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RESEARCH

Comparison of success rates of probing surgery in congenital nasolacrimal duct obstruction by age range

Konjenital nazolakrimal kanal tıkanıklığında sondalama cerrahisinin yaş aralıklarına göre başarı oranlarının karşılaştırılması

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Abstract

Purpose: To evaluate the effectiveness of probing surgery in patients with congenital nasolacrimal duct obstruction (CNLDO) according to application time and age groups.
Materials and Methods: In this retrospective study, patients with CNLDO who were followed up at Cukurova University Faculty of Medicine between 2012 and 2022 were evaluated. One hundred thirteen eyes of 90 patients with CNLDO were included in the study. The fluorescein dye disappearance test was used to evaluate the diagnosis and treatment success. The demographic characteristics of the patients and the success of the surgeries were recorded.
Results: Considering the first probing surgical time, our success rates according to age groups were as follows: 0-12 months (n=10) 100%, 12-18 months (n=29) 86.2%, 18-24 months (n=24) 87.5%, 24-36 months (n=24) 79.2%, 36-48 months (n=14) 57.1%, and 66.7% in patients aged 48 months and older (n=12). When our entire patient group was evaluated regarding success before and after age 2 years, the rate was 88.9% in patients younger than 24 months (n=63), and 70% in patients aged 24 months and older (n=50).
Conclusion: In our study, the most successful age ranges for probing surgery were found as 0-12 months, 12-18 months, and 18-24 months. Probing surgery should be performed for patients with congenital nasolacrimal duct obstruction before the age of 2 years because the success rates decreased in patients older than 2 years in our study.

Keywords:. Congenital nasolacrimal duct obstruction, probing, epiphora

Öz

Amaç: Bu çalışmada konjenital nazolakrimal kanal tıkanıklığı olan olgularda sondalama cerrahisinin uygulama zamanı ve yaş gruplarına göre etkinliğinin değerlendirilmesi amaçlanmıştır.
Gereç ve Yöntem: Bu retrospektif, kesitsel çalışmada Çukurova Üniversitesi Tıp Fakültesi'nde 2012-2022 yılları arasında takip edilen konjenital nazolakrimal kanal tıkanıklığı olan hastalar dahil edildi. Çalışmaya konjenital nazolakrimal kanal tıkanıklığı olan 90 hastanın 113 gözü alındı. Diffüzyon göllenme testi tanı ve tedavi başarısının değerlendirilmesi amacıyla kullanıldı. Çalışmamızda hastaların demografik özellikleri, operasyon öncesi ve sonrası diffüzyon göllenme testi sonuçları ile operasyon başarısı kaydedildi.
Bulgular: İlk sondalama (probing) uygulama zamanına bakılarak yaş gruplarına göre başarı oranlarımız; 0-12. ay %100 (n:10), 12-18. ay: %86,2 (n:29), 18-24. ay: %87,5(n:24), 24-36. ay: %79,2(n:24), 36-48. ay: %57,1 (n:14), 48 ay ve üzeri hastalarda %66,7 (n:12) olarak bulundu. Tüm hasta grubumuz 2 yaş öncesi ve sonrası olarak değerlendirildiğinde 24 aydan küçük olgularda başarı oranımız %88,9 (n:56), 24 ay ve üzeri olgularda başarı oranımız %70 (n:35) olarak izlendi, bu fark istatistiksel olarak anlamlı idi.
Sonuç: Çalışmamızda sondalama cerrahisi uygulanan en başarılı bulunan yaş aralığı 0-12 ay, 12-18 ay ve 18-24 ay olarak bulunmuş ve 2 yaş üzeri yaş gruplarında başarı oranı düştüğü izlenmiştir. Çalışmamızda 2 yaşından büyük hastalarda başarı oranlarının düştüğü gözlendiğinden, doğumsal nazolakrimal kanal tıkanıklığı tanısı alan hastalarda çok fazla geciktirilmeden sondalama cerrahisinin en geç 2 yaşına kadar yapılması gerektiği düşünülmüştür.

Anahtar kelimeler: Konjenital nazolakrimal kanal tıkanıklığı, sondalama, probing, epifora

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INTRODUCTION

Congenital nasolacrimal duct obstruction (CNLDO) is the most common congenital or developmental lacrimal disorder[1,2]. CNLDO is a clinical condition that presents with symptoms of epiphora and occasional burring after birth and may cause mucoid secretion reflux when the pouch area is pressed[1,2]. The most common cause of epiphora in the pediatric population is CNLDO,[1-3] which is a significant ophthalmologic problem affecting up to 20% of all neonates[3-5]. The nasolacrimal drainage system is formed by the canalization of an epithelial cord derived from ectoderm[2-6].

Although canalization of the nasolacrimal duct is complete at the end of the intrauterine 6th month, it can sometimes be delayed up to several weeks after birth[1-4]. CNLDO can occur in any part of the nasolacrimal system; however, the obstruction is typically located at the level of the valve of Hasner, at the distal end of the nasolacrimal canal[2-5]. The most common symptoms of CNLDO include tear stagnation, epiphora, crusting of the eyelashes, and mucopurulent discharge[1-5]. The risk factors for CNLDO include maternal infections, exposure to radiation, medications, some occupational hazards during pregnancy, as well as a genetic predisposition[4-6]. Persisting CNLDO carries the risk of dacryocystitis, and preseptal and orbital cellulitis[2-6].

In the literature, the spontaneous opening of nasolacrimal duct obstruction was reported within the first 3 months in 70% of patients and within the first 12 months in 95% of patients[3-5]. Nasolacrimal sac massage is advocated because it may increase the likelihood of spontaneous resolution[5-7]. CNLDO was seen bilaterally in 14-33.8% of patients[6,7]. The fluorescein dye disappearance test (FDDT) is commonly used to confirm the diagnosis of nasolacrimal duct obstruction[1-3]. The sensitivity and specificity of the FDDT are 100% and 85%, respectively[1-4]. Conservative treatment, which includes massaging the pouch area, is widely preferred in clinical practice due to the high chance of spontaneous opening within the first year in the treatment of CNLDO[7,8].

Probing surgery has been advocated as the first-line treatment option with a 75-90% success rate in patients who do not improve with conservative treatment[7-10]. Alternative treatments after probing surgery have been used including silicone intubation, balloon dacryoplasty, and dacryocystorhinostomy[6-9]. However, these treatments are more invasive interventions than probing procedures. The timing of probing is the subject of debate, and there is no definite consensus in the literature for the ideal probing time.[5-9] Probing surgery seems to be more successful at an early age; however, studies have reported that it has been effective at a later age[4-8].

Considering our hypothesis according to a literature review that probing success in children aged over 2 years would decrease, we investigated how late probing surgery affected the success rate, especially in children aged over 24 months. In this study, we aimed to present the results of probing surgery in CNLDO and to evaluate the efficacy of probing according to different age groups.

MATERIALS AND METHODS

Study design

A retrospective analysis was conducted on patients with CNLDO who were treated at the Ophthalmology Department of the Cukurova University Faculty of Medicine from January 2012 to March 2022. This study received approval from the Ethics Committee of Cukurova University and was adherent to the tenets of the Declaration of Helsinki (2022-123/21). Informed consent was obtained from the parents of each participant. We retrospectively reviewed the medical records of patients who had been diagnosed as having CNLDO at Cukurova University Faculty of Medicine Opthalmology Department Oculoplasty Section from January 1st, 2012, to March 31st, 2022. Patient data were evaluated using Cukuruova University's database file records.

Sample

All enrolled children exhibited CNLDO. One hundred thirteen eyes of 90 patients who were diagnosed as having CNLDO and underwent probing surgery in our clinic were included in the study. Demographic data were collected for all children including age, sex, comorbid disease, epiphora laterality, dacryocystitis status, preceptal/orbital cellulitis status, and the timing of probing procedure interventions.

The diagnosis of CNLDO was based on the history of tearing, clinical findings (confirmed epiphora,

mucopurulent discharge, and regurgitation via lacrimal sac area hydrostatic massage, increased tear meniscus), and FDDT under the supervision of experienced oculoplastic surgeons (AAO, BU) of the Pediatric Oculoplasty Section of Ophthalmology Department.

Procedure

In patients where obstruction symptoms persisted and there was no regression despite the use of conservative treatment (hydrostatic massage of the nasolacrimal sac area and anti-bacterial eye drops four times daily [Netilmicin (Netira® SIFI, SpA, Catania, Italy)], children were qualified for surgical treatment. FDDT was performed by administering one drop of 2% fluorescein solution into the conjunctival fornices. After 5 minutes, each eye was evaluated for clearance from the fluorescein using a cobalt blue filter light of an indirect ophthalmoscopy device. Nasolacrimal duct fluid passage was normal in the absence of fluorescein in the conjunctival sac or thin marginal tear strip. If CNLDO was present, it was documented by the presence of an ongoing wide, bright fluorescent tear strip.

Parents were instructed to perform a correct nasolacrimal sac massage three times per day to increase the chances of CNLDO spontaneous resolution. Patients aged under 6 months were eligible for probing surgery if they had an abscess, mucous cyst, or chronic purulent inflammation of the nasolacrimal sac that persisted despite appropriate conservative treatment. Probing was performed under general anesthesia in the operating room with an anesthesiologist. Children were excluded from the study group in whom: previous procedures on the lacrimal sacs and ducts were performed; epiphora was associated with other conditions (eyelid position disorders, congenital glaucoma, abnormal nasal bone structure, facial malformations, ectopic lacrimal puncta, congenital fistulas of the lacrimal sac) and those who did not attend follow up visits to confirm resolution of symptoms of nasolacrimal duct obstruction or had incomplete records.

Considering the first probing surgical time, patients were first divided into six age groups: 0-12 months, 12-18 months, 18-24 months, 24-36 months, 36-48 months, and 48 months and older. Then, the patients were divided into two groups, aged under 2 years and over 2 years. The success rates of the patients were evaluated according to the time of the first probe procedure.

Treatment

All probing procedures were performed by two experienced surgeons (AAO, BU) in the Oculoplasty Unit of the Ophthalmology Department under general anesthesia. The nasolacrimal duct probing procedure was started by widening the superior and inferior punctum using a fine dilatator. Probing was performed using the Bowman probe, which was selected according to the width of the lacrimal canaliculi, with sizes ranging from 00 (0.90 mm diameter) to 1 (1.10 mm diameter). The next step was the introduction of the Bowman probe through the upper lacrimal punctum into the vertical duct, later through the horizontal and common ducts, to the lacrimal sac. Moving the Bowman probe approximately 8-10 mm from the punctum, feeling the hard stop with the medial wall of the nasolacrimal sac. Then the probe was turned upwards towards the brow bone and guided inferiorly and posterolaterally by the nasolacrimal duct until feeling the stop of the obstructed Hassner valve (approximately 20 mm). The obstruction site was passed using a firm downward movement. After the Bowman probe was withdrawn, patency was checked by irrigating the lacrimal pathways with physiologic saline. There were no complications after the probing in any patients. No patients had false passage or injury to the nasolacrimal duct, canaliculi, or punctum were seen. After the probing procedure, topical antibiotic application four times daily netilmicin (Netira® SIFI, SpA, Catania, Italy) for 1 week with a hydrostatic massage was prescribed.

The patients were followed up at the 1st week, 1st month, 3rd month, and 6th month after the surgery. During the follow-ups, the families were questioned about whether the epiphora symptoms persisted, complete ophthalmologic examinations of the patients were performed, and the FDDT was performed. Treatment was deemed successful when the three main clinical symptoms (epiphora, tear lake, mucous discharge) had subsided and FDDTs were normal. Probing surgery was considered successful if there was no watering, no epiphora was observed in the examination, and the fluorescein dye did not pool in the conjunctival fornix in the FDDT at the 6th-month follow-up.

Statistical analysis

Categorical variables are expressed as numbers and percentages, and continuous variables are summarized as mean and standard deviation and median and minimum-maximum where appropriate. The Chi-square test was used to compare categorical variables between the groups. All analyses were performed using the IBM SPSS Statistics Version 20.0 statistical software package. The statistical level of significance for all tests was considered 0.05.

RESULTS

The medical records were reviewed and 90 patients were eligible for inclusion in this study. The study included 113 eyes in 90 children aged from 1 month to 60 months (mean age: 26.3 ± 15.3 months). Procedures were performed in 49 (54.4%) girls and 41 (45.6%) boys. Probing was performed on the right eye in 52 (46%) patients and the left eye in 61 (54%) patients. Bilateral probing was performed in 23 patients. Unilateral occlusion was present in 67 (74.4%) patients and bilateral nasolacrimal duct obstruction was found in 23 (25.6%) patients. The first probing surgery was successful in 91 (80.5%) of 113 eyes in all age groups. According to the age groups, the success rates of probing were observed as follows: 0-12 months (n=10) 100%, 12-18 months (n=29) 86.2%, 18-24 months (n=24) 87.5%, 24-36 months (n=24) 79.2%, 36-48 months (n=14) 57.1%, and 66.7% in patients aged over 48 months (n=12) (Figure 1). No intraoperative and postoperative complications were documented.

There was no significant difference in the success of probing between males and females (F: 83.9%, M:76.5%, $p>0.05$, respectively) (Figure 2). Our success rate was 88.9% (n=63) in patients younger than 24 months, and 70% (n=50) in patients aged 24 months and over. The difference between them was significant ($p<0.05$) (Figure 3).

Considering the success rates for the age groups in this study, the power value was 70%, and the effect size (d=0.299) for 113 eyes; all results are shown in Table 1.

Table 1. Success rates by age groups and sexes.

		Success n (%)	Failure n (%)	Total	P value
Age groups (months)	0-11	10 (100)	-	10 (8.8)	0.05
	12-17	25 (86.2)	4 (13.8)	29 (25.7)	
	18-23	21 (87.5)	3 (12.5)	24 (21.2)	
	24-35	19 (79.2)	5 (20.8)	24 (21.2)	
	36-47	8 (57.1)	6 (42.9)	12 (12.4)	
	>48	8 (66.7)	4 (33.3)	12 (10.6)	
Sex	Female	52 (83.9)	10 (16.1)	62 (54.9)	0.349
	Male	39 (76.5)	12 (23.5)	51 (45.1)	
Age groups (months)	0-23	56 (88.9)	7 (11.1)	63 (55.8)	0.016
	>24	35 (70)	15 (30)	50 (44.2)	

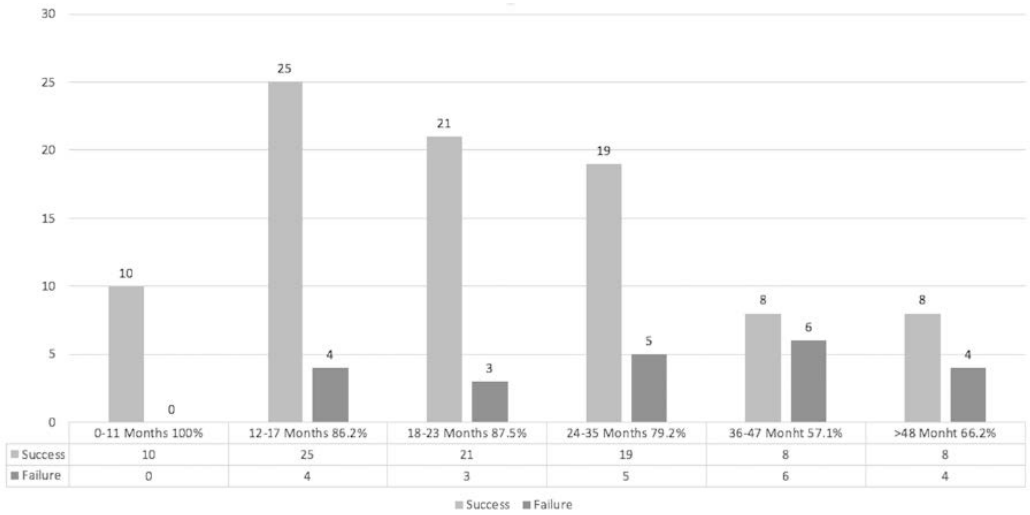

Figure 1. Evaluation of success and failure rates by age groups.

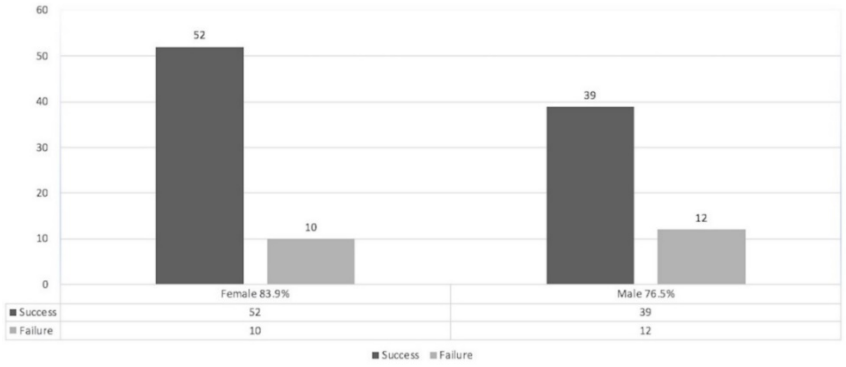

Figure 2. Evaluation of success rates by sex.

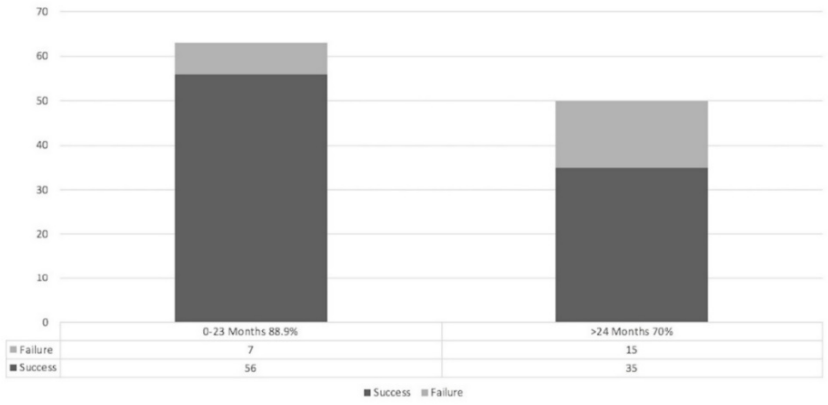

Figure 3. Evaluation of success rates in patients younger than 24 months and older than 24 months.

DISCUSSION

Congenital nasolacrimal duct obstruction is the most common cause of epiphora in the pediatric population[10]. Congenital nasolacrimal duct obstructions are often caused by developmental defects of the structures of the nasolacrimal duct[11,12]. The most common type is membranous occlusion at the level of Hasner's valve[11-13]. The management of congenital nasolacrimal duct obstruction remains controversial because spontaneous resolution reportedly occurs in up to 90% of patients by the age of 12 months[13-15]. Spontaneous resolution with conservative treatment in the second year of life has not been extensively reported[14-17]. Nakayama et al. reported that spontaneous resolution of CNLDO occurred after the age of 12 months in 45% of infants[7]. Nasolacrimal probing is the treatment of choice for CNLDO that does not have a spontaneous resolution[4-7] because probing, which is performed by inserting a small blunt probe into the punctum and throughout the nasolacrimal drainage system, has several advantages over more complex procedures such as short surgical time, minimal surgical manipulation, low risk of bleeding, and no need for subsequent tube removal[5-8]. However, there is no consensus about the best time for probing[1-4].

Some studies have reported higher failure rates with late probing compared with early probing[2-5]. Studies suggested that probing should be delayed until the age of 12-24 months because of the high efficacy of conservative treatment, but the optimal time for surgical treatment of CNLDO remains controversial[1-3,7-10]. Surgical procedures for CNLDO include probing, balloon dacryocystoplasty, and silicone intubation. Probing is the preferred primary intervention because of its safety and simplicity, as well as its high success rates. In patients with CNLDO, probing surgery is a minimally invasive procedure with very good results when performed with the right technique and timing[11-13]. Sagiv et al. reported that the overall probing procedure success rate was 79% (83 out of 105 patients) in their study[5]. In other studies in the literature, probing success rates vary between 69% and 92% when used as primary treatment[11-14]. In our study, the success rate was found as 80.5% in the total evaluation of all patients including all age groups, in line with previous reports.

Probing is a standard therapeutic method for CNLDO; however, the issue of optimal timing remains controversia[11-14]. In the other studies, the success rate of probing earlier than 12 months of age ranged from 78% to 97%. In our study, the success rate among infants younger than 12 months was 100% (10/10 patients). We determined success rates of primary probing in multiple age groups, 100% in 0-12 months, 86.2% in 12-18 months, 87.5% in 18-24 months, 79.2% in 24-36 months, 57.1% in 36-48 months, and 66.7% in those aged 48 months and over. These results agree with the findings in previous reports, showing that the success rates of probing decreased with age. Lekslul et al. reported that the success rate of probing did not significantly decrease until patients were aged at least 4 years[1]. However, multiple studies have shown that patient age is correlated with the success of primary nasolacrimal duct probing. Furthermore, Kashkouli et al. reported a significant reduction in the success rate of probing after the age of 24 months[18]. In their study, Arora et al. reported a probing procedure success rate of 78% in children aged under 36 months and the success rate declined to 50% in children aged over 36 months[19]. Zwaan et al. reported that the probing success rate was 97% in patients with CNLDO aged under 1 year, 88% between the ages of 1-2 years, and 93% over the age of 2 years, stating that the results of probing did not differ significantly in patients aged over 1 year compared with patients aged over 2 years[17]. In our study, the 0-24 months success rate was 88.9%, in patients aged 24 months and over it was 70%, and a statistically significant difference was observed. In our study, we observed that the success rate decreased in patients aged 24 months and over.

When various studies on this subject are examined in the literature, Esgin et al. reported 100% success in the first 4-6 months, 96.9% in 7-12 months, and 85.4% in 13-48 months as probing time in their study[15]. Erdol et al. reported probing success as 93.7% between 13-24 months and 81.2% between 25-48 months in their study[16]. In our study, the success rate of probing surgery according to age groups was found to be highest in 0-12 months, 12-18 months, and 18-24 months, and the success rate decreased with advancing age.

Sagiv et al. reported that probing resulted in high success rates with no operative complications or adverse events during the follow-up[5]. The most common and concerning complication associated with CNLDO is acute dacrycystitis[3-7]. Lekslul et al reported that the incidence of acute dacryocystitis as

a complication was approximately 1.8% (2/108 patients)[1]. In our study, acute dacryocystitis nor any other complication was observed after probing in any patients.

There are several limitations in this single-institution retrospective analysis of success rates of probing surgery in CNLDO by age ranges. The main limitation is the retrospective nature of the study and associated selection biases. The difference in the sample size between the groups is another limitation. Our single-center small sample size can affect statistics. However, the study is among the rare studies with a large series of 10 years conducted in Turkey. Hence, the results of the study should be interpreted with caution as hypothesis-generating and not conclusive. Despite the inherent limitations, there is a paucity of data about probing surgery in CNLDO by age ranges in the literature, and this study is important because it is one of the rare studies with a high number of patients in Turkey. Taking into account the above limitations, this study presents the effect of age groups on the success rates of probing.

In conclusion, probing surgery is a safe and effective method for CNLDO. Probing is an effective, minimally invasive procedure for patients with CNLDO when performed at the right time and under appropriate conditions. We think that following patients with a conservative approach in the first year of life and performing probing before age 2 years according to the clinic of the patient will be the most appropriate treatment option because the chance of success decreases after age 2 years. We encourage the use of probing in patients younger than 24 months of age, specifically in surgical treatment-naive patients because the procedure has a very high success rate. Further studies with larger sample sizes are required, additionally taking into account the success rates of probing procedures in different age groups.

Yazar Katkıları: Çalışma konsepti/Tasarımı: AAÖ, BU; Veri toplama: AAÖ, MA; Veri analizi ve yorumlama: AAÖ, BU; Yazı taslağı: BU, AAÖ, MA; İçeriğin eleştirel incelenmesi: AAÖ, BU; Son onay ve sorumluluk: BU, AAÖ, MA; Teknik ve malzeme desteği: AAÖ, MA, BU; Süpervizyon: AAÖ; Fon sağlama (mevcut ise): yok.
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