

Superficial cryotherapy – An effective therapeutic modality for ingrown toenail

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Abstract *Objective* To evaluate efficacy of topical cryotherapy with liquid nitrogen as an alternative modality for ingrown toenails

Methods A total of 39 ingrown toenails in 30 patients were enrolled in the study; Grading was done and superficial cryotherapy with liquid nitrogen was done weekly for 4 weeks on the affected nails. Patients were followed up for 24 weeks.

Results At 24 weeks follow-up, 29 nails in 22 patients showed complete clearance with no recurrence; while rest needed some other modalities like partial nail avulsion / complete nail avulsion. Only 2 nails out of 31 completely cured nails showed recurrence during follow-up period of 24 weeks. Patients who did not improve were patients with grade III ingrown nail or grade IIb ingrown nail.

Conclusion Superficial cryotherapy with liquid nitrogen has been found to be an effective therapeutic modality for ingrown toenail.

Key words

Ingrown toenail, superficial cryotherapy, onychocryptosis.

Introduction

Onychocryptosis [from Greek onyx nail and kryptos hidden] also known as ingrown toenail, or unguis incarnatus is a common and painful form of nail disease.¹ An ingrown toenail occurs when the edge of the nail grows down and extends into the skin of the toe. Ingrown toenails are common, particularly in young adults and usually result in a prolonged period of discomfort or pain that is sufficient to interfere with working and social activities. The prevalence of the ingrown toenail is 24.5 per 1000 individuals. The various factors implicated include poorly fitting shoes, improperly trimmed toenails, excessive sweating, nail infections, nail apparatus abnormalities like a 'pincer nail'. Diabetic patients have been found to have a higher

incidence of ingrown nails compared with nondiabetic patients.² Ingrown toenail and paronychia have been reported secondary to drugs, such as indinavir and indinavir / ritonavir combination.^{3,4} Excess nail fold granulation tissue and ingrown toenail have also been reported with retinoids, docetaxel, cyclosporine and oral antifungal treatment.⁵⁻⁸ Subungual neoplasms may cause ingrown toenails due to compression of the nail plate against the nail fold. There are two school of thoughts about pathogenesis, first says that it occurs when the lateral nail fold is penetrated by the edge of the nail plate, resulting in pain, sepsis and later formation of granulation tissue,⁹ while other states that the nail is not the real culprit and it is actually the excess skin surrounding the nail, which is the real problem.¹⁰ The main aim of the treatment is to relieve symptoms and prevent the recurrence of the condition. There are various treatment modalities from conservative methods to surgical methods like nail avulsion. In spite of

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many treatment modalities treatment may be difficult or prolonged; hence we evaluated the efficacy of topical cryotherapy with liquid nitrogen in the treatment and its role in preventing recurrence in ingrown toenail.

Methods

A total of thirty patients were enrolled from out patient Department of Dermatology, Venereology and Leprology at G.G.S. Medical College and Hospital, Faridkot. Both males and females of age group 15-45 years of age having ingrown toenail were enrolled in the study. Patients with history of cold intolerance were excluded from the study. After written consent ingrown toenail were graded on the basis of Mozena classification.¹¹ All grades of ingrown toenail were taken up. On first visit, toenail was clinically examined for any bacterial infection, if present patient was given antibiotics and anti-inflammatory treatment for 5-7 days. After being clear from any other infection, it was cleaned with povidone-iodine solution. Then, the autoclaved cotton tipped applicator dipped in liquid nitrogen, was applied on the lateral nail fold and nail plate. Two freeze thaw cycles were given on lateral nail fold and five freeze thaw cycles on nail plate during one application. Each cycle was of 5 seconds of freezing time.

A total of 4 applications were given at weekly interval, for first 4 weeks. After treatment, patients were followed up at two weekly intervals for another 8 weeks and four weekly for next 12 weeks, completing a total period of 24 weeks.

All the selected lesions were assessed clinically, as well as, photographically at the baseline, at each visit before subjecting to cryotherapy and at each follow-up visit.

The therapeutic response was determined as: grade 0= no improvement; grade 1= upto 50% improvement in pain, swelling and granulation tissue; grade 2: 51-75% improvement in pain,

swelling and granulation tissue; and grade 3: more than 75% improvement in pain, swelling and granulation tissue.

Results

A total of 39 nails of 30 patients were enrolled in the study as 9 patients had bilateral involvement. Involvement of 11 (28.2%) nails was stage I, maximum nails 17 (43.6%) had stage IIa involvement, 5 (12.8%) nails were stage IIb, while 6 (15.4%) nails were severely involved i.e. stage III (**Table 1**).

All the patients having signs of inflammation were given antibiotics and anti-inflammatory treatment for 5-7 days on week 0. Application of liquid nitrogen started on week 1. A total of four weekly applications were given. Most of the patients started responding on first application of cryogen, when they were seen on week 2 for 2nd application. Response to cryotherapy was according to the grade of initial involvement.

Results of cryotherapy on different grades of ingrown toenails:

Stage I All the 11 ingrown nails responded to cryotherapy after first application. Grade 3 improvement was seen in 10 nails after first application on week 2, while in one nail grade 3 improvement came after 2nd application. Though complete 4 weekly applications of cryotherapy were given in all patients and none out of 11 nails showed any recurrence of condition during 24 weeks follow-up (**Table 2-4**).

Table 1 Severity of nail involvement before treatment (n=39).

Severity of disease	N (%)
Stage I	11 (28.2%)
Stage II a	17 (43.6%)
Stage II b	5 (12.8%)
Stage III	6 (15.4%)

Table 2 Response of treatment on different stages at week 2 (n=39).

Grade of involvement	Total nails	G0	G1	G2	G3
Stage I	11	0	0	1	10
Stage II a	17	0	1	2	14
Stage II b	5	0	2	3	0
Stage III	6	3	3	0	0
Total	39	3	6	6	24

$\chi^2 = 43.161$; $df = 9$; $p < 0.001$, highly significant.

Table 3 Response of treatment on different stages at week 4 (n=39).

Grade of involvement	Total nails	G0	G1	G2	G3
Stage I	11	0	0	0	11
Stage IIa	17	0	0	0	17
Stage IIb	5	0	2	0	3
Stage III	6	2	3	1	0
Total	39	2	5	1	31

$\chi^2 = 35.930$; $df = 9$; $p < 0.001$, highly significant.

Table 4 Response of treatment on different stages at week 24 (n=39).

Grade of involvement	Total nails	G0	G1	G2	G3
Stage I	11	0	0	0	11
Stage IIa	17	1	0	0	16
Stage IIb	5	3	0	0	2
Stage III	6	6	0	0	0
Total	39	10	0	0	29

$\chi^2 = 27.770$; $df = 3$; $p < 0.001$, highly significant.

Stage II a: All the 17 involved nails responded well after first application of cryotherapy. 15 nails showed grade 3 improvement after first application while rest 2 showed grade 3 recovery after 2 applications of liquid nitrogen. All the patients were followed up for 24 weeks, one out of these 17 nails showed recurrence. All 4 applications were given, but in one nail, symptoms returned on 8th week follow-up. Rest all nails remained symptomless during complete 24 weeks follow-up (**Table 2-4**).

Stage IIb All 5 nails showed mild improvement in symptoms after first application. 3 nails showed grade 3 improvement after 2nd application, while rest 2 did not improve much and grade 1 improvement, which was noticed after applications of cryogen, reverted back after stopping the applications. Out of 3 nails which recovered 1 showed recurrence of symptoms on 8th week follow-up. Rest all remained symptomless for complete follow-up period (**Table 2-4**).

Stage III All 6 nails, which were graded as having stage III involvement, were least improved. 4 nails showed mild improvement as grade 1, but never improved further, rest 2 never showed any improvement. So stage 3 ingrown toenails did not improve on cryotherapy (**Table 2-4**).

So, 31 nails out of 39 (79.5%) involved nails showed complete recovery after 2 applications of cryotherapy with liquid nitrogen, 29 patients remained free from symptoms during complete follow-up of 24 weeks, while 2 patients showed recurrence on 8th week follow-up.

Best results were seen in stage I and IIa ingrown toenails with 100% improvement in both groups, while one (5.8%) nail of stage II group showed recurrence during follow-up. Ingrown nails of stage IIb showed 60% improvement, while 40% did not improve and 1 nail (33%) of improved nails showed recurrence. Stage III ingrown toenails did not show any significant improvement after 24 weeks follow-up, as none of the 6 nails

involved showed any improvement after completion of follow-up. Nail avulsion with application of phenol was done in all non-responders.

So overall cure rate in the study was 29 out of 39 nails (74.3%). Recurrence rate occurred in 2 of 31 (6.4%) improved nails.

No major side effects were seen in all the 30 patients, mild adverse effects like, blister formation, mild bleeding from the lesions and erythema were seen in some patients. All the side effects were mild and needed no specific management. Rest all 23 patients did not have any significant side effect, except mild pain during application.

Discussion

Ingrown toenail is a very common condition, which is a common source of morbidity throughout the world. It has a significant impact on the quality of life of an individual. Correct management of onychocryptosis requires identification of the stage and evaluation of the affected tissues. Nail surgery should be kept as last option for recurrent onychocryptosis, surgical relapse, and failure of conservative treatment. The evidence suggests that simple nail avulsion combined with the use of phenol, is more effective at preventing symptomatic recurrence of ingrowing toenails, though with an increased risk of infection. Though this is an effective option for preventing recurrence, but it is cosmetically not very acceptable because in this one has to loose his/her nail permanently. Despite innumerable treatment options, ideal technique with a low recurrence rate, low downtime and high cosmetic acceptability is still to be elucidated. In the present study, we tried to find a better alternative for ingrown toenails, which is simple, painless, cost-effective and cosmetically acceptable and most importantly with low recurrence rate. We used superficial cryotherapy with liquid nitrogen. No controls have been kept, as this condition

is painful and needs to be dealt with as early as possible. Comparative study was not done as each nail and each person is different and response depends upon various other factors like shoe habits, age and other preventive measures.

Most common age group involved was of age less than 25 years (63.3%), while 9 (30%) were in the age group of 25-35 years, showing the prevalence in younger and active age group.

Maximum i.e. 17 (56.7%) patients were students and 5 (16.7%) were service personals. This shows that the condition is much more common in people who wear shoes for longer durations and are active in their lives.

Out of total 30 patients, 15 (50%) had previous history of the same condition, which was managed by different methods.

Condition was bilateral in 9 (30%) patients while it was unilateral in rest of the 21 (70%) patients. So significant number of patients had bilateral condition, suggesting wearing wrong footwear in those patients can be possible etiology.

Till now, only one study has been done with cryotherapy in ingrown toenail by Sonnex and Dawber in 1985.¹² They treated 44 patients with spray method using 30 seconds of freeze time. Only one application was given, while in our study 4 weekly applications were given using 7 freeze thaw cycles of 3 seconds of freeze time. Overall cure rate in 1985 study was 63.6%, while it was 74.3% in our study. In our study, cure rate was very high for stage I and stage IIa i.e. 27 out of 28 nails (96.4%), with 3.6% recurrence as all 28 nails improved while 1 showed recurrence, while it was not very encouraging for stage IIb and stage III ingrown toenails. Reason for absence of much improvement was very short freeze time during applications, as it has been noticed during previous studies that freezing time of

30 seconds is needed to destroy the granulation tissue, while it was very short.

Previous study¹² had patchy leuconychia and painless onycholysis as adverse effect, but in our study adverse effects were only minor and transient.

Other therapies used for the treatment for ingrown toenails like Band-Aid method, Dental floss, nail splinting, partial or complete nail avulsion are associated with high recurrence rate, while complete nail avulsion with penalization seems to be treatment modality with high cure rate and least recurrence rate but it is cumbersome procedure with need of surgical efficiency and is cosmetically non-acceptable as patient has to loose his/ her nail permanently.^{10,13-16}

So cryotherapy has got all the potential to be a very good treatment modality for stage I and stage IIa ingrown toenails as it is cost-effective and without any significant side effect and can be used in any age group. So it is a safe and effective mode of therapy. While nail avulsion with penalization could be considered in severe involvement i.e. stage IIb and III ingrown toenail.

Conclusion

Liquid nitrogen cryotherapy is a better alternative than any other technique for those patients, who do not want to loose their nail. It is simple, cheap, safe and effective treatment modality with minimal side effects for ingrown toenail. It is very effective in mild to moderate grade of ingrown toenail, while is not that effective in severe ingrown toenail.

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