



Congenital Nasolacrimal Duct Obstruction and Refractive Amblyopia Risk Factors: Effect of Age at the Time of Probing

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Abstract

Objectives: To determine whether treatment time of congenital nasolacrimal duct obstruction (CNLDO) has any effect on refractive amblyopia risk factors (ARFs).

Methods: This is a cross-sectional study and it was conducted in the Pediatric Ophthalmology Department at Kayseri City Training and Research Hospital. The ages of 174 patients who underwent probing were obtained from electronic medical charts and used to divide the patients into two groups: an early-probing group (<24 months old) and a late-probing group (≥24 months old). After inclusion criteria were applied, a pediatric ophthalmologist examined 189 eyes of the 174 patients. The groups were evaluated and compared for cycloplegic refractive errors.

Results: The median age of patients who underwent probing was 30 months (ranging from 11–44 months). A total of 40 of 189 eyes (21.2%) examined had refractive ARFs, which were significantly more prevalent in the late-probing group ($p=0.044$). The ARFs associated with astigmatism were greater in the late- versus the early-probing group ($p=0.037$), whereas no other refractive ARFs or anisometropia differed between the groups ($p=0.887$ for myopia, $p=0.364$ for hyperopia, and $p=0.672$ for anisometropia). Astigmatic ARFs were significantly higher in the late-treatment group.

Conclusion: Astigmatic ARFs were significantly higher in the late-treatment group. Therefore, ophthalmologists should regularly monitor the refractive status of children with CNLDO, especially those treated after 24 months old.

Keywords: Astigmatism, congenital nasolacrimal duct obstruction, probing, refractive errors.

Introduction

Epiphora is attributed not only to congenital abnormalities but also to obstructions of the nasolacrimal duct (NLDO), the incidence of which is reportedly as high as 20% (1,2). Most patients' symptoms disappear by 12 months of age, either spontaneously or by lacrimal sac massage (1,3). For

persistent, non-resolving NLDO, probing is generally the first treatment procedure, although the appropriate probing time continues to be debated.(4)

Another condition, amblyopia, causes a major vision impairment during childhood with an estimated worldwide prevalence between 2% and 6.2% (5,6). Classified as refractive, strabismic, or deprivation amblyopia, this condition

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can be treated successfully with occlusion or penalization provided that it is detected early (7,8). For that purpose, a screening referral guide that targets both refractive and non-refractive amblyopia risk factors (ARFs) has been widely consulted (5).

Untreated NLDO has recently been identified as a risk factor for the development of amblyopia (9–14). Researchers for these studies have generally examined the presence of NLDO and its association with amblyopia and related risk factors. However, the literature demonstrates a lack of evidence about how treatment time of NLDO affects refractive errors and refractive ARFs of patients with NLDO. In response, the goal of the study reported here was to narrow this gap by determining ARFs in patients treated for NLDO and whether any association exists between treatment time and refractive ARFs in patients with NLDO.

Methods

Study Design and Participants

A cross-sectional study was conducted at the Pediatric Ophthalmology Department at Kayseri City Training and Research Hospital University ethics committee approved the study (2019-819), all procedures in which strictly followed the tenets of the Declaration of Helsinki. The electronic medical charts of patients diagnosed with NLDO (with dye disappearance test and/or dacryoscintigraphy) between November 2018 and November 2019 were reviewed with reference to three inclusion criteria. In particular, each chart needed to 1) be complete, with the patient’s full history of symptoms and preoperative ophthalmological examinations; 2) provide precise information about the patient’s previous medical therapies and surgical procedures, if any; and 3) list the phone number of the patient’s parent or guardian.

Patients whose charts met those criteria were called back to the Pediatric Ophthalmology Department in December 2019 to confirm that they met three additional inclusion criteria: (1) a complaint of epiphora or mucous discharge since birth; (2) age from 6–36 months at time of probing; and (3) history of only one probing procedure, which had to have

been performed by an experienced surgeon at the hospital.

Patients who met all inclusion criteria received a detailed anterior and posterior segment examination. Those patients who were found to have any other ocular pathology that could affect refractive status (e.g., persistent epiphora, ocular allergy, ptosis, congenital strabismus, corneal or lenticular opacities, or any sign of glaucoma such as asymmetric corneal enlargement, corneal haze, or cupping of the optic disc) or any systemic or genetic disorder, including premature birth, were subsequently excluded from the study.

Patients who met all inclusion criteria were divided into two groups according to probing time. The early-probing group comprised children who underwent probing before 24 months of age, whereas the late-probing group comprised those who underwent probing at ≥24 months of age.

Refractive Amblyopia Risk Factors

An experienced pediatric ophthalmologist (SG) performed all ophthalmological examinations between 9 a.m. and noon. Each patient’s refractive status was detected via retinoscopy after cycloplegic refraction using 1% cyclopentolate drops (Sikloplejin 1% 5 mL, Abdi Ibrahim Global Pharm LLP, Istanbul, Turkey). ARFs were defined according to the guidelines of the American Association for Pediatric Ophthalmology and Strabismus (AAPOS) (5). The criteria for the refractive ARFs are summarized in Table 1.

Statistical Analysis

The Statistical Package for the Social Sciences for Windows (version 24.0, IBM SPSS, Armonk, NY, USA) was used for the statistical analysis of the mean ± standard deviation (SD), frequency (%), and ratio as descriptive statistics. The distribution of variables was evaluated with the Kolmogorov–Smirnov test. Quantitative values were compared between the groups with a t test and Mann–Whitney U test. The chi-squared test was used to compare qualitative variables, and any P value less than .05 was considered statistically significant.

Results

The study included 189 eyes of 174 patients.

Table 1. Refractive amblyopia risk factors regarding ages

Age (months)	Refractive risk factors			
	Myopia	Hyperopia	Anisometropia	Astigmatism
<30	> -3.5 D	> 4.5 D	> 2.5 D	> 2.0 D
31-48	> -3.0 D	> 4.0 D	> 2.0 D	> 2.0 D
>48 months	> -1.5 D	> 3.5 D	> 1.5 D	> 1.5 D

D: diopters.

Demographic Features

Median patient age on the examination day was 30 months (range 11–44 months). Detailed anthropometric data and data about the laterality of the affected eyes are listed in Table 2. The success rate of probing between the groups did not differ significantly ($p=0.381$). Considering all eyes, the success rate of probing was 87.9% (Table 2).

Refractive Amblyopia Risk Factors

The refractive ARFs in each group appear in Table 3. In total, ARFs were significantly more prevalent in the late-probing group ($p=0.044$).

A total of 40 of the 189 eyes (21.2%) had refractive ARFs. Astigmatism was the leading refractive ARF, followed by hyperopia and myopia. Astigmatic ARFs were significantly greater in the late-probing group ($p=0.037$), whereas anisometropia did not differ between the groups ($p=0.672$).

Discussion

The study reported here was designed to determine whether late treatment of NLDO is associated with increased re-

fractive ARFs. It revealed that probing after 24 months of age is significantly associated with increased astigmatic ARFs, whereas the other refractive statuses and anisometropia did not differ between early- and late-probing groups.

Leon et al. (15) found that the depth of amblyopia was greater if the patient was more than 3 years old and had a high magnitude of refractive errors. Therefore, to detect refractive ARFs early, the present study restricted inclusion to patients less than 36 months old who, as results revealed, underwent probing at a median age of 20 months. Considering the gender, both males and females were found to be similarly affected by NLDO, which correlates with other studies showing that NLDO affects both sexes equally (16–18).

The laterality of the cases was similar in both groups. However, in total, the prevalence of bilateral cases was 7.5% which was less than unilateral ones. That result was less than values reported elsewhere showing that the prevalence of bilateral cases was 20–30% (11,19–21). In another study conducted in Turkey by Ozgur et al. (12), NLDO occurred bilaterally in 14% of cases. To resolve such discrepancies, additional prospective epidemiological studies should be per-

Table 2. Clinical characteristics of children

	Early probing (n=122)	Late probing (n=52)	Total (n=174)	p
Age -months				
M±Sd (range)	15.02±3.65 (6-23)	28.79±3.92 (24-36)	20.17±3.22 (6-36)	<0.001 ^a
Sex (male-%)	58-47.5%	26 - 50%	84-48.2%	0.866 ^b
Laterality of NLDO				
right eyes (number-%)	62-50.8%	29-55.7%	91-52.2%	0.687 ^b
left eyes (number-%)	50-40.1%	20-38.5%	70-40.2%	0.656 ^b
Both eyes (number-%)	10-8.2 %	3-5.8%	13-7.5%	0.122 ^b
Success rate of Probing (Number- %)	109-89.3%	44-84.6%	153-87.9%	0.381 ^b

NLDO; nasolacrimal duct obstruction; boldface, significant values, $P < 0.05$; ^aIndependent samples t-test; ^bchi-square.

Table 3. Refractive amblyopia risk factors according to the groups

	Early probing (n=133 eyes)	Late probing (n=56 eyes)	Total (189 eyes)	p*
Myopia (n-%)	2 (1.5%)	0 (0%)	2 (1.1%)	0.885
Hyperopia (n-%)	3(2.3%)	3 (5.4%)	6 (3.25%)	0.364
Astigmatism (n-%)	13 (9.8%)	12 (21.4%)	25 (13.2%)	0.037
Anisometropia (n- %)	5 (3.8%)	1 (1.8%)	6 (3.2%)	0.672
Total (n- %)	23 (17.3%)	17 (30.4%)	40 (21.2%)	0.044

*, Chi-square test; boldface, significant values, $p<0.05$

formed to evaluate the prevalence of the laterality of eyes affected by NLDO.

The idea that the greater tear lake in children with NLDO may result in visual disturbance and, thereby, amblyopia was first postulated by Ellis et al. (10) However, those authors also found that the incidence of amblyopia did not differ between patients with NLDO and controls. The ARFs were later examined in children with NLDO in light of the knowledge that the prevalence of amblyopia can decrease if detected early. For example, in their prospective study, Matta et al. (13) found that 20% of children with NLDO had refractive ARFs and that astigmatism was the leading ARF, with a prevalence of 54%, followed by hyperopia (37%) and myopia (9%). In another study, Kim et al. (22) observed that the prevalence of refractive ARFs was 35%, whereas astigmatic ARFs appeared in 80% of children, hyperopia in 20% and myopic ARFs in none at all. By comparison, the findings of the present study include that astigmatism seemed to prompt refractive ARFs in children with NLDO, consistent with the findings of Matta et al. and Kim et al. (13,22) The present study is also the first research to show that delayed probing (>24 months of age) is associated with higher astigmatic ARFs.

Despite genetic causes, several ocular-surface disorders, including eyelid diseases (e.g., ptosis and chalazion) and dry-eye diseases, can also induce astigmatism (23,24). However, no study in the literature has involved evaluating whether prolonged epiphora can alter the corneal surface and, in turn, lead to astigmatism. If the probing procedure is delayed, then a larger tear lake and increased discharge may disrupt the corneal surface for a longer period and, as a result, increase the prevalence of astigmatic errors. In this study the success rate was not different between the groups. In further studies the effect of failed probing procedures on refractive results could also be demonstrated. Based on studies showing that eye-rubbing induces astigmatism, it is also possible that a parent's massaging of their child's lacrimal sac for an inappropriately prolonged period could increase astigmatic errors in children who undergo probing after 24 months of age (25).

Many investigations have revealed a negative correlation between age and success rates of probing (26). Although the success rate was slightly greater in the early-probing group, it was statistically similar between the groups. The sample comprised children less than 36 months old, which could explain the similarity of the success rates. Regardless, the overall success rate agreed with rates determined in other studies (27–29).

The present study's greatest limitation is its retrospective design, whereas the relatively large sample for identifying significant differences is its greatest strength. Corneal topographic or at least keratometric and refractive measure-

ments should be taken before as well as after the probing procedure to clarify the mechanisms of the higher rate of astigmatic ARFs. At the same time, taking those measurements with such young patients can be difficult to perform in an office setting.

Conclusion

In sum, the study revealed that 21.2% of CNLDO patients had refractive ARFs and that probing after 24 months of age was associated with an increased rate of astigmatic ARFs but did not affect anisometropia. Given these findings, pediatric ophthalmologists should carefully monitor children with NLDO to protect them from possible amblyopia.

Disclosures

Ethics Committee Approval: Kayseri Erciyes University Faculty of Medicine, Ethics Committee, 2019/819, 27/11/2019.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Involved in design and conduct of the study (DK, IA, HB); preparation and review of the study (DK, MRS, SG); data collection (IA, HB, MRS); and statistical analysis (DK, IA, HB, MRS, SG).

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