

Results of Nasolacrimal Duct Probing in Children between 9-48 Months

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Abstract- Congenital nasolacrimal duct obstruction (CNLDO) is a common disease in children. The classic treatment of CNLDO is probing that was done around one year old. However, controversy exists regarding the outcome of probing in children older than one year. This study aimed to find the cure rate of initial probing for CNLDO and identify factors producing the failure rate in old age. In this retrospective interventional case series study, 100 eyes of 92 patients aged 9-48 months with CNLDO underwent probing with general anesthesia. According to the intraoperative results of probing, CNLDO were categorized in two groups of membranous obstruction at the end of nasolacrimal duct obstruction (NLD) and complex obstruction at canaliculus, lacrimal sac and NLD. Patients were categorized in three groups according to the age of probing into under 12, 12 to 24 and over 24 months. Success rate was defined as successful irrigation of NLD intraoperatively and absence of lacrimation and discharge at 1 week, one, three and six months postoperatively. The average age of patients and probing were 47.35 ± 25.59 and 17.32 ± 7.85 months respectively. Membranous obstruction accounted for 72% of patients and remainder had complex type. An overall cure rate of 91%, 89% and 60% was found in patients aged 9-12, 12-24 and 24-48 months respectively. Surgery success rate after six months was 91% in membranous group and 52% in complex group. There was a significant relation between the type of obstruction and opening of NLD ($p < 0.001$). This study showed that the probing failure of probing after one year was related to the complexity of obstruction rather than the age of the patient. It is recommended that probing could safely be done in under 4 years old.

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Introduction

Congenital nasolacrimal duct obstruction (CNLDO) is a common problem in the early years of life (1). The most common type of congenital nasolacrimal duct obstruction is a simple membrane at the valve of Hasner (2-4). Standard management in the first months of age includes hydrostatic massage of the lacrimal sac and topical antibiotics. Whenever the condition continues around the age of one year, early nasolacrimal duct probing yields good results (5). Two major opinions exist regarding the management of CNLDO after one year. Some investigators report that increasing age significantly decreases the success rate of probing after the age of 1 year (6-8). Therefore, some ophthalmologist prefers to perform silicone intubation as the initial surgical procedure for older children (9). Some other ophthalmologist claimed that increasing

age has no significant effect on the success rate of probing in older children (10-13). Several authors have reported that the success rate of nasolacrimal duct probing is related to the type of obstruction (14-15). Kushner (9) stated that nasolacrimal duct probing had a 95% success rate in patients with simple obstruction at the valve of Hasner versus 58% in patients with complex types of obstruction. On the other hands, Katowitz and Welsh (7) seven reported a 97% success rate with nasolacrimal duct probing for children younger than 13 months old and only 33% success rate for children older than 24 months.

There are two hypotheses for the lower success rate of probing in older children with CNLDO. The first is prolonged inflammation and fibrosis in the lacrimal drainage system with increasing age, and the second one is the accumulation of subjects with complex obstruction over time (8,9,12). Paul and Shepherd (8) suggested that

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older children with nasolacrimal duct obstruction are more likely to represent the pool of children born with more complicated types of obstructions that did not resolve spontaneously in the first year of life.

Materials and Methods

In this retrospective non-comparative interventional case series, samples consisted of 100 eyes of 92 consecutive patients between the ages of 9 and 48 months with CNLDO, which were probed from 2000 to 2012. Sample inclusion criteria in the study consisted of no history of previous probing and trauma, no evidence of punctal atresia, lid and nasal disorders and no evidence of dacriocystitis. The diagnosis of CNLDO was based on history of tearing or discharges since or shortly after birth. Samples were categorized into three groups of under 12m, 12-24m and over 24m. Probing was performed by pediatric ophthalmologists under brief general anesthesia. After dilatation of the inferior punctum, the Bowman’s probe was introduced vertically into the punctum and then rotated horizontally 90 degrees in the same plane to enter the canaliculus. With lateral tension exerted over the lid, the probe was advanced until it touched bony firmness that indicated it had touched the nasal wall of the lacrimal sac. The probe was then slightly withdrawn and rotated upward 90 degrees and advanced down the nasolacrimal duct. The membranous CNLDO was defined as a membranous obstruction at the end of the nasolacrimal duct that was perforated without much resistance or no resistance in the punctum, canaliculus and lacrimal sac. A complex CNLDO was defined as resistance to the probe in the punctum, canaliculus, lacrimal sac or nasolacrimal duct. Intraoperative success rate or patency of lacrimal duct confirmed by metal to metal contact (probe and second probe under the inferior turbinate) or passage of

fluoresceinated normal saline into the nasal cavity. Postoperatively, the patients were given antibiotic (sulfacetamide 10%) and steroid (betamethasone 1%) eye drops, four times daily, for one week. Patients were re-evaluated at regular intervals of one week, one month, three months and six months postoperatively. Postoperative success rate defined as complete disappearance of lacrimation and the pus discharge. Data were entered with software SPSS /16. The Chi-square, Fisher’s exact test was used for statistical analysis.

Results

In a retrospective non-comparative interventional case series, 100 eyes of 92 consecutive patients between the age of 9 and 48 months with CNLDO were probed from 2000 to 2012. The average probing and age of patients were 47.35±25.59 and 17.32±7.85 months respectively. Most samples were female (51%) with membranous obstruction (72.8%). Most children in membranous group (53.7%) were 9-12 months and 52% of the complex group was in 12-24 months group. In 9-12 months group, 89% of patients were in membranous group, in 12-24 months group, 69% in membranous group and 24-48 months group, 80% of patients were in complex group. The distribution of membranous and complex obstruction is summarized in Table 1. Most probing (97%) was done in under 24 months old. Distribution of age of probing among patients is depicted in Table 2 and 3. The average success rate of surgery after 6m in membranous group and complex group were 91% and 52% respectively. Based on the success rate, there were statistically significant differences between membranous and complex groups (Table 3). Study results were evaluated based on the type of obstruction (membranous vs complex), time of follow-up and age of probing.

Table 1. Distribution of membranous and complex obstruction

Type of obstruction	Uni- or bilateral			Total
	Right eye	Left eye	Bilateral	
Membranous	46%(31)	43%(29)	11%(7)	72.8%(67)
Complex	44%(11)	52%(13)	4%(1)	27.2%(25)
Total	45.5%(42)	45.5%(42)	9%(8)	100%(92)

Table 2. Distribution of patients of probing groups according the type of obstruction

Age of probing	Type of obstruction		Total
	Membranous	Complex	
9-12m	36(89.5%)	2(10.5%)	38(100%)
12-24m	29(69%)	13(31%)	42(100%)
24-48m	2(16.5%)	10(83.5%)	12(100%)
Total	67(100%)	25(100%)	92(100%)

Table 3. Distribution of age of probing among patients

Type of obstruction	Age of probing			Total
	9-12m	12-24m	24-48m	
Total	38(41.3%)	42(45.7%)	12(13%)	92(100%)
Membranous	36(53.7%)	29(43.3%)	2(3%)	67(100%)
Complex	2(8%)	13(52%)	10(40%)	25(100%)

Membranous groups

This group accounted for 72.8% of patients. The average success rate of surgery after 6m was 91%. According to the success rate, there was a statistically significant difference between membranous and complex groups ($P<0.001$, Table 4). The best success rate of operation was seen intraoperatively (95%) and the least was in 3months postoperatively (88%). There was statistically significant difference between both

groups during follow-up ($P<0.001$, Table 5). The success rate of probing in membranous and complex groups was compared according to the age of probing during the follow-up. A significant difference was seen in 12-24months group ($P=0.001$, Table 6) but there was no significant difference in 9-12 and 24-48 months groups ($P>0.05$, Table 6). This may be due to low number of 9-12 month olds (2 subjects) in complex and membranous groups (Table 6).

Table 4. comparison of success rate of probing in different age groups in membranous & complex – obstruction

Type of obstruction	Age of probing of patients				P- value
	9-12m	12-24m	24-48m	Total	
Complex	54%	43%	48%	52%	0.001
Membranous	95%	92%	80%	91%	
Total	91%	89%	60%	85%	

Table 5. Comparison of success rate of probing between membranous and complex intraoperative

Success rate	Type of obstruction				P-value
	Membranous		Complex		
	Number	%	Number	%	
intra op*	64(67)	95.5%	16(25)	64.0%	0.001
1week	61(67)	91.0%	15(25)	60.0%	0.001
1month	60(67)	89.6%	12(25)	48.0%	0.001
3month	59(67)	88.1%	13(25)	52.0%	0.001
6month	61(67)	91.0%	13(25)	52.0%	0.001

Intra op=intraoperative

Complex group

This group accounted for 27.2% of patients. The average success rate of surgery after 6m was 52%. According to the success rate, there was a statistically significant difference between membranous and complex groups ($P<0.001$) (Table 4). The best success rate of operation was seen intraoperatively (%64, table5) and the least was in 1month postoperatively (48%, Table 5). There was statistically significant difference between both groups during follow-up ($p<0.001$, Table 5).

There were no statistically significant difference between two probing groups (up to 12 and 24-48 months) during all follow-ups ($P>0.05$, Table 6). The success rates of probing of membranous and complex groups were compared according to age of probing during follow-up. A significant difference was shown in 12-24months group ($P<0.001$, table 6). Our

explanation for this fact was as below. There was little number of patients in complex group (2 subjects) in low-12months group and a small number of subjects in membranous group (2 subjects) (Table 6). We also evaluated results according the age of probing in three groups.

Up to 12 months

About 41.3% (38 patients) of samples belong to this group. Membranous obstruction accounted for 89.5 % (36 patients), and the rest were in complex group (Tables 2, 3). The success rate of probing was 95% in membranous and 54% in complex group (Table 4) which indicated no significant difference that may be due to a small number of patients in complex group ($P>0.5$, Table 6). There was statistically no significant difference between success rate of female and male in complex and membranous groups ($P>0.05$, Table 7).

Table 6. Comparison of success rate of probing between membranous and complex in different age group in different time of follow-up

Age of probing	Success rate	Type of obstruction				P-value
		Membranous		Complex		
		Number	%	Number	%	
Up to 12 months	Intra op	34(36)	94.4%	2	100.0%	0.89
	1week	31(36)	86.1%	2	100.0%	0.75
	1month	32(36)	88.9%	1	50.0%	0.249
	3month	31(36)	86.1%	1	50.0%	0.294
	6month	33(36)	91.7%	1	50.0%	0.202
12 - 24 months	Intra op	28(29)	96.6%	6	46.2%	0.001
	1week	28(29)	96.6%	4	30.8%	0.001
	1month	26(29)	89.7%	3	23.1%	0.001
	3month	26(29)	89.7%	4	30.8%	0.001
	6month	26(29)	89.7%	4	30.8%	0.001
24 months - high	Intra op	2(2)	100.0%	8	80.0%	0.682
	1week	2(2)	100.0%	9	90.0%	0.832
	1month	2(2)	100.0%	8	80.0%	0.683
	3month	2(2)	100.0%	8	80.0%	0.682
	6month	2(2)	100.0%	8	80.0%	0.682

Intra op=intraoperative

Table 7. Comparison of success rate of probing between membranous and complex in different age group in low-12 months group in male-female

Type of obstruction	Time of follow-up	Probing group low - 12 months						P-value
		Total		Male		Female		
		Number	%	Number	%	Number	%	
Membranous	Intra op	34(36)	94.4%	17(18)	94.4%	17(18)	94.4%	1
	1week	31(36)	86.1%	16(18)	88.8%	15(18)	100.0%	0.349
	1month	32(36)	88.9%	16(18)	88.8%	16(18)	88.8%	0.999
	3month	31(36)	86.1%	16(18)	88.8%	15(18)	83.3%	0.785
	6month	33(36)	91.7%	17(18)	94.4%	16(18)	88.8%	0.999
Complex	Intra op	2(2)	100.0%	1(1)	100.0%	1(1)	100.0%	1
	1week	2(2)	100.0%	1(1)	100.0%	1(1)	100.0%	1
	1month	1(2)	50.0%	1(1)	100.0%	0(1)	0%	0.6
	3month	1(2)	50.0%	1(1)	100.0%	0(1)	0%	0.6
	6month	1(2)	50.0%	1(1)	100.0%	0(1)	0%	0.6

Intra op=intraoperative

12-24 months

Forty-two patients (45.7%) belong to this group. Membranous obstruction accounted for 69 % of patients, and the rest were in complex type group (Table 2&3). The success rate of probing was 92% in membranous and 43% in complex group (Table 4).

There was statistically significant difference between success rate of complex and membranous groups ($P < 0.001$, Table 6). There was statistically no significant difference between success rate of female and male in complex and membranous groups ($P > 0.05$, table 8).

24-48 months

This group accounted for 13% (12 subjects). Complex obstruction accounted for 83.5 % of patients and remainder belonged to membranous type (Table 2,3). The success rate of probing was 80% in membranous and 48% in complex group (Table 4). There was no statistically significant difference between them which may be due to a small number of patients in membranous group and good success rate in complex group ($p > 0.05$ Table 6). There was statistically no significant difference between success rate of female and male in complex and membranous groups ($p > 0.05$, table 9).

Table 8. Comparison of success rate of probing between membranous and complex in different age group in 12-24 months group in male-female

Type of obstruction	Time of follow-up	probing group 12 - 24 months						P-value
		Total		Male		Female		
		Number	%	Number	%	Number	%	
Membranous	Intra op	28(29)	96.6%	14(14)	100%	14(15)	93.3%	0.8
	1week	28(29)	96.6%	14(14)	100%	14(15)	93.3%	0.8
	1month	26(29)	89.7%	13(14)	92.8%	13(15)	86.6%	0.75
	3month	26(29)	89.7%	13(14)	92.8%	13(15)	86.6%	0.8
	6month	26(29)	89.7%	13(14)	92.8%	13(15)	86.6%	0.7
Complex	Intra op	6(13)	46.2%	3(6)	50.0%	3(7)	42.8%	0.8
	1week	4(13)	30.8%	2(6)	33.3%	2(7)	28.5%	0.75
	1month	3(13)	23.1%	1(6)	16.6%	2(7)	28.5%	0.5
	3month	4(13)	30.8%	2(6)	33.3%	2(7)	28.5%	0.6
	6month	4(13)	30.8%	2(6)	33.3%	2(7)	28.5%	0.6

Intra op=intraoperative

Table 9. Comparison of success rate of probing between membranous and complex in different age group in 24-48 months group in male-female

Type of obstruction	Time of follow-up	probing group 24 months - high						P-value
		Total		Male		Female		
		Number	%	Number	%	Number	Female	
Membranous	Intra op	2(2)	100%	1(1)	100.0%	1(1)	100.0%	1
	1week	2(2)	100%	1(1)	100.0%	1(1)	100.0%	1
	1month	2(2)	100%	1(1)	100.0%	1(1)	100.0%	1
	3month	2(2)	100%	1(1)	100.0%	1(1)	100.0%	1
	6month	2(2)	100%	1(1)	100.0%	1(1)	100.0%	1
complex	Intra op	8(10)	80%	4(5)	80.0%	4(5)	80.0%	1
	1week	9(10)	90%	4(5)	90.0%	5(5)	100%	0.9
	1month	8(10)	23.1%	4(5)	80.0%	4(5)	80.0%	1
	3month	8(10)	80%	4(5)	80.0%	4(5)	80.0%	1
	6month	8(10)	80%	4(5)	80.0%	4(5)	80.0%	1

Intra op=intraoperative

Discussion

Probing of NLD is a classic procedure in the management of the CNLDO; however, controversy exists regarding the outcome of probing in children older than 1 year (14). This study showed that membranous and complex type of obstruction accounted for 72.8% and 27.2% of patients respectively. The success rate of probing was evaluated according to the type of obstruction (membranous, complex) and the age of probing. The average success rate of surgery after 6m was 91% in membranous group and 52% in complex group ($P<0.001$). An overall cure rate of 91%, 89% and 60% was found in 9-12, 12-24 and 24-48 months old children respectively.

This success rate is comparable with the cure rate in early probing (around the first year of life). The success rate of late initial probing (24-48months) was 60%, which was significantly ($p = 0.01$) less than late probing (91%) for CNLDO. Some studies evaluated the success

rate based on the type of obstruction. Other investigators considered the time of probing and some others studied both the type of obstruction and time of probing. This study findings indicated that the average success rate of surgery after 6m was 91% in membranous group and 52% in complex group ($P<0.001$). In under 2year olds, this success rate is comparable with the cure rate in early probing (around the first year of life). The success rate of late initial probing (24-48months) was 60%, which was significantly ($P = 0.01$) less than late probing (91%) for CNLDO. Kashkouli *et al.*, (14) reported that cure rate was 89% in patients 13–24 months of age and 72% after the age of 24 months ($P = 0.01$). It was 90.2% in the membranous and 33.3% in the complex CNLDO in both late and very late probing. Their study findings support our study results. Based on the type of CNLDO intraoperatively, Kushner (9) divided the CNLDO into the membranous and complex type. There are two explanations for the lower cure rate with probing in older children. Some authors suggested that it might be a

result of chronic infection and fibrosis with increasing age (7). On the other hands, Paul and Shepherd (8) considered that it might be due to a self-selection process. They suggested that possibly older children with CNLDO are more likely to represent the pool of children with more complex type of obstruction. Kushner (9) in his study reported success rate of 100% with a simple membrane at the valve of Hasner and 36% in complicated obstructions. Sturrock *et al.*, (15) reported a success rate of 72% in the second year of life and 42% in children more than 2 years of age. Young *et al.*, (16) stated a cure rate of 54% in children probed after 2 years of age. Katowitz and Welsh (7) believed that increasing age after 13 months not only decreases the cure rate but also increases the number and complexity of future procedures. In sharp contrast to these reports, Robb (10) and Zwaan *et al.*, (11) and El-Mansoury *et al.*, (12) found more than 90% success rate in late and very late probing for CNLDO. Some investigators reported an insignificant effect of the increasing age on the success rate of initial probing after the age of 12 Months (13). Kushner (9) and Honavar *et al.*, (17) showed that the complex CNLDO was more likely to be found in older patients. It seemed that the significance of the increasing age on reduction of cure rate in patients older than 24 months was the effect of complex CNLDO.

The important question is whether patients with complex CNLDO have the same improvement rate in early, late, and very late initial probing. The outcome at one week postoperative follow-up (cure rate of 60%) was highly correlated with the final result at the three month follow-up (cure rate of 52%). Hence, it seems that the early result could represent the final result in probing for CNLDO. Kushner (9) found the same outcome in 21 out of 23 patients at 6 weeks and 1 year follow up and suggested that a reasonable approach to the older child with a CNLDO is to plan a probing procedure with other alternative management if a complex obstruction is found. Some authors have also suggested intranasal endoscopy with probing or Silicone intubation especially in patients with previous failed probing (18,19).

An older child with a nasolacrimal duct obstruction is more likely to represent the patient in whom spontaneous resolution did not occur because the more complex type of obstruction was present from birth. An important question is the explanation of why any of these patients is improved with a simple probing. Possibly the act of probing does dilate the system sufficiently in these patients to affect a long-term cure.

Becker *et al.*, (20) have advocated balloon catheterization of the nasolacrimal duct for children more than one year old undergoing surgery for congenital nasolacrimal duct obstruction. Our study showed that the older children have an excellent prognosis with a simple nasolacrimal duct probing procedure if a simple obstruction at the valve of Hasner is found and the prevalence of complex obstructions is related to age. Present study also supports the suggestion given by Paul and Shepard (8) that the lower success rate with nasolacrimal duct probing in older children is not the result of age per se.

We consider that the evidence from the present study would support the theory of self-selection.

The improvement rate of probing at the age of 9–24 months is high enough to justify an initial late probing in CNLDO. Also, half of patients with very late probing patent CNLDO. Based on study findings, late probing could be considered as an initial surgical step in the management of CNLDO due to the simplicity and low rate of complication.

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