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Retrospective Study

The Treatment of Ingrown Toenails: A Retrospective Study of Combined Wedge Resection with Phenol *Versus* Silver Nitrate Cauterization

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ABSTRACT

Aim
The aim of the current study is to retrospectively review the efficacy of phenol *versus* silver nitrate matricectomy for treating ingrown toenails.

Methods
A total of 132 charts for ingrown toenails treated at Umm Ghuwailina Primary Health Care Center, Doha, Qatar were retrospectively reviewed for association with socio-demographic characteristics, infection rate, pain level, duration of treatment, treatment modalities and their outcomes.

Results
A total of 64 phenol ablations and 68 silver nitrate ablations were performed on patients with stages II and III diseases.
The patients were reviewed daily until the achievement of full wound healing and later on, they were regularly followed-up for a mean period of 36 months. In the phenol group, the healing period post-operatively ranged from 2 to 4 weeks with no post-operative complications including loss of sensation or nail spikes with only one recurrence (0.57%) were observed, after 16 months. On the other hand, the silver nitrate group had a longer healing period ranging from 4 to 10 weeks with post-operative complications ranging from post-operative nail bed infection (soft tissue necrosis) (43%), post-operative pain (65%). The success rate was found to be 98.8%. Treatment with phenol therapy and 96% with silver nitrate therapy respectively.

Conclusion
We conclude that both phenol and silver nitrate cauterization are an excellent method for the treatment of ingrowing toenail. However, phenol is far superior to silver nitrate due to its simplicity, low morbidity, pain-free course post-operatively, no post-operative infection, better satisfaction and high success rate. Before surgical intervention, 79% of patients had a severe pain score, 72% had difficulty wearing their normal footwear and 65% had the restriction of normal activities due to their ingrown toenails. Overall, 100% of phenol arm were satisfied (n=63) with the procedure whereas in the silver nitrate arm only 82% (n=56) were satisfied. No loss of sensation at the surgical site was reported in either of the arms.

Keywords
Primary care; Phenol; Silver nitrate; Ingrown toe nails; Doha; Qatar.

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INTRODUCTION

The treatment options for ingrown toenails ranges from simple conservative approaches, limited surgical intervention to extensive surgical procedures.

Conservative treatment modalities are usually employed for patients with stage 1 disease whereas patients stage 2 and 3 toenails usually require surgical intervention. Primary care physicians frequently encounter young adults with ingrown toenails although it can be seen at virtually any age. The condition primarily affects the big toe with pain, swelling, redness, and discharge occasionally and if left untreated granulomatous tissue and lateral wall hypertrophy ensues as a result of chronic inflammation. Inflicted individuals have difficulty in ambulation, decreased quality of life (QoL), absenteeism from work and reduced social activities and increased economic cost.[1,2] Currently, various treatment options are available; however, they are associated with high rates of recurrence, poor cosmetic results, and low rates of patient satisfaction.[1-3]

Conservative management is initially offered to patients with mild cases of ingrown toenail including, the use of warm baths, avoidance of tight-fitting footwear and soft compresses[4] along with taping, packing,[5] and nail braces and gutter treatment. Refractory cases, on the other hand, are offered the option of surgical intervention. Many techniques have been illustrated, with majority targeting the nail as the responsible agent. Simple nail avulsion is described in the literature but has high recurrence rate reaching up to 70%,[6] Partial nail avulsion along with chemical matricectomy using silver nitrate or phenol have been described.[1,4] One old study reported a high overall recurrence rate of 34% when the procedure was carried out by family physicians with an increase to 50% when carried out by general surgeons.[7] Other techniques involve the use of partial nail avulsion coupled with sharp pulse carbon dioxide laser matricectomy.[10]

In replacement of the surgical dissection of the matrix horn, disposable electrocautery pen has been utilized,[11] however, the risk of developing a thermal periostitis with long-term post-operative pain is a concern. Sodium hydroxide has been in use for the last two decades with good post-operative results.[12-14] Recently, lateral matrix horn has been done with the use of 100% trichloroacetic acid. Reported success rate along with complete healing within two weeks was reported at 95%.[15] Important contributing factors to the development of ingrown toenail include pressure necrosis of the soft tissue surrounding the nail[8] along with repetitive rotation of the toe, higher weight-bearing on the nail fold and increased nail-fold skin width.[8-9] In our health center, we have applied disposable phenol sticks matricectomy as a safe, pain-free, cost-effective option to silver nitrate.

As symptoms may recur 1-2 years after the operation; a long-term follow-up is usually needed. Therefore, we have carried out a 7-year retrospective study of all the subjects treated with this technique at our healthcare center. Patients were followed-up for a mean period of 36 months in order to assess the long-term efficacy of our treatment.

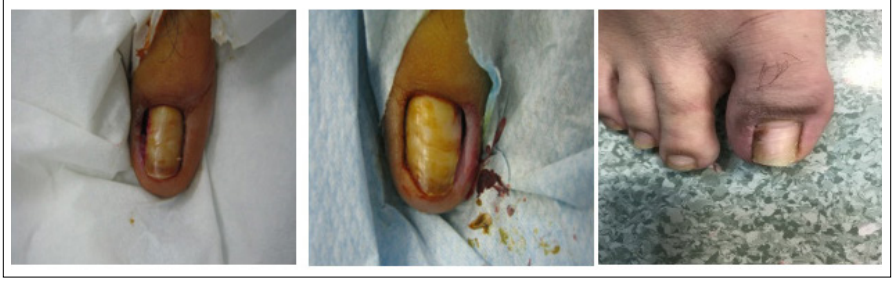
METHODS AND MATERIALS

One hundred and thirty-two participants files were scrutinized from January 2012 till Aug 2015 in total. Phenol EZ sticks ablations were carried out on 64 patients whereas silver nitrate ablation were carried out on 68 patients with stage II and stage III ingrown toenails. No subjects with diabetes or peripheral vascular disease were excluded unless the patient had a severe peripheral vascular disease. Infected toenails were treated initially by topical and oral-antibiotics and daily dressing at the healthcare center povidone-iodine. Once the nail and skin fold became dry surgery was performed.

Surgical Technique

Initially, the toe was sterilized with povidone-iodine solution and anesthesia was introduced *via* a standard digital block using lidocaine hydrochloride 2% without epinephrine. A rubber tourniquet was utilized towards the big toe base to make the toe be exsanguinated. A 2-3 mm lateral nail segment of nail bed was cut free along the length of the lateral fold and taken out using a straight hemostat, at the same time making sure that nail removal is carried out lower than the basal lateral matrix. Any hypertrophied granulation tissue had been curetted before application of phenol EZ sticks or silver nitrate sticks. Disposable phenol EZ sticks or silver nitrate sticks were applied and massaged it into the matrix area. Extra precaution were taken to prevent any spillage of phenol or silver nitrate onto the adjacent skin. The phenol EZ or silver nitrate sticks were applied only once during an application time of 10 seconds. After completion of this procedure, the tourniquet was released and antibiotic ointment (fusidic acid) was applied to the wound, followed by circumferential and longitudinal gauze wrapping. An adhesive tape was used to secure the dressing and the total time of the procedure was approximately 15 minutes. Figure 1 shows the

Figure 1. *Excision of Bilateral Ingrown Toe Nail and Third Picture Showing Complete Healing*



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ingrown toenails pre- and post-phenol application.

Post-operative Care

The patient was instructed to take ibuprofen 600 mg six hourly for 24 hours for pain control. Following the procedure, the patient was allowed to ambulate after 20 minutes rest in the supine position and instructed to rest at home and elevate the foot whenever possible. Patients were asked to come for daily dressing, 24 hours post-operatively and followed on a daily basis thereafter. A dressing change was performed after 24 h in the health center. Patients were reviewed in the healthcare center on a daily basis and daily dressing included cleaning the wound with normal saline soaked cotton gauze, followed by the application of povidone-iodine and dressed with fusidic acid ointment. This dressing continued nearly for a period of approximately 2-4 weeks until full wound healing was achieved. Patients were followed-up post-operatively for a period ranging from 12 to 36 months, with a mean time interval of 22 months. Recurrence of ingrown toenail was defined as evidence of nail edge ingrowth or spicule formation.

RESULTS

We retrospectively reviewed the charts of 132 patients in total, the majority of our patients were less than 30 years of age with a predominant male to female ratio (Table 1). The study sample comprised 81.2 toenails from male patients while 50.8 nails are from female patients. Among phenol group, 58 ingrown toenails had bacterial infection (paronychia with pus discharge), whereas the silver nitrate group had 53 infected toenails. We treated 64 ingrown toenails with partial wedge resection and phenol matricectomy while 68 patients were treated with wedge excision and silver nitrate matricectomy (Table 2). Follow-up of the patients was performed on a daily basis for the first four weeks and then monthly thereafter. Granulation tissues (12 in the phenol group *versus* 14 in the silver nitrate group) were excised with a surgical blade and cauterized with a disposable battery operated cautery pen (Table 2).

All procedures relieved pain for a mean of 3.7-6.8 days after the initiation of treatment. The mean duration required in our study to completely cure an ingrown toenail in the phenol group ranged from 2-4 weeks compared to 6-10 weeks in the silver nitrate group. Patients treated with phenol ablation showed earlier resolution, less post-operative pain and necrosis compared to silver nitrate. Our study showed that no patient had either developed osteomyelitis or complained of loss of sensation although one of the major post-operative complications which can occur post excision of soft tissue is a loss of cutaneous innervation.[16]

Pre-operatively the majority of the patients had impaired QoL as depicted by painful toes, difficulty wearing their footwear and restricted ambulation (Table 3). On the other hand, post-operatively, 80% of the silver nitrate group had soft tissue necrosis compared to 0% in the phenol group. Additionally, the duration of cure was shorter in the phenol group compared to the silver nitrate group (Table 2).

DISCUSSION

Ingrown toenails are managed either conservatively or operatively depending on the grade. Grade I and II may be treated conservatively but relapse is a major concern along with the long duration of the treatment, inconvenience, and cost. Operative procedures

Table 1. *Demographic Characteristics of 64 Patients Who Underwent Phenol EZ Sticks Ablation and 68 Patients who had Silver Nitrate Ablation Coupled with Surgical Correction*

Characteristic	% of patients
Age, years	**Phenol group/Silver nitrate group**
<19	30.8/32.0
20-29	21.0/18.0
30-39	5.0/6.1
40-49	3.2/5.9
50-59	3.0/1.0
>60	1.0/1.0
Sex	
Male	39.4/41.8
Female	24.6/26.2

Table 2. *Treatment Outcomes of each Treatment Procedure for Stage III Ingrown Toenails*

Granulation tissue	Procedures	Ingrown Toenails *n*	Infected *vs.* non infected at presentation	Post-operative soft tissue necrosis *n*(%)	Duration until pain relief, days Mean±SD Median (range)	Duration until cure of ingrown toenail, weeks Mean±SD Median (range)	Recurrence *n* (%)
12	Phenol	64	58 *vs.* 42	0%	3.7±4.0	5.2±2.1	0
14	Silver nitrate	68	53 *vs.* 47	80%	6.8±5.5	8 .1±3.3	0

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Table 3. *Pre-operative Answers of Patients Undergoing Surgical Treatment of Ingrown Toenails*

Characteristic	% of patients Phenol group/silver nitrate group
Experienced severe pain	
Strongly agree	78.8 / 69 .2
Neutral	13.0 / 21.0
Strongly disagree	8.2 / 9.8
Difficulty with daily footwear	
Strongly agree	69.9 / 58.6
Neutral	10.6 / 8.4
Strongly disagree	19.5 / 23
Difficulty with daily regular activities	
Strongly agree	64.3 / 59.4
Neutral	12.2 / 13.6
Strongly disagree	23.6 / 23

on the other hand, may rarely result in relapse of the ingrown toenail. Limited surgical interventions including wedge resection are often augmented with chemical matricectomy to achieve better outcome and avoid the unnecessary complications of surgical matricectomy such as post-operative pain, recurrence, and osteomyelitis. Many reports in the literature reported conflicting results in regards to the effectiveness, cure rates, and complications as a result of using phenol for matrix cauterization in the treatment of ingrown nails.[17-19] However, a cochrane review have concluded that combining simple nail avulsion with matrix phenolization was more effective than all other modalities.[20]

Although, liquefied phenol is widely used for lateral matrix horn cauterization due to its onsite (topical) safety, low cost, technical simplicity, time-honoring, and with a recurrence rate between <1 and 2%. It is not appreciated in certain regions of the world due to the risk of spillage from the bottles containing it as it may cause a corrosive chemical burn if it came in contact with the skin. However, nowadays disposable single-use phenol sticks are available in the market which avoids this practical risk.

Phenol has many positive properties including its disinfectant potency, anesthetic activity, coagulating power and its safety to be used in children, patients with diabetes and those impaired arterial supply.[21,22] Although, the application times of 1, 2, and 3 minutes are effective with a recurrence rate of 12.9, 3.9, and 2.1%, respectively.[22] However, this study utilized 10 seconds application of the phenol EZ sticks only with no recurrence. Additionally, after swabbing the nail matrix with phenol EZ sticks we did not apply or pour any alcohol on the wound.

CONCLUSION

Our technique of 10-seconds matrix ablation with phenol EZ sticks resulted in high rates of patient satisfaction, no recurrences, and excellent cosmetic results. It is technically simple, cost-effective, and can be carried out easily in any primary healthcare facility. Further randomized controlled trials are needed to explore this option further.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONSENT

The authors have received written informed consent from the patient.

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