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ORIGINAL ARTICLE
ORİJİNAL ARAŞTIRMA

Efficacy of Minimally Invasive Crystallized Phenol Application in the Treatment of Pilonidal Sinus in Children

Çocuklarda Pilonidal Sinüs Tedavisinde Minimal İnvaziv Kristalize Fenol Uygulamasının Etkinliği

Sabriye Dayı, Serpil Sancar, Meryem Anayurt

University of Health Sciences, Bursa Faculty of Medicine, Bursa, Turkey

ABSTRACT

Aims: Pilonidal sinus treatment involves surgical excision or flap reconstruction; however, the disease has a high recurrence risk. We determined the outcomes of a modified local application of crystallized phenol.

Material and Method: In the outpatient clinic, the pilonidal sinus orifices were connected by an incision under local anesthesia. The hair in the sinus was removed. Then, crystallized phenol was applied. The incision was not sutured. Daily dressings and baths were recommended.

Results: Crystallized phenol was applied to 50 patients with pilonidal sinus disease (median age=15 years). During the follow-up, no bleeding or pain was reported. Recurrence was not found in the follow-ups (one year to three years).

Conclusions: Surgery has disadvantages such as long-term hospitalization, recurrence risk, and high cost. Crystallized phenol does not have any of the aforementioned disadvantages. The modified method, in which we incised and applied crystallized phenol to all sinus tracts, might have also reduced the recurrence.

Keywords: Pilonidal sinus disease, crystallized phenol, pilonidal sinus recurrence, surgery

ÖZ

Amaç: Pilonidal sinüs tedavisi, cerrahi eksizyon veya flep rekonstrüksiyonunu içerir; ancak hastalığın tekrarlama riski oldukça yüksektir. Çocuklarda kristalize fenolün modifiye edilmiş lokal uygulamasının sonuçlarını sunmayı hedefledik.

Gereç ve Yöntem: Poliklinik şartlarında pilonidal sinüs ağızları lokal anestezi yapıldıktan sonra bir insizyonla birleştirildi. Sinüsteki kıllar temizlendi. Daha sonra kristalize fenol uygulandı. Sinüs ağızlarına yaptığımız insizyon sütüre edilmedi. Günlük pansuman ve banyo önerildi.

Bulgular: Pilonidal sinüs hastalığı olan 50 çocuk hastaya (medyan yaş=15 yıl) kristalize fenol uygulandı. Takiplerinde kanama ve ağrı şikayeti olmadı. Takiplerde nüks saptanmadı (1-3 yıl)

Sonuç: Cerrahinin uzun süreli hastanede kalış süresi, nüks riski ve yüksek maliyet gibi dezavantajları vardır. Kristalize fenol yukarıda belirtilen dezavantajların hiçbirine sahip değildir. Değiştirdiğimiz yöntem, tüm sinüs yollarına kesilip kristalize fenol uygulanması olup nüksü de azaltmış olabilir.

Anahtar Kelimeler: Pilonidal sinüs hastalığı, kristalize fenol, pilonidal sinüs nüksü, cerrahi

Corresponding Author: Sabriye Dayı
Address: University of Health Sciences, Bursa Faculty of Medicine, Bursa, Turkey
E-mail: sabriyedayi@yahoo.com

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INTRODUCTION

Pilonidal sinus disease (PSD) is a debilitating infectious and inflammatory condition. In PSD, a hair-containing sinus or abscess occurs in the sacrococcygeal region. Although the etiology is unknown, the cleft creates a suction that draws hair into the midline pits when a patient sits down (1,2).

The incidence of PSD was 26 out of 100,000 (3). In recent years, the incidence (56/100.000) and regional difference have increased (4,5). The information on the frequency of PSD occurrence in children is unclear. However, the frequency of admission of children with PSD, especially adolescents, to outpatient clinics has increased.

Ingrown hair in the pilonidal sinus might become infected and present acutely as an abscess in the sacrococcygeal region. After resolving an acute episode, recurrence is common. Several procedures have been proposed to treat chronic PSD. Complex and/or recurrent sinus tracts may require extensive resection and closure with Z-plasty, advancement, or rotational flaps (1).

The recurrence rate of PSD is high even after different surgical interventions (6). Therefore, better treatment methods are under investigation, and phenol application is one of them (7-10). Grabowski et al. (2) studied non-surgical interventions for treating PSD. The complications associated with the application of phenol were the least, and recurrence was lower after administering this treatment than after implementing other approaches. Further studies need to compare the percentage and type of phenol applied and the feasibility of the pediatric population. (2).

Crystalized phenol (CP) (also known as carbolic acid) is an effective sclerotic agent for treating PSD. It also has antiseptic characteristics and anesthetic properties and can be administered to conscious patients. It can be found in crystallized and liquid forms. The CP has some advantages, such as being easy to apply and safer because it does not flow in liquid form. CP becomes liquid at body temperature. It also irritates the internal PSD cavity, produces granulation tissue, or inflammation, then heals by fibrosis and closes the cavity (9).

In recent years, there have been successful publications on the application of CP in children with PSD. In our study, we aimed to present our experience and results about the modified CP application, which we think will reduce recurrences.

MATERIAL AND METHOD

This study was carried out at the University of Health Sciences, Bursa Faculty of Medicine, Bursa City Hospital. Following the approval of the ethics committee (no. 2021–11/7), patients with PSD who applied to our clinic between January 2020 and January 2022 were retrospectively analyzed. Patients diagnosed with pilonidal sinus who applied to the outpatient clinic were included in the study. However, patients with abscess formation at that time were not included in the study. They were included in the study after the abscess was drained and the inflammation subsided. Patients who previously underwent surgery, such as flap reconstruction and primary excision for PSD, were excluded from the study. Fifty patients (19 girls, 31 boys) were included in the study.

The procedure was performed under local anesthesia in outpatient clinics. Sinus orifices were observed (**Figure 1a**). The sinus orifices were connected using a surgical instrument with an incision (**Figure 1b**). If there was only one sinus orifice, the sinus cavity was opened with an incision (**Figure 1c**). The hair in the sinus was removed after performing the incision (**Figure 1d**). An antibiotic ointment was applied to the skin to prevent skin irritation due to phenol. Then, CP (**Figure 1e**) was applied to all pilonidal tracts (**Figure 1f**). The incisions were not sutured. The patients were educated about performing daily dressings and taking baths regularly and discharged. They were suggested to visit the clinic for regular check-ups. No recurrence was detected in 1-3 years of follow-up.

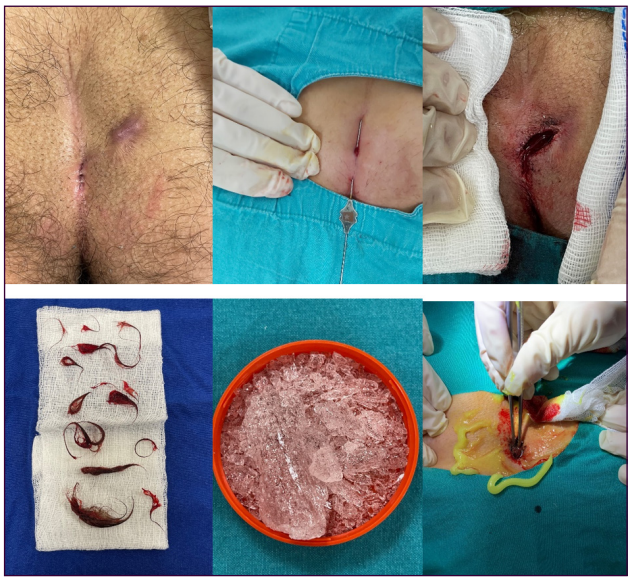

Figure 1. Modified crystallized phenol method

a: Pilonidal sinus with four sinus orifices in the sacrococcygeal region in a boy with a previous history of discharge and, drained abscess. b: Control of the sinus orifices with a surgical instrument in another patient, c: Incision of the orifices of pilonidal sinus, d: Hair removed from the sinus pilonidalis, e: Crystallized phenol, f: Application of crystallized phenol after incision in a patient. The surrounding tissue has protected with an antibiotic ointment.

Statistical Analysis

The conformity of we determined whether the continuous variables followed the normal distribution by performing the Shapiro-Wilk test. Continuous variables were expressed as the mean ±standard deviation or the median (minimum: maximum); categorical variables were expressed as n (%). Based on the normality test results, the Mann-Whitney U test was used for comparisons between groups. Categorical variables were analyzed

by the Chi-squared test, Fisher's exact test, and Fisher-Freeman-Halton tests. A logistic regression analysis was performed to determine the risk factors affecting the duration of wound closure. All statistical analyses were performed using the SPSS (IBM Corp. Released 2015; IBM SPSS Statistics for Windows, Version 25.0; Armonk, NY: IBM Corp.) program. The type I error level was accepted as α=0.05 in the statistical analysis.

RESULTS

CP was administered to 50 patients with PSD (19 females and 31 males; median age=15.5 years). These patients were admitted to our clinic for the first time. However, they had previously received medical and drainage treatments for discharge, swelling, and abscesses in other centers. No patient had undergone surgery (such as primary excision with primary suture, primary healing after excision, or flap reconstruction). Most patients had at least three sinus orifices. After applying CP, there was no bleeding or pain in the follow-up, but wound infection developed in two patients. These two patients, who did not perform their dressings regularly, recovered without problems after regular dressing. No recurrence was observed in the follow-up (one year to three years).

The duration of the patient's complaint affected the time of wound closure, as shown in **Table 1**. In our study, wound healing time was observed in 16 patients in less than 2 weeks. Wound healing time was observed in 34 patients after more than 14 days. (14 days-42 days). The number of sinuses, family history, and incision length also affected the duration of wound closure. Since the incision is made along the tract, the length of the incision also shows the length of the tract. Therefore, tract length affects wound healing.

We performed a logistic regression analysis to determine the risk factors affecting the duration of wound closure for 14 days or more in the patients. We first examined the patient's age, gender, weight, complaint, duration of complaint, treatments received, number of sinuses, additional disease, income status, family history, and incision length by performing a univariate logistic regression analysis. The information on the gender, weight, duration of complaint, number of sinuses, family history, and incision length were included in the multivariate logistic regression analysis. In the multivariate logistic regression analysis, the forward elimination method was used for selecting the variable. In the final step, gender, incision length, and family history were found to be the significant variables. The steps of the analysis are presented in **Table 2**.

Table 2: Risk factors that affect the duration of wound closure.

Step-1	Wald	p-value	OR	95% (CI)	
				Min	Max
Incision length (cm)	7.34	0.007	8.35	1.80	38.79
Model $\chi2=0.358$; $p < 0.001$					
Hosmer-Lemeshow Test: p=0.949					
Step-2	**Wald**	**p-value**	**OR**	**95% (CI)**	
				Min	**Max**
Family history (Present)	3.82	0.050	0.19	0.04	1.00
Incision length (cm)	7.19	0.007	9.44	1.83	48.76
Model $\chi2=1.044$; $p < 0.001$					
Hosmer-Lemeshow Test: p=0.959					
Step-3	**Wald**	**p-value**	**OR**	**95% (CI)**	
				Min	**Max**
Gender (Female)	4.17	0.041	12.48	1.10	140.67
Incision length (cm)	6.08	0.014	17.79	1.80	175.08
Family history (No)	5.28	0.022	18.00	1.53	211.68
Model $\chi2=3.141$; $p < 0.001$					
Hosmer-Lemeshow Test: p=0.872					

OR: Odds ratio, CI: Confidence interval.
The "male" category for the gender variable and the "present" category for the family history were accepted as the reference category.

Table 1: Comparisons of patient groups regarding the duration of wound closure, less than 14 days and 14 days or more.

	Duration of wound closure				p-value
	n	< 14 days	n	≥ 14 days	
Patient complaint					
Abscess	16	5 (31.30%)	34	5 (14.70%)	0.581[c]
Pain		3 (18.80%)		10 (29.40%)	
Discharge		6 (37.50%)		13 (38.20%)	
Swelling		2 (12.50%)		6 (17.60%)	
Duration of complaint (Months)	16	3 (1:12)	34	6 (1:12)	0.008[a]
Received treatment					
Drainage	13	3 (23.10%)	30	9 (30%)	0.727[d]
No treatment		10 (76.90%)		21 (70%)	
Number of sinuses	16	3 (3:4)	34	4 (3:10)	0.011[a]
Additional disease	16	0	34	2 (5.90%)	>0.999[d]
Income level					
Low	16	4 (25%)	34	9 (26.50%)	>0.999[d]
Medium		12 (75%)		25 (73.50%)	
Family history	16	9 (56.20%)	34	9 (26.50%)	0.041[a]
Length of incision (cm)	16	4 (3:4) 3.56 ±0.51	34	4 (3:8) 5.03 ±1.42	<0.001[a]

The data were expressed as median (minimum: maximum) and n (%).a: Mann-Whitney U Test, b: Chi-square Test, c: Fisher-Freeman-Halton Test, d: Fisher's Exact Chi-square Test.

The multivariate logistic regression analysis ended in three steps, as shown in **Table 2**. The logistic regression model obtained in the final step was significant ($p < 0.001$), and the dataset was compatible with this model ($p=0.872$). The analysis results indicated that the risk of prolonging the duration of wound closure in female patients was 12.48 times higher than that in male patients. An increase in the incision length by 1 unit increased the risk of prolonging the duration of wound closure by 17.79 times. The risk of wound closure lasting 14 days or more was 18 times higher in the group without a family history of the disease compared to the group with a family history of the disease

The ROC analysis was performed to determine the cut-off point for incision length according to the duration of wound closure. When the incision length was > 4 cm, the area under the ROC curve was calculated as 0.82 (sensitivity=47.06%, specificity=100%; $p < 0.001$), and the incision length > 4cm was significantly associated with a risk of wound closure time of 14 days or more.

DISCUSSION

Many treatment alternatives have been developed for PSD because of its high recurrence rates (22.8%) (11). Phenol application is one of them. Many treatment methods are applied in the treatment of PS, from primary excision to flap techniques. however, due to the high recurrence rates, ideal treatment method researches are being tried. In recent years, successful results have been published with CP application as a minimally invasive method in children and adults with PSD (2,7-10). In our study, CP application was made by incising the sinus orifices. We aimed to share the results of our modified CP application.

Kayaalp et al. (9) in review study, reported that although the recovery time varies, it occurs within three weeks in most cases. In our study, we determined that the incision length (tract length), female gender and absence of family history caused delayed wound healing. We found that the incision length was 4 cm or more in children with wound healing time over 14 days. Although it depends on the distance between the sinuses, we tried to keep the incision length to a minimum without extending the incision. After this experience, we planned to keep the tract incision below 4 cm in patients with a tract length of 4 cm and above and to perform CP in a few sessions. Delayed wound healing in girls may be caused by structural gender differences such as high percentage of fat in tissues. The positive effect on wound healing in children with a family history of PSD was evaluated as the fact that children with PS both applied to the hospital earlier and paid more attention to wound care and cleaning due to their families' experience. During the wound healing process, the activities and daily lives of our patients are not restricted. They continued their routine activities with daily bathing and dressings. It is recommended not to do heavy exercise and sports only in this process. Our patients performed their daily activities the day after the procedure. During follow-ups, they reported that they spent their days comfortably and did not feel the need to use analgesics.

Different recurrence rates have been reported following the application of phenol (9–15.7%) (12,13). While evaluating recurrence in PSD, the follow-up period can be very long. Buenova et al. (6) showed an overall recurrence rate of 16.1% at 24 months, 21.4% at 60 months, and 47.4% at 303 months; 24 months after the operation, the recurrence rate ranged from 10.5% for excision with primary midline closure to 30.0% for the Bascom I procedure. Recurrence after excision with primary midline closure was 71.8% at 268 months postoperatively. Dogru et al.(13) found the recurrence rate below 18 years to be 32.9%, higher than the recurrence rate for adults. In a study of Madenci and Uysal (14) on children, they found postoperative recurrence developed in 14 patients (16.3%). In our study, no recurrence was observed, which was probably because the connection of the sinus orifices and the hair in the cavity was cleaned, and phenol was applied thoroughly in the cavity. However, although the small number of our patients and the short follow-up period limit us to provide data on clear recurrence, it is hopeful that there is no recurrence in our early-term results. Therefore, long-term follow-up of our patients will show the actual recurrence rate.

When we compared our study with the reported phenol applications in the literature, the number of pilonidal sinus orifices reported for phenol applications in other studies were either unspecified (7,15) or less than 3 (10). The number of pilonidal sinus orifices influences recurrence. The success rate was better in the cases with 1–3 sinus orifices and comparable to surgical methods' success rate. No recurrence was observed in our study. In this respect, the effect of the number of sinuses on recurrence was not evaluated. However in our study, the number of orifices was found to be effective on the wound healing time, but in further evaluation, it was seen that the length of the sinus tract affected more than the number of sinuses.

Phenol provides treatment with its sclerosing effect by destroying epithelium and debris in the PS tract. In the German National Guideline on the management of pilonidal disease: update 2020, phenol is not allowed to be used by German health authorities due to its possible side effects (16). In the study, "Despite favorable results in recent studies, the human use of phenol has been banned by German health authorities due to its toxicity" was added as the last sentence (16). Garabowski et al. In their review study by evaluating 97 articles in the literature on the treatment of pilonidal disease, they commented that phenol is an

effective method in the management of pilonidal disease with low recurrence and complication rates, with level 2-4 evidence, grade B recommendation. This valuable study suggests further research on the consequences of its use in children (2). Following this article, Yüksel (17) stated in his letter to the editor that it should not be used in children yet, citing Germany as an example. Otherwise, the feasibility of phenol application has been shown in the literature in other studies, including application in the children group, and no severe side effects have been encountered were reported (7,15,18-20).

In a study conducted by Arslan et al. (12), the mean number of CP application sessions was 2.2 in the simple group and 4.2 in the complicated group. Although no recurrence was reported in the phenol group in a study by Kurt, 37 patients were administered phenol once, six patients were administered phenol twice, and two patients were administered phenol thrice (21). Dogru et al. reported that the mean number of phenol applications was 2.1. Similar to our findings, they found that the number of sinus orifices, the number of phenol application sessions, the duration of the disease before treatment, and positive family history affected recurrence (13). We applied phenol once after removing hair and following the incision to connect the sinus orifices. In other studies, the cases in which phenol was administered more than once were not evaluated as recurrence. The requirement for re-application of phenol was probably reduced in our study since an incision was made. We had two questions regarding the cases that were not considered recurrences when phenol was applied more than once. How should recurrence be defined in phenol application? What should be the standards in phenol application?

CP, which is a minimally invasive method, is easy to apply and easy to learn. Its other advantages are that it can be applied on an outpatient basis, without the need for an operating table, in outpatient settings (2,22). Therefore, Yuksel explained the crystallized phenol technique in detail to encourage dermatologists to treat PSD in the outpatient clinic (22). Also, CP application eliminates the cost of hospitalization and possible complications of surgery and anesthesia (23).

The limitation of our study was the need for a longer follow-up period and a larger number of patients. However, it is promising that there is no recurrence in the follow-up period with the number of patients available as a preliminary study.

CONCLUSIONS

In our study, CP was evaluated as a minimally invasive, easy to apply, no recurrence, cost effective method in children with PSD. The modified CP method in which we incised the sinus tracts might have also contributed to a reduction in recurrence.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of University of Health Sciences, Bursa Faculty of Medicine, Bursa City Hospital Ethics Committee (no. 2021–11/7)

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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