Original Article

Clinical profile of the patients with pediatric epiphora in a tertiary eye care center

Rebika Dhiman, Bhavna Chawla, Mahesh Chandra, Mandeep S Bajaj, Neelam Pushker

Purpose: To study the clinical profile of children aged <10 years presenting with epiphora at a tertiary eye care center, to compare the clinical profile between the early onset (<3 years) and the late-onset (≥3 years) group, and to study the success of different treatment modalities. **Materials and Methods:** A prospective nonrandomized observational study was conducted in 209 eyes of 167 patients (42 bilateral cases). The main outcome measure was postoperative relief of presenting symptoms and signs at 3 months follow-up. **Results:** Fifty-five percent cases (92 of 167) were early-onset cases, and 45% (75 of 167) were late onset. The male:female ratio was 1.9:1. Seventy-five percent cases were unilateral. The etiological profile was –76% cases of congenital nasolacrimal duct obstruction (NLDO), 18% traumatic/surgical, 4% acquired NLDO, and 2% punctal causes. The overall success rate of all the treatment modalities in our study was 80% (167/208) –82% for sac massage, 77% for probing, 79% for intubation dacryocystorhinostomy, and 100% for punctal surgery. A significant association was noted between the treatment outcome and laterality (P = 0.04), presence of infection (P = 0.032), symptom severity (P = 0.027), history of previous treatment (P = 0.024), and age. No significant association was found between the treatment outcome and gender (P = 0.73), socioeconomic status (P = 0.43), etiology (P = 0.45), and treatment modality (P = 0.33). **Conclusion:** This study describes the complete range of causes and treatment modalities for pediatric epiphora and highlights the etiology, signs and symptoms, treatment, and the comparative outcome between the early versus the late-onset group and analyses the factors predictive of the outcome.

Key words: Congenital nasolacrimal duct obstruction, dacryocystorhinostomy, epiphora, pediatric epiphora

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Epiphora is defined as an overflow of tears in the presence of normal tear production, produced due to either obstruction in the drainage apparatus, i.e., puncta, canaliculi, sac or nasolacrimal duct or improper tear drainage. In children, the most common cause of epiphora is congenital nasolacrimal duct obstruction (NLDO) occurring in 20%–30% of the newborn.[1-3] However, only 1%–6% of these children become symptomatic.[1] The other causes are mostly acquired and occur following trauma, surgery, inflammation, etc., leading to NLDO, canalicular obstruction or punctal stenosis and malposition.

Several studies have demonstrated the efficacy of probing in congenital NLDO in children up to 3–4 years of age.[4-8] Various other studies have evaluated the role dacryocystorhinostomy (DCR) in congenital as well as acquired cases of NLDO.[9-11] However, none of the studies have taken into consideration the complete range of causes and treatment modalities for pediatric epiphora in children. Therefore, the primary objective of this work was to study the clinical profile and treatment outcome of epiphora in pediatric patients presenting at a tertiary eye care center. The secondary objective was to highlight the differences in demographic and clinical characteristics between the early versus (<3 years) the late-onset group (≥3 years) and to determine the factors predictive of the outcome.

Oculoplasty Services, Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi, India

Correspondence to: Dr. Bhavna Chawla, Oculoplasty Services, Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi - 110 029, India. E-mail: bhavna2424@hotmail.com

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Materials and Methods

A prospective, nonrandomized observational study was conducted on 209 eyes of 167 patients (42 bilateral cases) aged <10 years that presented with true epiphora to our center in the period between July 2011 and July 2013. The Institute Ethical Committee approval was taken, and the study was in accordance with the Declaration of Helsinki. Informed consent was obtained from the parents/guardians. The diagnosis of epiphora was based on the presence of any one of the following – a history of tearing and discharge for >4 weeks, presence of lacus lacrimalis, raised tear meniscus height, presence of discharge, and positive regurgitation test. Patients with hyperlacrimation or pseudoepiphora and those not willing for follow-up were excluded from the study.

Demographic details and clinical history of the patients were taken from the parents or attendants and included the following – age, gender, laterality, socioeconomic status (using modified Kuppuswamy scale), etiology, and previous treatment history. The presenting symptoms and signs, culture and sensitivity reports of conjunctival swabs (in cases where swabs were sent), associated craniofacial and ocular anomalies,

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treatment given and any other additional investigations such as computed tomography (CT)-dacryocystography (DCG) as advised by the treating clinician were noted. The patients were followed up for a minimum period of 3 months after the treatment to look for the resolution of presenting signs and symptoms.

Statistical analysis

The analysis was done following compilation of data using SPSS (version 11) (SPSS Inc., Chicago, USA). Descriptive statistics were used for demographic characteristics and the data being presented as percentages, mean, and standard deviation. Chi-square and Fisher's exact test were used to test the difference in the two proportions. $P < 0.05$ was denoted a statistically significant difference.

Results

A total of 167 patients were studied. The mean age of onset of symptoms was 1.4 ± 2 years (range, 1 month–8 years) and the mean age of presentation was 2.9 ± 2.4 years (range, 2 months–9 years). Ninety-two patients (55%) had an early onset (<3 years of age), and 75 patients (45%) had a late-onset epiphora (≥3 years). The male:female ratio in the early-onset group was 1.4:1, and in the late-onset group, it was 3.2:1, with an overall ratio of 1.9:1. Overall, 125 cases (75%) were unilateral (64% in early-onset group 64% and 88% in late-onset group). Congenital NLDO was the most common cause of pediatric epiphora seen in 76% (126/167) of the cases, followed by trauma (iatrogenic and non-iatrogenic) seen in 18% (30/167). The other causes included – acquired NLDO in 4% (6/167) and punctal causes in 2% (5/167) cases. Table 1 describes the various types of traumatic and punctal cases. The most common cause in the early-onset group was congenital NLDO constituting 99% of the cases, whereas in the late-onset group, both traumatic and acquired causes contributed equally.

Regarding socioeconomic status, 50% of the patients belonged to the upper lower class on assessment of socioeconomic status using modified Kuppuswamy scale. Eighty-eight percent (147/167) cases first presented to an ophthalmologist, and the rest 12% (20) showed first to a general practitioner or a pediatrician, which was followed by a referral to an ophthalmologist. A previous history of treatment was present in 140 eyes (77% in the early-onset cases and 52% in late-onset cases) that included sac massage in 102 cases (73%), a single trial of probing in 30 cases (21%), multiple failed trials of probing in 7 cases (5%), and 1 case (1%) of a failed DCR.

The most common symptom seen in both the groups, early as well as late onset, was discharge (61%), followed by watering (34%). There was one case of congenital fistula associated with NLDO.

Conjunctival swab was sent for culture only in cases with discharge, and culture positivity was seen in 67% cases. The most common bacteria isolated was *Streptococcus pneumoniae* (51%), followed in frequency by *Staphylococcus epidermidis* (20%), *Staphylococcus aureus* (19%), *Pseudomonas* (5%), and other Gram-negative bacteria (5%). The other Gram-negative bacteria included cases of *Acinetobacter*, *Escherichia*, *Proteus*, and *Diphtheroids*. There were no fungal isolates.

We also included patients of pediatric epiphora with associated craniofacial and ocular anomalies which were excluded in most other studies. These systemic and ocular anomalies have been enlisted in Table 2.

CT-DCG was done in 14 out of 30 cases of post-traumatic pediatric epiphora where there was dilemma regarding the site of obstruction. The parents were explained about the risk of radiation exposure during the procedure. The most common site of obstruction seen in 13 cases was the sac-NLDO junction as was evident by the accumulation of the dye in the dilated lacrimal sac. In one case, the obstruction was noted at the proximal nasolacrimal duct.

The various modes of treatment advised included sac massage in 84 cases (40%), probing in 74 cases (35%), intubation DCR in 43 cases (21%), and surgeries for punctal malposition in 7 cases (3.5%). No treatment was advised in one case with Type 4 Tessier's cleft as the patient was referred to a maxillofacial surgeon. The punctal surgeries included punctal dilatation, snip procedure, and skin grafting (for cicatricial ectropion and euryblepharon). The type of treatment administered based on the age of presentation has been shown in Fig. 1. The mean duration of follow-up was 5.4 ± 1.3 months.

The overall success rate of treatment was 81%. The success rates of individual treatment modality were –82% for sac

Table 1: Distribution of traumatic and punctal causes

	n
Type of trauma	
Motor vehicle accident	20
Fall from height	5
Bicycle accident	3
Dog bite	1
Postsurgical (following maxillary surgery)	1
Types of punctal causes	
Punctal malposition	
Cicatricial ectropion	2
Euryblepharon	1
Punctal stenosis	1
Punctal agenesis	1

Table 2: Distribution of craniofacial and other ocular anomalies in epiphora patients

	n
Craniofacial anomalies	
Down's syndrome	2
Tessier's cleft number 0, 3, 4	3
Apert syndrome	1
Craniosynostosis	1
Mild cranial anomalies	2
Total	9
Other ocular anomalies	
Telecanthus	23
Epiblepharon	1
Lid coloboma	1
Irido-fundal coloboma	1
Microphthalmos	1
Total	27

massage, 77% for probing, 79% for intubation DCR, and 100% for punctal surgeries. Some cases showed recurrence following an initial resolution of symptoms that included 7 (8.3%) cases of sac massage, 6 (8.1%) cases of probing, and 2 (4.7%) cases of intubation DCR. These cases were considered as treatment failure. Repeat interventions done in these cases were repeat interventions done in these cases were - seven cases of failed sac massage underwent probing, two cases of failed probing underwent repeat probing, four cases of failed probing underwent intubation DCR, and two cases of failed intubation DCR underwent a repeat surgery. The success rate of intubation DCR for NLDO (congenital and acquired) was higher (92%) as compared to traumatic cases (73%). The association of treatment outcome with demographic factors was studied. These included the age, sex, socioeconomic status, etiology, laterality, symptom severity, presence or absence of infection, and previous treatment history. Increasing age was a significant risk factor associated with the failure of sac massage and probing The success rate of sac massage declined significantly after 12 months of age ($P = 0.0004$) and that of probing declined after the age of 3 years ($P = 0.005$). A statistically significant association was also seen between treatment outcome and laterality ($P = 0.04$), presence of infection ($P = 0.032$), symptom severity ($P = 0.027$), and previous history of treatment ($P = 0.024$) [Table 3]. The success rate of probing in the eyes undergoing a first trial of syringing and probing was 90% (40/44), whereas the success rate in the eyes with a previous failed history of syringing and probing was 57% (17/30) ($P < 0.05$).

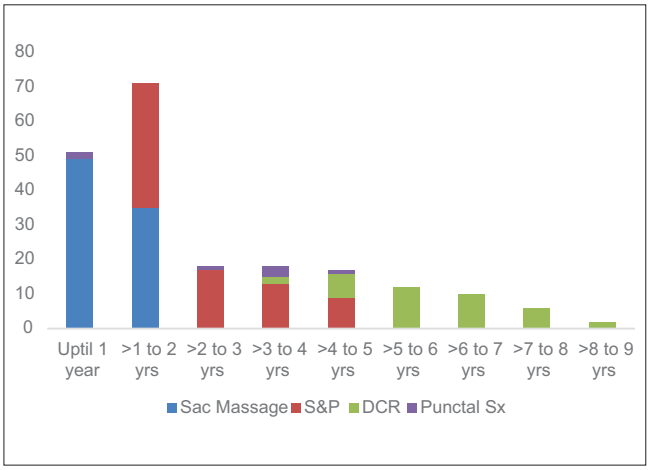

Figure 1: The type of treatment administered based on the age of presentation

Sac massage	S and P	DCR	Punctal Sx
49	0	0	2
35	36	0	0
0	17	0	1
0	13	2	3
0	9	7	1
0	0	12	0
0	0	10	0
0	0	6	0
0	0	2	0

DCR: Dacryocystorhinostomy

Discussion

Pediatric epiphora is a common problem in clinical ophthalmology. However, with the exception of congenital NLDO, little has been known and studied about its other causes. We performed a prospective evaluation of pediatric patients with true epiphora due to any cause and compared the data between the early versus the late-onset group. Hence, our study gives a good representation of the entire range of causes of pediatric epiphora.

Congenital NLDO constituted the most common cause of epiphora in our study, followed by traumatic NLDO. Ninety-nine percent cases in the early-onset group were due to congenital NLDO, whereas in late-onset group, both congenital and acquired causes were almost equally prevalent. The most common mode of trauma was motor vehicle accident which resulted in medial canthal injuries. These were mostly avulsion injuries typically associated with a triad of telecanthus, epiphora, and ptosis as also reported by Priel *et al*.[12] The obstruction in traumatic cases can be anywhere in the lacrimal drainage apparatus. Hence, the location of site of obstruction before intervention is of relevance in traumatic cases. CT-DCG is a useful diagnostic tool in clinically challenging cases of traumatic epiphora. It helps to (l) describe the level of the obstruction; (2) evaluate whether the obstruction is complete or incomplete, intrinsic, or extrinsic to the duct; and (3) determine the cause of obstruction.[13] In our study, CT-DCG was done in 14 out of 30 traumatic cases with the most common site of obstruction being sac-NLDO junction.

On comparing the severity of the symptoms in the two groups, it was found that there was greater symptom severity in the late-onset group with 77% cases presenting with discharge, 19% with watering, and 4% cases with medial canthal swelling. This can be explained by the presence of cases with refractory pathology and recalcitrant cases with prolonged duration of inflammmation, leading to greater symptomatology in the late-onset group.

Bacteriology of pediatric epiphora acquires great significance in view of its bearing on the treatment outcome as seen in our study. In our study, Gram-positive bacteria were the major

Table 3: Treatment outcome based on laterality, presence of infection, symptom severity, and previous treatment history

	Success	Failure
Laterality		
Unilateral	108	16
Bilateral	31	11
Infection		
Present	111	29
Absent	96	12
Symptom severity		
Watering	63	7
Discharge/mucocele, etc.	104	34
Previous treatment history		
Present	106	34
Absent	61	7

isolate (89%), with *S. pneumoniae* contributing to 51% of the cases. The results are very similar to those reported by Bareja and Ghose and Al-Faky *et al*.[14,15] Brook and Frazier who studied the bacteriological profile of the dacryocystitis patients in the age group 14–81 years, reported *S. aureus* followed by *S. epidermidis* as the common causative organisms.[16] The inclusion of causes other than congenital NLDO did not alter our results much from the results of those studies that solely studied the bacteriology of congenital cases of NLDO.

The success rate of probing with or without silastic intubation reported in various studies range from 55% to 96%.[4,5,7,8,17-19] A comparatively lower success rate of probing alone (77%) in our study could be due to several reasons. First, the inclusion of cases with a complex form of obstruction like previously failed treatment and syndromic patients with associated craniofacial and ocular anomalies which were excluded in most other studies is the most important reason. In fact, a comparison of the treatment outcome of probing in cases undergoing a first trial of probing with the cases who had a previous history of ≥1 failed probing showed that the success rate was significantly lower in the latter group (90% vs. 57%). Second, additional procedures such as inferior turbinate fractures repair, etc., were not done during probing in our study. Third, a referral bias cannot be excluded as being a tertiary care center; there were obvious referrals of recalcitrant cases.

In our study, all the patients posted for DCR underwent an intubation DCR. Consistent with our results, a lower success rate of intubation DCR in traumatic cases (73%) as compared to the primary cases (92%) has also been reported in other studies[20,21] and is explained by the distorted anatomy of the medial canthal area and a tendency toward vigorous repair process. Various other studies that reviewed the surgical outcome in purely primary NLDO cases have reported a higher success rate.[9,11]

We noted a higher treatment success rate in the early-onset group (86% [106/124]) than in the late-onset group (73% [61/84]) with a statistically significant difference ($P < 0.0221$). A lower success rate in the late-onset group is expected as a significant percentage of cases have a refractory pathology in the late-onset group (post-traumatic NLDO, post-inflammatory NLDO, etc.).

In our study, we also included the syndromic patients and patients with associated craniofacial and ocular anomalies (36 patients) which were excluded in most other studies.

We analyzed the impact of several clinical factors on the outcome and found a statistically significant association between treatment outcome and laterality ($P = 0.04$), presence of infection ($P = 0.032$), symptom severity ($P = 0.027$), and previous treatment history ($P = 0.024$). Honavar *et al*. reported the factors predictive of failure of probing such as age >36 months, bilateral affection, failed conservative therapy, failed earlier probing, dilated lacrimal sac, and firm obstruction.[7] Mannor *et al*. found a significant association between success of probing with age and symptom severity but not with a previous treatment history[6] while Kashkouli *et al*. found no association with laterality or presence of infection.[18] Repka *et al*. found an association with laterality and symptom severity.[5]

NLDO is a common condition during the 1st year of life. Most cases resolve spontaneously or after lacrimal sac massage.[22,23] For those children in whom the blockage does not resolve, probing of the nasolacrimal duct is a widely used surgical treatment. The success of these treatment modalities has been found to decrease with increasing age, but there are no universally accepted age limits. Several studies have found a significant increase in the failure rate in those patients undergoing probing after the age of 12 months,[6,7,18,24,25] which has led to the recommendation of early probing in children. Other authors, however, have found no correlation of recurrence rate with the age at probing.[5,8,26] Table 4 shows the success rate of probing reported in several studies. Although Robb[17] reported a higher success rate of probing even in older children, his definition of success included even those cases with partial resolution of signs and symptoms. Our definition was stricter as we considered only cases of complete resolution of signs and symptoms as successful. In our series, increasing age was found to be an important factor affecting the success rate of the treatment modalities – sac massage and probing. A significant reduction in the success rate of sac massage was noted in children >12 months of age and of probing in children >3 years of age. It is thought that probing could be less successful in older children, perhaps because of prolonged inflammation of the nasolacrimal system resulting in scarring[27] or because of accumulation of more severe obstructions with time as less severe ones clear spontaneously or with

Table 4: Success rate of probing in several studies

Study	Number of eyes	Success rate of simple probing as per the age		
		0-12 months	13-24 months	>24 months
Katowitz and Welsh[25]	572	97%	69%	33.3%
Zwaan[26]	110	97%	88%	92%
Robb[17]	280	98% from 0 to 24 months		100%
Mannor *et al*.[6]	142	92%	89%	69%
Honavar *et al*.[7]	60	All patients >24 months of age		73%
Maheshwari[8]	84	88.1%		80.1%
Kashkouli *et al*.[24]	207	92%	85%	65%
Repka *et al*.[5]	955	78%	79%	79%
Lee *et al*.[19]	138	Overall success rate of 86% (average age of 12.4 months)		
Present study	**Number of eyes**	**12-23 months**	**24-35 months**	**≥36 months**
Dhiman *et al*.	74	91%	77%	40%

conservative management.[23] Resolution of symptoms can also be attributed to spontaneous resolution in children <1 year. Hence, it is not possible to differentiate whether the success in this age group was due to spontaneous resolution or solely due to intervention in the absence of a control group.

There are a number of strengths of our study. First, we utilized prospective data collection. Second, we successfully recruited a large number of patients with a low rate of loss to follow-up. Third, we included the complete range of causes of pediatric epiphora and studied the outcome of various treatment modalities that has not been the case in the majority of studies so far. In addition, to the best of our knowledge, a comparative analysis between early and late-onset groups has not been conducted.

However, there were a few limitations of this study. First, the number of patients enrolled in the group other than NLDO was few that reduced the precision of the estimates of success for these groups. Second, the differentiation of type of obstruction (simple and complex) was not noted at the time of probing in our study. In addition, additional procedures such as inferior turbinate fracture, etc., were not done that could have influenced the outcome. Third, we could not include the objective tests for assessment such as fluorescein dye disappearance test, and all possible management options of pediatric epiphora, such as balloon dacryoplasty, and which is not commonly done at our center.

Conclusion

Congenital NLDO remains the most common cause of pediatric epiphora in the younger age group while traumatic and other secondary causes contribute significantly to the etiology of the older age group. Gram-positive bacteria is the most common infecting organism in pediatric epiphora, with *S. pneumoniae* being the most common of all. In congenital NLDO, sac massage is an important treatment modality in children up to 1 year of age and probing remains an effective treatment approach in children up to 3 years of age. Increasing age decreases the success rate of sac massage and probing. The factors predictive of treatment failure other than age are laterality, increasing symptom severity, presence of infection, and previous history of treatment.

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Conflicts of interest

There are no conflicts of interest.

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