The recurence of onychocryptosis when treated with phenolization: does phenol application time play a role? A follow-up study on 622 procedures.

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ABSTRACT

Introduction: Chemical matricectomy using phenol (CMP) is a recognized treatment option for onychocryptosis. However, the appropriate phenol application time to achieve nail matrix destruction is still unknown. Optimal ablation leads to low recurrence rates. The aim of this research was to assess the recurrence rate of onychocryptosis in a cohort of 622 consecutive patients treated with a 4-min CMP.

Methods: We recruited all patients undergoing a 4-min CMP for onychocryptosis at the Istituto Podologico Italiano, Rome, Italy in 2008–2017. Postoperative follow-up visits were set at 24h, 7d, 14d, 21d, 28d, 6m, and 1y after surgery. We used adjusted logistic regression to evaluate the potential risk factors for the disease recurrence including age, gender, toe shape, comorbidities, and disease localization.

Results: The risk of recurrence in all patients treated with a 4-min CMP was 1.1% (N= 622, 95%CI= 0.5%–2.3%). In the subgroup of patients with cardiovascular disease (n=39) the recurrence risk was 5.1% (95%CI= 0.61–7.3). Young age was also associated with increased odds of recurrence (P= 0.036).

Conclusion: In this observational study, four minutes with no interruptions seems to be the appropriate application time of phenol when using CMP for the treatment of onychocryptosis. A randomized controlled trial should be carried out to confirm our results.

Key message: The application time of phenol in the treatment of ingrowing nail is important.

Keywords: Onychocryptosis; Chemical Matricectomy; Phenol; Dermatology; Appropriateness.

INTRODUCTION

Onychocryptosis or ingrown toenail is a common pathology in the general population.[1] It occurs when the edge of the nail grows into the flesh at the side of the nail, causing a painful injury. The punctured skin can become inflamed and infected. Therefore onychocryptosis is defined as the penetration of a nail fragment into the dermis at the margins of the nail plate, so that the area becomes painful, hot, red, swollen, and often infected (presence of pus).[2] The formation of granulation tissue often occurs at the side of the puncture due to the presence of a portion of the lamina within the tissue.[3] Most commonly, the big toe is involved, but it may also involve the lesser toes.[1]

Several potential causes of onychocryptosis have been identified: violent trauma; improper trimming of the nail; tearing nails off; microtrauma; higher foot temperature due to wearing constricting footwear.[1–5] Other possible risk factors are: deviated big toe exerting a compression on the near finger; invaginated nail; flexed big toe; thin and sharp nail edges; endocrine conditions (e.g. thyroid disease, diabetes, pregnancy, and breastfeeding).[1–5] Young adults, adolescents, children, and even infants may suffer from onychocryptosis.[1–5]

Onychocryptosis causes a great deal of discomfort and is associated with several comorbidities. The disease interferes with everyday activities (walking, going to school, working). The diagnosis is clinical, but it should be differentiated from subungual exostosis and tumours of the nail bed.[1–5]

A systematic literature review from 2012 evaluated the effects of surgical and non-surgical interventions for onychocryptosis.[2] The most effective treatments for onychocryptosis were surgical matricectomy (SM), chemical matricectomy with phenol (CMP), and a combination of both. Surgical interventions appeared to be more effective than non-surgical interventions in preventing the recurrence of an ingrowing toenail, but the authors concluded that more studies with phenol needed to be conducted to confirm these outcomes.[2]

A more recent study (Romero-Pérez at al., 2017) compared the success rates of SM with those of CMP in a non-randomized way on 520 patients. CMP appeared to facilitate better postoperative outcomes such as lower pain, lower infection rates, and higher cosmetic satisfaction. However, CMP had a considerably higher recurrence risk compared to SM (17.8% vs 8.2%).[6] In that study, the application of phenol onto the matrix to achieve chemical ablation lasted for one minute and was repeated three times. However, the appropriate length of time during which the chemical

should be left reacting on the nail matrix is still unknown, and an intermittent 3-min CMP may be not enough to achieve optimal results. We hypothesized that a higher CMP application time may lead to lower recurrence rates.

In a study carried out in 2012 using cadaveric fresh specimens, Becerro et al. assessed the phenol application time required for complete denaturation of the nail matrix, arguing that identifying the optimal time required to destroy the matrix without causing further damage should reduce the complications.[7] It was found that after a 1-minute application of 88% phenol solution, only superficial damage to the nail bed epithelium was noted, with the basal layer primarily intact. After a 2-minute application, the nail plate was avulsed with a thin basal layer remaining. After a 3-minute application, full-thickness necrosis of the nail bed epithelium was noted in 6 of the 10 specimens. After 4-, 5-, and 6-minute applications, full-thickness necrosis of the nail bed epithelium was noted, and the basal layer was completely destroyed in all 30 specimens.[7] Therefore, 4-minutes seems to be the ideal timing.

The aim of this study was to estimate the recurrence rate of patients undergoing a continuous 4-min CMP for the treatment of onychocryptosis.

METHODS

All patients undergoing CMP for onychocryptosis at the Istituto Podologico Italiano, Rome, Italy in 2008–2017 were included in the study (n=643).

We used iodopovidone 10% for antisepsis before and after surgery, and lidocaine 10mg without epinephrine for local anaesthesia. One ampoule containing 0.15-0.20 ml of 89% phenol was applied onto the matrix using a cotton-tipped applicator and was left reacting for 4 min continuously. We excluded 21 debilitated patients from this study, as their application time was reduced to 3 min to avoid the potential risk of ulceration or ischaemia (they were either very old or with severe co-morbidity [especially cardiovascular]).

Postoperative follow-up visits were set at 24h, 7d, 14d, 21d, 28d, 6m, and 1y after surgery. The treatment outcome was considered successful when there was no recurrence at any follow-up visit, with no maximum limit.

We recorded patients' age, gender, toe shape, comorbidities, and disease localization at baseline. During the follow-up visits we recorded information about postoperative complications (infection and bleeding) and pain (defined as the use of painkillers). All procedures were carried out by the same practitioner to ensure uniformity.

Statistical analysis

We cleaned the data before the statistical analysis and each variable was inspected in isolation for missing values, outliers, and abnormal distributions.

We calculated the risk of recurrence and its 95% confidence intervals using exact binomial distribution. We then used adjusted logistic regression to model the chances of recurrence against several potential risk factors: age, gender, presence of comorbidities, toe shape, whether both feet were affected or not, and whether the disease affected the lateral side of the nail (facing the second finger) or the medial side (facing the shoe). We did not consider infection, bleeding, and excessive pain, as they were present in less than 0.5% of the sample. Patients with a recurrence were all males and we have therefore excluded that variable from the adjusted model.

As for sensitivity analyses, we have adjusted for comorbidities (binary) vs comorbidities (categorical) vs CVD (binary). We have also adjusted for number of lesions (linear) vs whether both feet affected or not (binary). We excluded people with CVD from the models, as they accounted for just the 6% of the sample (39/622) and they had a much higher risk of recurrence. The estimates did not relevantly change following the sensitivity analyses.

RESULTS

All study participants presented with onychocryptosis in the big toe. The recurrence risk was 1.1% (N=622, 95%CI= 0.5%–2.3%).

Table 1 shows a description of the sample characteristics for patients who had a recurrence and patients who did not have a recurrence separately. Patients with a recurrence were all males. Patients with cardiovascular disease were at higher risk of recurrence (Table 1).

Table 2 shows the output after the adjusted logistic regression. After considering all other variables in the model, young age was associated with increased risk of recurrence (P= 0.036), as well as the presence of cardiovascular disease (P = 0.007). Gender, toe shape, and disease localization did not appear to be associated with the outcome.

DISCUSSION

In this observational study we have reported a very low recurrence rate in a cohort of 622 patients affected by onychocryptosis who were treated with a 4-min phenolization. Four minutes seems to be the appropriate application time of phenol. Cardiovascular disease may increase the recurrence risk dramatically.

Moreover, we have found that older age may be protective against the recurrence of onychocryptosis when treated with CMP. This may be because in young people the cells reproduce themselves more quickly than in old people and therefore the nail matrix keeps producing new cells in spite of the ablation.[8]

In the published literature, there is considerable variation in phenol application time and reported recurrence rates, and it does seem that the higher the phenol application time, the lower the recurrence rates. For example, Hassell et al. in 2010 applied 90% phenol to the matrix area using a cotton-tipped applicator for just 2 minutes, and then the phenol activity was stopped with 70% isopropanol; the authors found a recurrence rate as high as 31.5%.[9]

Our treatment protocol may differ from those used by other health care providers not only in the CMP timing, but also in other factors. For example, we instruct patients on how they should take care of their wound every day during the follow-up time, and we do not know whether other practitioners do the same.

Vaccari and colleagues in 2010 found a recurrence rate of 2.2% (3/139) after 3-min intermittent CMP.[10] Di Chiacchio and colleagues in 2010 found a recurrence rate of 1.9% (5/267) using just a continuous 2-min CMP, and argued that the low recurrence rate that they found may be due to their technique, in which nail matrix, nail bed, and lateral nail fold curette was performed after nail plate removal and before phenolization.[11] We have also used the curette during our procedures and it may be that this tool has improved our performance. However, those authors did not describe their samples with sufficient details, and we do not know whether their patients were a priori at lower risk of recurrence instead of having it reduced by the use of the curette. For example, Vaccari and colleagues excluded patients with vascular disease[10] and in our analysis we found that the presence of cardiovascular is associated with a dramatic risk increase: the recurrence rate in patients with cardiovascular disease was 5.1% (95%CI= 0.61–7.3). Another alternative reason for the low recurrence rates that we observed may concern the use of alcohol. Many practitioners (including Romero-Pérez and colleagues) neutralized the phenol with alcohol during or after the procedure, whereas we did not do so.

In conclusion, we found that four minutes with no interruptions seems to be the appropriate application time of phenol for the treatment of onychocryptosis in terms of recurrence rates. However, a randomized controlled trial should be carried out to confirm our results.

DECLARATIONS

All authors declare no conflict of interest. SM was responsible for the data collection. AIL was responsible for the data analysis. All authors read and approved the final manuscript. All participants provided informed consent before any data collection. Ethical approval was obtained from the Ethics committee at the Istituto Podologico Italiano. All investigations were carried out in accordance with the principles of the Declaration of Helsinki as revised in 2000.

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Table 1. Sample description.

	Recurrence		
	No	Yes	**P value**
	N=615	N=7	
Age	31.1 (18.0)	20.1 (10.6)	0.11
Male gender	364 (59.2%)	7 (100.0%)	0.029
Toe shape			
Egyptian	196 (31.9%)	2 (28.6%)	0.9
Greek	193 (31.4%)	1 (14.3%)	0.3
Roman	202 (32.8%)	4 (57.1%)	0.17
Comorbidity			
Cardiovascular disease *	37 (6.0%)	2 (28.6%)	0.014
Thyroid disease	11 (1.8%)	0 (0.0%)	0.7
Inflammatory/autoimmune disease	7 (1.1%)	0 (0.0%)	0.8
Cancer	6 (1.0%)	0 (0.0%)	0.8
Hepatitis	6 (1.0%)	0 (0.0%)	0.8
Epilepsy	4 (0.7%)	0 (0.0%)	0.8
Other	12 (2.0%)	0 (0.0%)	0.7
No comorbidities	532 (86.5%)	5 (71.4%)	0.3
Lesion localization §			
Lateral nail side	503 (81.8%)	5 (71.4%)	0.5
Medial nail side	462 (75.1%)	4 (57.1%)	0.3
Number of lesions			
One foot	319 (51.9%)	5 (71.4%)	0.3
Both feet	289 (47.0%)	2 (28.6%)	0.3
Three lesions	7 (1.1%)	0 (0.0%)	0.8

Data are presented as mean (SD) for continuous measures (age), and n (%) for categorical measures. P values come from the two-sample T test for continuous measures and from the Pearson's chi-squared test for binary measures.
*Includes diabetes and hypertension.
§Percentages do not sum up to 100 as some patients had more than one lesion.

Table 2. Output from the adjusted logistic regression model showing mutually-adjusted odds ratios, 95% confidence intervals, and P values for each factor and category.

Factor	OR	(95%CI)		P
Age (5-year increase)	0.54	(0.30	0.96)	0.036
Male vs female	N/A*			
CVD	167.73	(4.12	6830.28)	0.007
Both feet affected	0.84	(0.12	6.05)	0.9
Medial vs lateral side	0.62	(0.09	4.28)	0.6
Toe shape				
Egyptian	1	(reference)		
Greek	0.70	(0.05	9.35)	0.8
Roman	2.55	(0.35	18.48)	0.4

*All patients with a recurrence were males.