of Bone and Joint Surgery*, 1966, **48B**, 354.

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Maternal smoking habits and congenital malformations: a population study

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Summary and conclusions

Maternal smoking habits in 67 609 singleton pregnancies were examined. The overall incidence of congenital malformations was 2.8% in both non-smokers and smokers. On analysing congenital defects according to individual systems there was no significant difference in the incidence of malformations according to the number of cigarettes smoked, except for neural tube defects. Further analysis, taking social class into account, showed that neural tube defects were less common in non-smokers in social classes I and II.

This study suggests that maternal smoking does not have teratogenic effects in the offspring, except in the case of neural tube defects, where the effect is at most modest.

Introduction

Babies of mothers who smoke during pregnancy are more likely to be born small; there is an increased incidence of placental separation, and a small but significant increase in perinatal mortality for every period of gestation.¹ Little attention has been focused on the possibility of a relation between maternal smoking habit and congenital malformation in the offspring. Cigarette smoking might possibly act as a teratogenic agent.

Nicotine crosses the placental barrier.² Smoking by pregnant women substantially raises the carboxyhaemoglobin concentration of fetal blood,³ and in pregnant animals a high induced concentration of carboxyhaemoglobin is associated with an increased incidence of congenital malformations in the offspring.⁴ *N*-nitroso compounds in cigarette smoke are teratogenic in rats when administered by the respiratory route.⁵

Yerushalmy⁶ and Mulcahy and Knaggs⁷ did not find any differences in congenital malformation that could be accounted for by maternal smoking habits. In a recent study by Kelsey *et al*⁸ women who smoked 20 or more cigarettes daily had a relative risk of 1.6 for congenital malformations in the offspring compared with non-smokers. This risk was greatest for abnormalities of the digestive system (2.9), heart valves (2.0), and skin (1.9), and neural tube defects and chromosomal abnormalities (1.8), and was independent of other indices including maternal age, social class, marital state, religion, parity, and race. Choi and Klavonski⁹ also noted a probable association between heavy smoking and neural tube defects. In a study of 18 000 patients Andrews and McGarry¹ found a significant association between maternal smoking and the incidence of cleft lip or palate, or both, and a small non-significant association with gastrointestinal and neural tube defects. They did not analyse their findings according to the number of cigarettes smoked. We analysed the association between maternal cigarette smoking and congenital malformation in the offspring in a large-scale study that included and extended the sample of Andrews and McGarry. We report here our results.

Patients and methods

A total of 69 062 singleton deliveries were recorded in the Cardiff Births Survey during the 12 years 1965-76. These included all deliveries to Cardiff residents and, to supplement the sample size, all deliveries in the city.¹⁰ The mothers were divided into four groups according to smoking habit: non-smokers, light smokers (1-9 cigarettes per day; including women giving up for part of the pregnancy), moderate smokers (10-19 per day), and heavy smokers (20 or more

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