in those infants who were discharged apparently normal and free of sequelae.[17] [18]

These factors added together make it extremely important that an accurate neonatal history is available when such infants come to hospital. The memory of the accompanying parent may be unreliable. If the infant has originally been transferred from local facilities to a neonatal regional centre the paediatric medical and surgical staff may not always have instant access to neonatal records. Changes of name may confuse the search for previous records (10% of this group had a different surname by the end of one year), and many admissions result from self referral so that the general practitioner's information is not available. Each area requires its own contingency plans for obtaining data in these situations, certainly within 24 hours of admission if not immediately.

This population of infants provides "new" problems for anaesthetists, paediatricians, and paediatric surgeons in addition to their better known and multiple neurodevelopmental difficulties. They also require proportionately more (here 16·4 times more) facilities for inpatients than term infants.

Even those infants who had apparently uncomplicated neonatal courses appeared to have considerably raised incidences of morbidity and even mortality throughout infancy, suggesting adverse consequences or correlates of their low birth weight itself. As being in hospital itself can lead to deleterious consequences in development at 2 years,[19] and in later behaviour and learning even in adolescence,[20] the importance of these medical and surgical problems should not be underestimated.

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Treatment of ingrowing toenails with liquid nitrogen spray cryotherapy

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Abstract

Ingrowing toenails are a common debilitating condition and often require surgical intervention. In 44 patients liquid nitrogen spray cryotherapy produced a rate of success comparable with that of other nail sparing techniques but had the advantage of being a quick, simple, and cheap outpatient procedure that could be carried out with limited facilities and without anaesthesia.

Introduction

Ingrowing toenails are common, particularly in young adults, and usually result in a prolonged period of discomfort or pain

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that is sufficient to interfere with working and social activities. Several aetiological factors have been implicated, including ill fitting footwear, incorrect cutting of nails, poor foot hygiene, hyperhidrosis, malalignment of the matrix, abnormally long toes, congenital excessive convexity of the nails, and prominence of the nail folds. Although a fundamental aim of management must be to correct these predisposing factors, further measures are usually required at the time of presentation. Antiseptic soaks, systemic antibiotics, regular pushing back of the nail fold, and packing of the lateral groove with cotton wool are usually tried, but a response, if it occurs, takes time and considerable effort by the patient. As recurrences are common an operation is the next inevitable step.

Nail ablation consistently produces the highest cure rates but is relatively time consuming and requires a high degree of skill by the operator. Patients are also not keen to lose part of the nail permanently unless there is no alternative. Any feasible alternative should be a simple, quick, cheap outpatient procedure that can be carried out with limited facilities by relatively inexperienced operators and that produces rapid relief of pain associated with an acceptable cure rate.

As cryotherapy fits most of these criteria we considered its use in the treatment of ingrowing toenails. Four of the main features of ingrowing toenails are pain, secondary infection, excessive

granulation tissue, and prominent nail folds. Cryotherapy produces fully reversible functional changes in peripheral nerves,[1] and it is thought to be through this mechanism that lesions treated by cryotherapy are subsequently free of pain. Liquid nitrogen also eradicates infection and is especially effective in destroying granulation tissue, as shown by the successful treatment of pyogenic granuloma.[2] Theoretically, therefore, we would expect a beneficial response after treatment with cryotherapy. We carried out this study to investigate the degree of benefit.

Patients and methods

Forty four consecutive patients referred with ingrowing toenails were treated by cryotherapy. All patients had painful lesions (bilateral in four) with secondary infection and abundant granulation tissue. Ingrowing toenails in 11 patients had recurred after avulsion of the nail, and eight patients had been unsuccessfully treated by resection of the lateral nail and matrix. The duration of the lesions before referral ranged from eight to 29 months (mean 22 months). The aetiological factors found in our patients were ill fitting footwear, incorrect cutting of nails, and prominent nail folds. None had malalignment of the matrix,[3] hyperhidrosis, or abnormally long toes.

Aspirin 600 mg was given before treatment, and none of the patients subsequently required local anaesthesia. A CryOwen liquid nitrogen spray gun fitted with an intermediate sized (B) nozzle, held 1 cm from the target area, was used to treat all patients. By this method freezing was produced in a well defined area and protection of surrounding tissue was not necessary, particularly as we did not need to encroach on to the matrix of the nail in any patient. The freeze time was for 30 seconds after the treatment (ice) field had been established. The area treated included all the granulomatous and infected areas as well as the adjacent nail fold. This freeze time was chosen because previous studies had shown that this was adequate to destroy granulation tissue and eradicate infection yet was unlikely to induce scarring[4]; it also cures many benign vascular tumours of the skin.

To minimise inflammation after treatment each patient continued to take aspirin 600 mg four to six hourly for 48 hours and applied a potent combined steroid antibiotic cream (Dermovate-NN, Glaxo Laboratories) six hourly under a dry dressing until exudation of serous fluid occurred, usually after about 18 hours. During this exudative phase the treated area was soaked daily for 20 minutes in 1/10 000 solution of potassium permanganate before a non-adhesive dressing was reapplied. Within four to five days the lesions had dried, leaving a crusted wound requiring only simple dry dressings during activity. Within one to two weeks these dressings were abandoned by most patients.

All patients were treated in our outpatient consulting rooms, each procedure taking only 15 minutes, including dressing. Systemic antibiotics were not used, and patients were instructed how to apply their dressings at home. General advice was given to the patients aimed at correcting the aetiological factors, but no further specific measures were taken.

Results

In 24 patients complete resolution occurred with no signs of recurrence during 13-18 months' follow up. Of these 24 patients, seven had been previously treated unsuccessfully by surgical procedures including avulsion of the nail (with or without curettage and phenolisation) and removal of the lateral nail and matrix. The remaining 20 patients responded initially with loss of infection and granulation tissue, but recurrence developed within one to three months. Six patients were retreated using exactly the same technique, complete resolution occurring in four, who remained free from recurrence during 14 months' follow up. In the remaining two the nails cleared initially but granulation tissue redeveloped within one to two months. If these six retreated patients are added to those whose ingrowing toenails did not recur after a single treatment the overall rate of success was 63·6% (28 patients).

Noticeable relief of pain occurred within one to two days in all patients and lasted for three to 15 months, even in those patients in whom infection and granulation tissue had recurred. This facilitated an early return to work and social activities. The treated nail folds were unchanged macroscopically with no scarring or loss of bulk.

Morbidity was not a problem; aspirin was sufficient to control discomfort after cryotherapy and was not required by any patient for longer than 48 hours. All patients were able to cope satisfactorily with their dressings at home without medical help. Subsequently, five patients developed patchy leuconychia and four developed painless onycholysis. These resolved within two to three months.

Discussion

Although conservative management may provide cure or at least acceptable control, many patients need more radical treatment for their ingrowing toenail. Surgical procedures can be divided into two broad groups depending on whether permanent loss of part or all of the nail plate results.

Avulsion of the nail plate is probably the most commonly used nail sparing procedure despite reported recurrences of 67%[5] and 64%[6] for first avulsions, with 86% after second avulsions and 80% after more than two avulsions. Murray and Bedi thought that this procedure should be a primary surgical procedure as it possessed the advantages of eradicating infection and relieving symptoms rapidly.[6] Partial avulsion of nails is also popular: Cameron reported that 61% of patients were cured at six months.[7] The patients selected, however, had experienced symptoms for only one month or less and had only mild infection and no permanent deformity of the nail fold. Even so they were advised after the operation to abstain from physical education and field sports for one month and to dry pack the nail fold for a further three months.

An alternative approach is to reduce the bulk of the nail fold and its proximity to the nail by resection of soft tissue. Murray and Robb reported that 60% of patients were cured after nine months using this method, although in 80% of cases preliminary avulsion of the nail was required (two to three weeks before resection of soft tissue) to reduce the degree of sepsis present.[8] Wallace et al used a polyethylene gutter that was inserted along the lateral edge of the nail after prior excision of all granulation tissue and left in place for eight to 12 weeks.[5] A success rate of 56% (with a one year follow up) was reported for selected patients with an ingrowing toenail of recent onset, no abnormal thickening of the nail, and no history of operations.

Nail reducing techniques have higher rates of success but because of the need for greater skill by the operators and time they tend to be reserved for those patients who are not responding to conservative or nail sparing methods. By performing segmental excision of the germinal matrix (wedge resection) Wallace et al cured 84% of patients,[5] while Townsend and Scott, using Zadik's total proximal nail bed ablation,[9] reported satisfactory results in 89% of cases.[10] Partial or total phenolisation (phenol cauterisation) of the nail bed with a reported recurrence of 4% over nine months' follow up[11] is superseding surgical ablation techniques because of the advantages that it can be performed in the presence of sepsis, is less painful during and after operation, is easier to perform, and produces better cosmetic results.

Our results with cryotherapy confirm the susceptibility of infection and granulation tissue to low temperature. Rapid relief of pain was a noticeable finding and correlates with the general observation that areas treated by cryotherapy are subsequently relatively free from pain. The mechanism is thought to be functional changes induced in peripheral nerves by the cold.[1] An additional advantage is that lesions can be retreated two to three months later without discomfort.

The lack of effect on the lateral nail fold was not surprising as the freeze time used in this study would not be expected to cause damage to the framework of connective tissue.[4] It may be justified to freeze the nail fold (but not the matrix) for longer than 30 seconds to produce damage to connective tissue and thus obtain a reduction in bulk of the lateral nail fold with retraction of the soft tissue away from the nail. The fact that over 60% of our patients were cured despite our not having first removed any nail spicules might imply that we were producing a degree of retraction of the nail fold that was not detected clinically.

Townsend and Scott reported that after operations 89% of

recurrences developed within one year, most within six months.[10] Thus our success rate of 64% after 13-18 months' follow up probably reflects the long term cure rate for cryotherapy in an unselected group of patients with ingrowing toenails. This success rate might be increased if cryotherapy was combined with a method of reducing the bulk of the nail fold, either by resection of soft tissue or by an increased freeze time.

Although nail reducing techniques are the most successful, patients may not be willing to lose permanently part or all of their toenail if a nail sparing technique would succeed. Even the most basic of these techniques, however, requires an anaesthetic, skill of the operator, suitable operating facilities, and time. Cryotherapy, however, is a quick, simple, and cheap nail sparing procedure that can be carried out without anaesthesia with limited facilities, has a rate of success comparable with that of surgical nail sparing procedures, and produces rapid relief of pain in most cases.

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SHORT REPORTS

Effect of a regional neonatal unit on a general paediatric ward

Increasing numbers of infants are surviving as a result of specialised care in neonatal intensive care units. Some require readmission to hospital,[1][2] either for further treatment of neonatal complications such as posthaemorrhagic hydrocephalus or for recurrent respiratory infections and apnoeic episodes due to the development of chronic lung disease after ventilation. Failure to thrive and child abuse are more common in these infants.[3] Many require prolonged inpatient medical care, and in this study we investigated the proportion of the workload of a paediatric ward that was generated by infants who had previously been treated in a neonatal intensive care unit.

Methods

All patients admitted to the regional neonatal intensive care unit at Cambridge Maternity Hospital during 1982 were studied and divided according to whether they were born inside or outside the Cambridge Health Authority area. Records of infants admitted to the paediatric ward in the same hospital were analysed. The ward admitted children under 5 years except those requiring ear, nose, and throat surgery or plastic surgery. The only regional commitment was for neurosurgical cases. Acute admissions were from the Cambridge area, although babies from outside this area who had previously been in the neonatal intensive care unit were readmitted on request. Diagnosis and length of stay of patients under 1 year old in the paediatric ward during 1982 were analysed. All admissions to the paediatric ward during 1982-3 of infants who had previously been in the intensive care unit during their first year were also recorded. Using this data, a comparison was made between those infants (under 1 year old) who had previously had treatment in the neonatal intensive care ward and those who had not.

Results

In 1982, 439 children under 1 year were admitted to the paediatric ward with a bed occupancy of 3386 days. Of 402 infants admitted to the neonatal intensive care unit, 133 were from the Cambridge area and 14 were subsequently admitted to the paediatric ward, before their first birthday, for a total of 193 days. Of the 269 infants from the region who had previously been in the intensive care unit, 38 were admitted to the paediatric ward during their first year of life for a total of 1222 days. They thus accounted for 42% of the bed occupancy of the under 1 year olds. Seventy seven infants with birth weights under 1500 g were admitted to the neonatal intensive care unit. Nine of the 16 from the Cambridge area who survived required admission to the general ward for a total of 200 days, and eight of the region's 37 surviving infants for 206 days. Thus 17 out of 53 survivors (32%) (birth weight < 1500 g) were

Diagnoses in children aged under 1 year admitted to hospital

	Infants who had been in neonatal intensive care unit			Other infants		
	n	No of days admitted	Mean No of days	n	No of days admitted	Mean No of days
Gastrointestinal surgery	4	590	147·5	19	109	5·7
Chronic lung disease	2	202	101			
Neurosurgery	7	214	30·6	23	299	13
Upper respiratory tract infection	15	156	10·4	59	186	3·2
Whooping cough	2	47	23·5	11	132	12
Feeding problems	3	46	15·3	17	79	4·6
Meningitis	1	28	28	10	92	9·2
Social	2	23	11·5	7	39	5·6
Developmental delay	2	21	10·5	7	42	6
Bronchitis	2	11	5·5	43	193	4·5
Apnoea	5	17	3·4	19	89	4·7
Hernia	2	9	4·5	7	18	2·6
"Asthma"	2	9	4·5	6	15	2·5
Febrile convulsion	3	13	4·3	11	32	2·9
Jaundice	2	8	4	4	27	6·8
Diarrhoea and vomiting	1	7	7	38	102	2·7
Pyloric stenosis	2	10	5	15	81	5·4
Tachycardia	1	4	4	1	4	4
Convulsions				17	71	4·2
Computed tomography				12	16	1·3
Pyrexia of undetermined origin				21	55	2·6
Failure to thrive				21	92	4·4
Bronchiolitis				9	35	3·9
Osteomyelitis				2	12	6
Stridor				2	67	33·5
Non-accidental injury				2	60	30
Poisoning				1	2	2
Cardiac				3	19	6·3
Haematological				1	3	3