Original Article

Comparative Efficacy of 10% Sodium Hydroxide, 88% Phenol, and 90% Trichloroacetic Acid as Chemical Cauterants for Partial Matricectomy in the Management of Great Toe Nail Onychocryptosis

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Abstract

Context: Lateral plate avulsion with chemical matricectomy is the treatment of choice for ingrown toenails. Phenol is the most widely used cauterant, followed by 10% NaOH and more recently trichloroacetic acid. **Aims:** To evaluate the efficacy of 10% NaOH, 88% Phenol, and 90% TCA in cauterizing the matrix with regular follow up post surgery and clinical photographs. **Materials and Methods:** Fifteen adult patients presenting with ingrowing toe nails were recruited to the study with prior consent. The NaOH group (Group A) had five patients and five nails treated, the phenol group (Group B) had five patients and six nails treated, and the TCA group (Group C) had five patients and six nails treated. A total of 17 great toe nails were treated. Following proximal digital block and partial nail avulsion, the matrix was curetted and the lateral horn cauterized with 10% NaOH (1 min), 88% phenol (3 min), and 90% TCA (3 min). Post-procedure follow-up was done at weekly intervals to evaluate post-operative pain, oozing, and wound healing. **Statistical Analysis Used:** Graph pad prism software was used for statistical analysis. ANOVA tests were used to test the statistical significance between post-operative parameters of each group. **Results:** Mean duration of post-op pain in Group A was 4.2 days; Group B was 8.6 days, and Group C was 1.2 days. Oozing occurred for a mean duration of 10.6 days in Group A, 14 days in Group B, and 5.6 days in Group C. Mean duration of tissue re-epithelization was 28.4 days in Group A, 40.5 days in Group B, and 27.4 days in Group C. **Conclusions:** TCA is an effective cauterant for chemical matricectomy with the advantage of less duration of post-op pain and faster healing.

Keywords: Chemical matricectomy, onychocryptosis/ingrown toe nail, phenol, sodium hydroxide, trichloro acetic acid

Key Messages: Trichloro acetic acid is a cheap and easily available cauterant which can be used for chemical matricectomy with relatively lesser post-operative morbidity and is equally efficacious as sodium hydroxide and phenol.

Introduction

Onychocryptosis/Ingrown toe nail is a painful condition that affects the great toe nails mainly in younger individuals and accounts for missed hours from work school, social, and sports activities. It is thus a cause of great morbidity. A significant number of cases thus require surgical correction. A simple nail avulsion will obviously cause recurrence and hence lateral plate avulsion with matricectomy provides definite cure for ingrowing nails. There are various modalities through which the lateral horn of the matrix can be destroyed such as chemical, electrosurgical, carbon dioxide lasers, and cryotherapy. An ideal surgical procedure is the one which is efficacious, associated with less post-operative morbidity and an early return to work.[1] Lateral plate avulsion with chemical

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matricectomy is one which fulfills all the above criteria and is efficacious.[2] 88% phenol has been used for more than five decades and is an effective cauterant but is associated with prolonged post-operative drainage.[3] 10% sodium hydroxide, however, is an alkali and has been used as a cauterant for more than a decade now and is equally efficacious as phenol, but comes with a side effect of intense pain in the initial post-operative days.[3] The most recent cauterant is 80–100% trichloroacetic acid which is equally efficacious as phenol.[4-6]

Objectives

The objective of this study was to evaluate the efficacy of the three different cauterants 10% NaOH, 88% phenol, and 90% trichloroacetic acid in the management of ingrown nails and to compare the duration of post-operative pain, drainage, and time taken for wound healing with regular follow up of patients.

Figure 1: Stage 1—ingrown nail with mild erythema and edema of nail folds; Stage 2—acute inflammation and suppuration; Stage 3—hypertrophy of nail folds with drainage and granulation tissue

Subjects and Methods

A total of 15 patients with ingrown nails of the great toe were treated with lateral plate avulsion with chemical matricectomy, five each with 10% NaOH, 88% phenol, and 90% trichloroacetic acid, respectively, with prior consent. Institute ethical committee clearance was obtained before starting the study. Adult patients above the age of 18 years were recruited into the study. The severity [Figure 1] was grading using the Heifitz grading of ingrown nails.[7]

After informed consent, the patients underwent nail surgery which involved proximal digital anesthesia with 2% plain lignocaine followed by exsanguination of the affected great toe and separation of nail plate at the affected side from nail bed, splitting of the lateral nail plate and avulsion. This was followed by curettage of the lateral horns of the matrix and application of the cauterants. 10% NaOH was applied for a period of 1 min, 88% Phenol for 3 min, and 90% TCA was applied for 3 min. Figure 2 shows the surgical procedure followed. Post application of cauterants, the tourniquet was removed and a bulky dressing with antiseptic ointment was applied to the great toe and the patients were advised to rest for 24 h. Oral antibiotics were given for a period of 5 days and non-steroidal anti-inflammatory drugs for 2 days. Foot end elevation was advised.

Dressing was changed on post-operative day 2. They were followed up at weekly intervals for 2 weeks and monthly thereafter and assessed for post-operative pain (using the visual analog scale) and wound drainage and healing. Clinical photographs were taken at each visit.

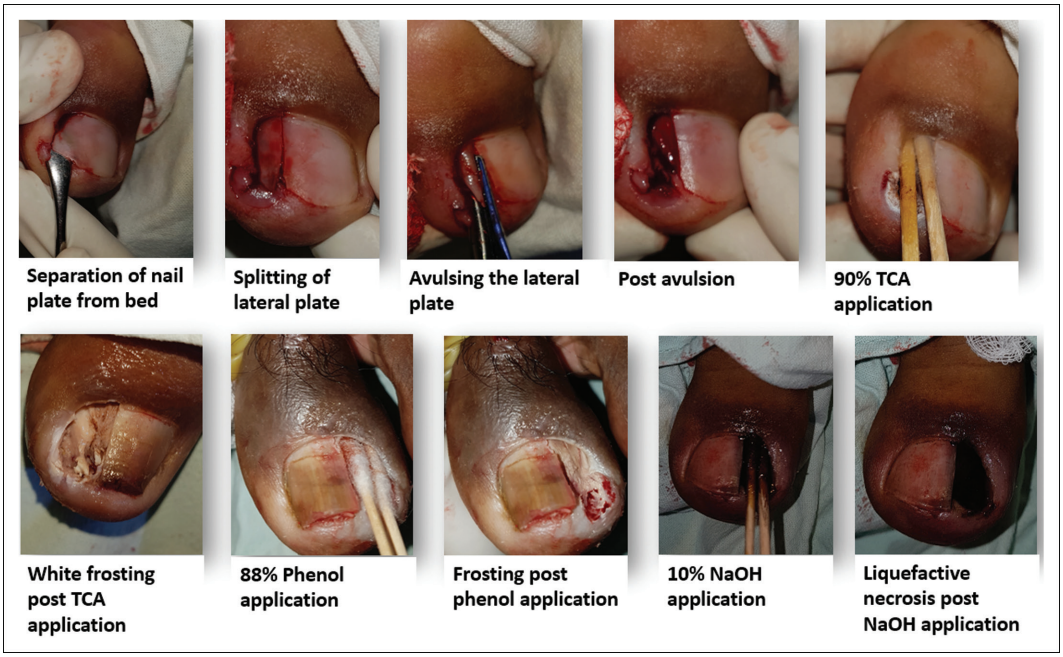

Figure 2: Different steps in nail surgery

Figure 3: Pre- and post-operative results following TCA matricectomy

Statistical analysis

A *P*-value of <0.05 was considered to indicate statistical significance. One-way ANOVA test (analysis of variance) was used to test the significance of difference between the post-operative parameters of pain, oozing, and wound healing in the different groups.

Results

Fifteen patients of the age 18 and above with ingrown toe nails were recruited in the study and underwent lateral plate avulsion with chemical matricectomy. They were allocated into three groups based on the cauterant used, which were 10% Sodium hydroxide (NaOH), 88% phenol, and 90% trichloroacetic acid. The number of patients in each group was 5. They were followed up at weekly intervals for 2 weeks and monthly thereafter and assessed for pain, oozing, and wound healing time. Figures 3–5 show pre-op and post-op results following chemical matricectomy with each of the three different chemicals. Table 1 shows the patient parameters and Table 2 shows post-operative parameters.

There was significant statistical difference in post-operative parameters in the three different groups, on using the one-way ANOVA tests.

Tukey's honest significant difference test revealed that there was significant difference (*F* ratio: 7.116438; *P*-value: 0.0072) between phenol group and TCA group in post pain, while there was statistically significant difference in post-operative oozing between phenol group and TCA group (*F* ratio: 8.4; *P*-value: 0.0082). There was a significant difference in wound healing between NaOH group and phenol group (*F* ratio: 12.4; *P*-value: 0.0089) and the phenol group and TCA group (*F* ratio: 13.4 and *P*-value: 0.0053).

Post-operative assessment of the patients who underwent lateral plate avulsion with chemical matricectomy revealed that 90% TCA was associated with lesser post-operative pain, discharge, and faster wound re-epithelization followed by sodium hydroxide and phenol.

All the participants were satisfied with the outcome with no recurrence at 1 year follow up.

Figure 4: Pre- and post-operative results following NaOH matricectomy

Figure 5: Pre- and post-operative results following Phenol matricectomy

Discussion

Phenol is an age old cauterant for the treatment of ingrown nails/onychocryptosis since more than half a decade. It has an added anesthetic effect as well. Bostanci *et al.*[8] in their retrospective study of 172 patients proved the success rate of phenol cauterization to be 98.8%. An ideal surgery should be easy to perform under local anesthesia, should be associated with lesser post-operative morbidity and

faster healing.Our observations in the patients treated with 88% phenol in our study revealed a mean duration of 8.6 days of post-operative pain and 14 days of post-operative discharge, highest in comparison with NaOH and TCA. Phenol does come with disadvantages such as chemical burns and excessive post-operative damage.[9] Sodium hydroxide has been used as a cauterant since more than a decade now and acts by liquefactive necrosis and destroys the matrix.[3,10] There are various comparative studies comparing the efficacy of Sodium hydroxide and Phenol which have concluded that sodium hydroxide is a better cauterant with minimal side effects and comparable efficacy.[9,11,12] Table 3 shows the comparison of post-operative parameters in NaOH group and Phenol group in our study with other studies.

Results from our study are comparable with the above-mentioned studies on the reduced post-operative morbidity by sodium hydroxide.

Trichloro acetic acid in lower concentrations is generally used for chemical peeling. Higher concentrations (80–100%) have been used in partial matricectomies. It causes coagulative necrosis of the tissues and is associated with both epidermal and dermal necrosis with the advantage of self neutralization. It also carries the advantage of faster cauterization and reduced bleeding post-operatively as observed in our study during immediate post-operative period. Terzi *et al.*[6] studied the efficacy of 90% TCA in 56 nails and reported lower rates of post-operative pain and post-operative discharge. Few studies have compared the efficacy of TCA and Phenol in matricectomies and have concluded that TCA is associated with lesser post-operative morbidity.[13,14]

Terzi *et al.*[13] reported a success of 88.2% with phenol and 98.2% with TCA. Table 4 shows the comparison of post-operative parameters in our study with other studies.

Table 1: Patient parameters

S. no.	Parameters	10% NaOH	88%Phenol	90% TCA
1.	Number of patients	5	5	5
2.	Number of nails	5	6	6
3.	Age (Years)	Mean: 35.2 SD: 16.81 (Range: 18–56)	Mean: 33.20 SD: 15.10 (Range: 18–52)	Mean: 26.00 SD: 10.56 (Range: 18–44)
4.	Gender (M: Males; F: Females)	M: 3, F: 2	M: 3, F: 2	M: 4, F: 1
5.	Duration of disease (Months)	Mean: 8.80 SD: 4.38 Range (4–12)	Mean: 7.00 SD: 6.56 Range: (2–16)	Mean: 5.20 SD: 4.09 (Range: 1–12)
6.	Severity	Grade 1: 1 Grade 2: 0 Grade 3: 4	Grade 1: 2 Grade 2: 3 Grade 3: 1	Grade 1: 1 Grade 2: 1 Grade 3: 4
7.	Trauma	5	1	1
8.	Recurrence	2	2	2
9.	Previous nail surgeries	3	3	2
10.	Occlusive foot wear	3	3	3
11.	Nail tic disorder	2	0	2

Table 2: Post-operative assessment

S. No.	Cauterant	Mean duration of pain (days)	Mean duration of oozing (days)	Mean wound healing time (days)
1.	NaOH	4.2 ± 2.77	10.6 ± 2.61	28.4 ± 5.9
2.	Phenol	8.6 ± 4.56	14 ± 4.85	40.5 ± 3.7
3.	TCA	1.2 ± 0.84	5.6 ± 2.97	27.4 ± 6.23
		P-value: 0.009162	*P*-value: 0.01037	*P*-value: 0.0033
		F ratio: 7.11644	*F* ratio: 6.84903	*F* ratio: 9.57373

Table 3: Comparison between post-operative parameters in NaOH and phenol group with other studies

Parameters	Bostanci *et al.*[9]	Arif *et al.*[11]	Grover *et al.*[12]	Present study
Post-operative drainage (days)	NaOH: 10	NaOH: 10	NaOH: 15.4	NaOH: 10.6
	Phenol: 15	Phenol: >10	Phenol: 18.13	Phenol: 14
Post-operative pain (days)	NaOH: 1	NaOH: 2	NaOH: 7.9	NaOH: 4.2
	Phenol: 0	Phenol: Less on 2nd day	Phenol: 16.25	Phenol: 8.6

Table 4: Comparison between post-operative parameters in phenol and TCA group with other studies

Parameters	Terzi *et al.*[13]	Moustaide *et al.*[14]	Present Study
Post-operative drainage (days)	Phenol: 15	Phenol: 17.6	Phenol: 14
	TCA: 10	TCA: 9.3	TCA: 5.6
Post-operative pain (days)	No. of days not assessed	Phenol: 18.6	Phenol: 8.6
		TCA: 9.34	TCA: 1.2

Our comprehensive literature search did not reveal any study that had compared the efficacy of three cauterants in the treatment of ingrown nails. We have thus compared the efficacy of all three cauterants although the sample size is a limitation.

Therefore, we conclude that trichloroacetic acid is associated with lower post-operative morbidity and faster re-epithelization of wound and carries an added advantage of quicker cauterization of the nail bed and no immediate post-operative bleeding.

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Conflicts of interest

There are no conflicts of interest.

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