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Original Research Article

The Efficiency of "Double Probing" in Congenital Nasolacrimal Duct Obstruction

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Abstract

The aim of this study was to investigate the efficiency and reliability of "double probing" in patients with congenital nasolacrimal duct obstruction (CLDO). In this retrospective study, we reviewed the clinical records of patients who underwent "double probing" due to CLDO between January 2008 and February 2013. The patients were separated into four groups according to their ages as follows: group 1 age 0-12 months, group 2 age 12-24 months, group 3 age 24-60 months and group 4 age 60 months or more. Probing was applied to patients with dacryocystoceles in the early post-medical treatment period whereas pressured massage and medical treatment up to at least 10 months were applied to patients with no complaints other than epiphora. 139 eyes of 95 patients were included in the study, from 49 (51.5%) females and 46 (48.5%) males. The patients' age range was 3 to 66 months, with an average of 24.36 months. Distribution of the patients according to groups was as follows: 27 eyes in group 1, 65 eyes in group 2, 44 eyes in group 3 and 3 eyes in group 4. After the first double probing, 131 eyes of 95 patients successfully recovered. The average age of the patients operated with success was 23.34±13.55 months, whereas the average age of the patients operated without success was 26.57±15.17 months. The success rate was 96.2% in group 1, 93.8% in group 2, 93.1%, in group 3 and 100% in group 4. Two of the 8 eyes that underwent unsuccessful first double probing were given second double probing, whereas 4 eyes underwent lacrimal intubation and 2 eyes underwent external DCR. After the second surgery, complete success was achieved in all patients.

Keywords: Double probing, Congenital nasolacrimal duct obstruction, Probing

INTRODUCTION

Congenital nasolacrimal duct obstruction (CLDO) is an important childhood illness that often occurs with epiphora in the first year of life. The reported incidence rates vary from 1.75% to 20% (Stager et al., 1992). The obstruction usually exists on Hasner's valve at the lower end of the nasolacrimal duct. Most of the cases recover spontaneously or with medical treatment combined with lacrimal massage (Paul and Shepherd, 1994). In CLDO patients with no improvement, nasolacrimal probing is an important and successful surgical treatment alternative. Most researchers prefer to apply probing in the early childhood years, based on published reports of a significant success rate of 77% to 97% in children younger than 18 months (Stager et al., 1992; Robb, 1998; Ciftci et al., 2000; Casady et al., 2006; Katowitz and Welsh, 1987). Some researchers have reported that

the success rate of probing decreases with age (Paul and Shepherd, 1994; Katowitz and Welsh, 1987). There are even researchers who recommend silicon intubation as a first treatment alternative for patients older than 18 months. (8) On the other hand, other researchers claim that age has no influence on the success of probing (Robb, 1998; Ciftci et al., 2000; Zwaan, 1997; El-Mansoury et al., 1986).

In this study, the efficiency and success of a different method, double probing, which was applied in our clinic for CLDO with different age groups, will be analyzed and the possible reasons for failure will be discussed.

METHODS

The records of patients who applied to our clinic due to CLDO and underwent "double probing" between January 2008 and February 2013 were analyzed retrospectively. The study was conducted in accordance with the tenets of the Declaration of Helsinki by obtaining written consent from all patients, with the approval of the local ethical review board. A diagnosis of CLDO was made for those with a history of congenital epiphora by eliminating other ophthalmologic diseases that may lead to epiphora such as trichiasis, congenital glaucoma, keratitis, conjunctivitis, etc. In addition, the CLDO diagnosis was confirmed by applying nasolacrimal lavage to all patients on the operating table preoperatively. The patients were separated into four groups according to their ages as follows: group 1 age 0-12 months, group 2 age 12-24 months, group 3 age 24-60 months and group 4 age 60 months or more. Patients who applied to our clinic for the first time with no previous treatment history were administered 4x1 Netildex® eye drops (1.32 mg dexamethasone disodium phosphate + 4.55 mg netilmicin sulphate) topically and pressured massage for two weeks. Those patients who did not improve after this treatment were given "double probing." Patients with a previous history of medical treatment and lacrimal pressured massage or probing in another clinic were directly administered double probing. Probing was applied to patients with dacryocystoceles in the early post-medical treatment period, whereas patients with no complaints other than epiphora were given pressured massage and medical treatment for up to at least 10 months.

Surgical Technique

All patients were operated by the same surgeon under general anesthesia (Laryngeal Mask Airway (LMA)) or sedation. All patients were administered nasolacrimal lavage on the reoperative operating table to confirm the diagnosis of CLDO. Afterwards, lower and upper punctums were dilated using a punctum dilator. Firstly small sized Bowman probes, chosen according to age group (Bowman probes no. '00' for group 1, no. '0' for group 2 and no. '1' for groups 3 and 4), were lubricated with sterilized Vaseline. The Bowman probe was inserted into the upper punctum vertically, thereby reaching the ampulla; it was then positioned horizontally to proceed into the upper canaliculus. The probe continued to be inserted until a hard ending was reached and the nasolacrimal sac was entered. Then the probe was slightly retracted to an angle of 90° and after a slight turn towards the back and the medial, it could be felt that the nasolacrimal duct had been entered. At this stage, the probe was slightly oscillated in order to feel, by the tip of the probe, the immobility inside the nasolacrimal duct bone in order to ensure that it had accurately entered the nasolacrimal duct. The probe proceeded through the nasolacrimal duct until the nasal cavity was entered via the lower meatus. At this stage it was observed that in normal cases, a slight obstacle was encountered which was overcome with a clicking sound, and the nasal cavity was entered thereafter. Another probe was inserted through the nose and confirmation was obtained by feeling metal contacting metal under the lower concha. The same process was repeated with the same probe by inserting it through the lower punctum. Then, as the second stage of "double probing," the same process was repeated with a probe one size bigger (size '0' for group 1, size '1' for group 2, size '2' for groups 3 and 4) (Figure 1). After the process was completed, the clarity of the passage was checked by nasolacrimal lavage. After the operation, all patients were administered 4x1 Netildex® eye drops (1.32 mg dexamethasone disodium phosphate + 4.55 mg netilmicin sulphate) topically for one week. Control examinations of the patients were conducted at day 1, week 1, month 1, month 3 and month 6 and annual consecutive control examinations were planned. The follow-up period was 6 to 38 months, with the average being 26 months.

The operational success criteria were epiphora history, obtained from the families of the patients, as well as the Fluorescein disappearance test (FDT). Statistical analysis was conducted with respect to the age and gender of the patients as well as the anesthesia applied, the obstructed side of the nasolacrimal duct and the efficiency of double probing on patients in terms of their undergoing probing in another clinic or not.

Statistical Analysis

In this study, statistical analyses were conducted using NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA). In addition to descriptive statistical methods (average, standard deviation) independent t tests were used to compare the double groups and chi-square tests and Fisher's exact tests

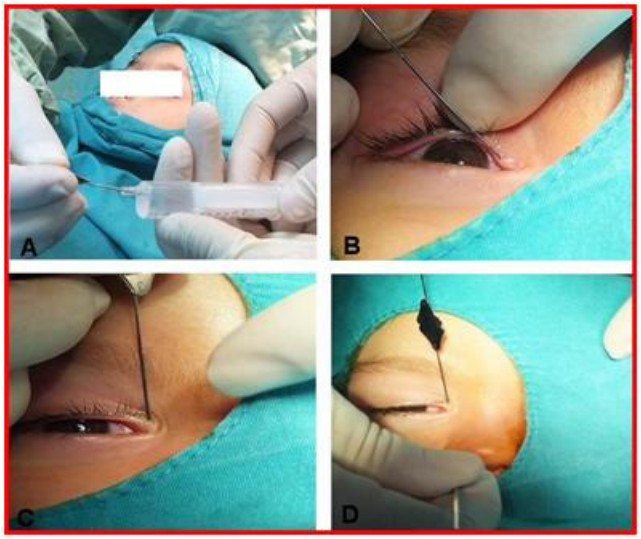

Figure 1. The stages of double probing (A: probe lubricated with sterilized Vaseline, B:probe horizontally inserted in the upper canaliculus, C: probe turned at an angle of 90°, entered into the nasolacrimal duct and inserted further, D: confirmation made by contacting metal with metal in lower meatus by using a further probe.

Table 1. Epidemiological information of patients (M:male, F:female, R:right, L:left, B:bilateral)

Age (Month)	Sex		Side			Previous lacrimal probing (in other clinic)
	M	F	R	L	B	
0-12	11	9	6	7	7	-
13-24	18	27	7	18	20	14
25-60	16	11	1	9	17	21
>60	1	2	0	3	0	3

were used to compare qualitative data. The results were analyzed for a significance level of $p<0.05$.

RESULTS

139 eyes of 95 patients were included in the study, from 49 (51.5%) females and 46 (48.5%) males. 44 patients had bilateral CLDO. The patients' age range was 3 to 66 months, with an average of 24.36 months. 38 eyes of 28 patients had a history of previous probing, and underwent probing in our clinic for the second time (Table 1). The distribution of such patients according to groups was as follows: no such patients in group 1, 14 eyes in group 2, 21 eyes in group 3 and 3 eyes in group 4. The remaining 101 eyes of 67 patients were probed for the first time in our clinic. Distribution of patients according to the four age groups was as follows: 27 eyes in group 1, all of which received double probing for the first time in our clinic, 65 eyes in group 2; 14 of which previously underwent unsuccessful probing in other clinics; 44 eyes in group 3, 21 of which previously underwent unsuccessful probing in other clinics; and 3 eyes in group 4, all of which previously underwent unsuccessful probing in other clinics. Two patients aged below 6 months were administered medical treatment due to dacryocystoceles followed by double probing. One patient had Rubenstein Syndrome, one had Down Syndrome and one had mucopolysaccharidosis. The remaining patients had no known illnesses.

In our clinic, 131 eyes of 95 patients successfully recovered after the first double probing. The average age of the patients who underwent successful first double probing was 23.34±13.55 months, whereas the average age of the patients without success was 26.57±15.17 months; this difference was not statistically significant ($p=0.548$). The success rate was 96.2% in group 1, 93.8% in group 2, 93.1%, in group 3 and 100% in group 4 (Figure 2). Again, these differences were not statistically significant ($p=0.684$, $p=0.884$, $p=0.992$, $p=0.620$). There was also no significant difference in the outcome of patients who were probed unsuccessfully in another clinic

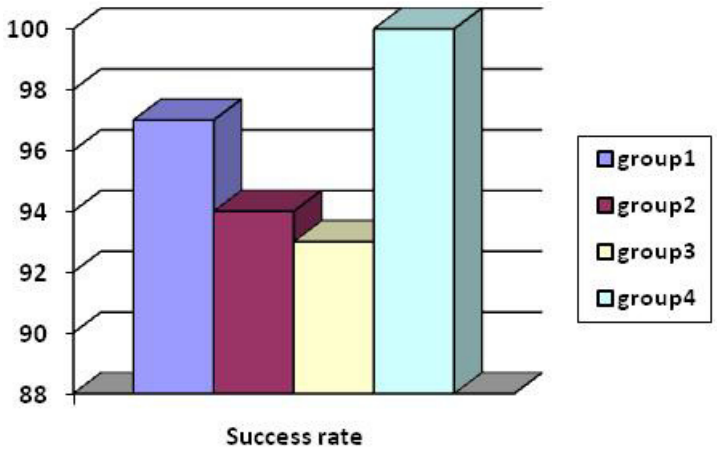

Figure 2. Success rate of patients according to age groups after first double probing in our clinic (group 1: 0-12 months, group 2: 12-24 months, group 3: 24-60 months, group 4: 60 months or more)

Table 2. Second surgical choice in our clinic for patients unsuccessfully applied first double probing and the final success rate (DCR: dacryocystorhinostomy)

Age range (months)	Second surgical choice			Final success rate (%)
	2nd double probing	Ritleng intubation system (bicanalicular)	DCR	
0-12	1			100.0
13-24	1	3		100.0
24-60		1	2	100.0

Table 3. Bowman probe sizes used in the first and second probings according to age groups.

Bowman type / Patient	First probing	Second probing
Group 1 (0-12 months)	Probe no. '00'	Probe no. '0'
Group 2 (12-24 months)	Probe no. '0'	Probe no. '1'
Group 3 (24-60 months)	Probe no. '1'	Probe no. '2'
Group 4 (>60 months)	Probe no. '1'	Probe no. '2'

and operated again for probing (first double probing) and the patients who received double probing for the first time in our clinic (p=0.095). In addition, there were no significant differences in success rate with respect to gender, the side of the nasolacrimal duct obstruction and the anesthesia applied (p=0.760, p=0.328, p=0.335, respectively). Epiphora continued in 8 eyes of 5 patients: in 1 eye of 1 patient in group 1, 4 eyes of 2 patients in group 2 (2 eyes were of patients who underwent unsuccessful second probing) and 3 eyes of 2 patients in group 3 (2 eyes were of patients who underwent unsuccessful second probing). Two of the 8 eyes that underwent unsuccessful first double probing in our clinic were applied a second double probing, whereas 4 eyes underwent lacrimal intubation via the Ritleng intubation system. External dacryocystorhinostomy (EDCR) was applied to two eyes with a rather narrow bone structure in the preoperative nasolacrimal duct. After the second surgery, complete success was achieved in all patients (Table 2). One patient to whom a silicon tube was applied via the Ritleng® intubation system (FCI Ophthalmics) developed silicon tube prolapse twice. No other complications were detected in the remainder of the patients.

DISCUSSION

Probing is the standard second stage treatment procedure for CLDO that does not recover spontaneously or through lacrimal massage. In cases where no success is obtained upon first probing, either a second round of

probing, balloon catheter dilatation or lacrimal intubation, which might be considered as the third treatment stage, are performed. If these treatments are also futile, a fourth treatment stage involving external dacryocystorhinostomy (EDCR), endoscopic DCR or recently developed laser DCR may be administered. In many previous studies in the literature, more than 90% success was achieved with probing, especially in young age groups (Stager et al., 1992; Robb, 1998; Ciftci et al., 2000; Casady et al., 2006; Katowitz and Welsh, 1987). However the same rate of success has not been achieved in advanced age groups (Sturrock et al., 1994; Young et al., 1996). (Mannor et al., 1999) indicate that there is negative correlation between the success rate and age, whereas (Katowitz and Welsh, 1987) believe that an increase in age not only decreases the success rate but also increases the number of subsequent operations and the complexity thereof. On the contrary, (Robb, 1998), (Zwaan, 1997) and (El-Mansoury et al., 1986) reported a success rate of more than 90% percent in patients in advanced age groups and very advanced age groups.

The reason for the low success rate in older children is related to two hypotheses: the first is long lasting inflammation and fibrosis (Katowitz and Welsh, 1987) in parallel with an increase in age and the second is deposits that develop over time due to a complex obstruction, leading to a more severe and complex obstruction (Paul and Shepherd, 1994; Kushner, 1998; El-Mansoury et al., 1986). However, there are few studies that focus on the impact of complex CLDO on advanced age probing (Kushner, 1998; Honavar et al., 2000). Is it sufficient to explain surgical failure only with such patient-based reasons? In other words, is it possible to increase the success rate by modifying the probing technique? Based on these questions, we modified the standard probing technique. We performed the first stage of double probing using a relatively smaller probe according to patient's age and by lubricating the probe using liquid Vaseline. The purpose of using a probe lubricated with Vaseline was to prevent possible epithelial damage in both the canalicular system and the nasolacrimal system that might negatively affect success. In the second stage, we particularly paid attention to slightly oscillating the probe to both sides at the entrance of the lacrimal duct in order to feel the hard structure of the duct bone before proceeding further into the lacrimal duct, so that we could be sure that we were correctly inside the lacrimal duct. Because probing is an operation that is conducted blindly, it is possible to open new pathways in the lacrimal sac and proceed accordingly. Especially in syndromic patients with morphologically defective lacrimal system anatomies, ensuring that the lacrimal duct is accurately entered will affect postoperative success. In this way, we achieved success in three cases with Rubenstein syndrome, Down syndrome and mucopolysaccharidosis.

Congenital nasolacrimal duct obstruction can be divided into two basic classes: the simple or membranous type where the membrane formed in the lower part of the lacrimal duct can be overcome easily with a probe without facing much resistance and the nasal cavity can be easily entered, and the complex type where CLDO develops with a narrowness in the bone structure of the nasolacrimal duct, thereby preoperative probing becomes difficult or impossible. Similar classifications have been made by many surgeons (Kushner, 1998; Kashkouli et al., 2003). Another complex type may be added to this classification: perhaps we, as surgeons, also contribute to the complexity through the damage we cause in the lacrimal system during probing. We are of the opinion that in CLDO patients with a narrow and complex nasolacrimal duct bone, probing will not be successful and subsequent surgical alternatives should be considered. In a patient with quite a narrow nasolacrimal bone structure, we chose EDCR as the second surgical alternative. Therefore, membranous type CLDO should primarily be chosen to increase success rates. We conducted double probing with a second probe a size bigger than the first. Our aim was to create a kind of balloon catheter dilatation effect by smashing the already ruptured membranes in the nasolacrimal duct upon first probing, followed by a second probe larger in size so that the pieces of the ruptured membrane would not come together and cause an obstruction. On the other hand, we entered both the lower and upper canalicular systems thereby conducting consecutive probing in order to detect the existence of any other membrane that might cause obstruction in the canalicular system level and if so, to clear it.

The success rate of balloon catheter dilatation after an unsuccessful probing differs, in a range from 53% to 95% (Tao et al., 2002; Becker et al., 1996; Hutcheson et al., 1997; Tien and Young, 2005). Similarly, the success rate of bicanalicular lacrimal intubation after an unsuccessful probing is in the range of 66% to 100% (Leone and Van Gemert, 1990; Heirbaut et al., 1990; Beigi and O'keefe, 1993; Al-Hussain and Nasr, 1993; Aggarwal et al., 1993; Ratliff and Meyer, 1994; Lim et al., 2004; Pe et al., 1998; Theodoropoulou et al., 2013; Sasaki et al., 2013; MacEwen et al., 2001). In our study, the success rates were 96.2% in group 1, 93.8% in group 2, 93.1% in group 3 and 100% in group 4. In particular, our success rate of more than 90% in the advanced age groups indicated that the double probing technique created the effect of balloon catheter dilatation. Therefore, we chose lacrimal intubation as the third treatment alternative.

Probing is a blind procedure. Another recently popular issue has been probing combined with endoscopy. In the reported literature, the success rate of probing combined with nasal endoscopy is 85% to 98% (Theodoropoulou et al., 2013; Sasaki et al., 2013; MacEwen et al., 2001; Kouri et al., 2008; Wallace et al., 2006; Elmorsy et al., 2010). Probing combined with nasal endoscopy is especially useful in demonstrating intranasal pathologies and opening of erroneous pathways. However, probing

combined with nasal endoscopy is still a relatively blind procedure since it does not show the inside of the lacrimal system. An interesting study in this regard has been reported by (Sasaki et al., 2013) where a probing technique with direct endoscopic methodology (dacryo endoscopy) was used. It seems that this method will be popular in the future due to the opportunity it provides for screening inside the lacrimal system.

Overall, double probing in younger age groups has similar success rates as standard probing. On the other hand, it is a successful, effective and reliable method, especially for older age groups. In addition, lubrication of probes with a lubricant such as Vaseline during probing will prevent epithelial damage inside the lacrimal system.

CONCLUSION

'Double probing' is a reliable and effective treatment alternative in CLDO patients of all age groups.

Conflict of Interest: *None of the authors has conflict of interest with the submission*.

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