INTRODUCTION

Congenital nasolacrimal duct obstruction (CNLDO) is a commonly presenting disease in the clinics of pediatric ophthalmologists. Children with CNLDO usually present with epiphora and discharge. The site of obstruction lies at the level of the valve of Hasner, which becomes symptomatic in 5-6% of the infants.\(^1,2\) It is still a worldwide debate if and how, during the period of emmetropization, tearing happening persistently in an infant, affects the visual development.\(^3,4\) Furthermore, an association has been postulated by ophthalmologists around the world between anisometropia and CNLDO.\(^5,6\) Nevertheless, it is proposed that increased tear meniscus, disturbances in the tear film, and mucopurulent discharge cause disturbance in the image formation during the critical period of visual development.\(^3,7\) This proposition has been the subject of a debate worldwide, as a cohort case study with most number of children enrolled to date, showed that CNLDO had no effect on visual development.\(^4\) Eyes with CNLDO are at risk of developing anisometropic amblyopia.\(^8\)

The objective of this study was to determine the refractive status of a consecutive series of children with bilateral CNLDO with special emphasis on the prevalence of anisometropia in these children and also to evaluate the role of early intervention in children having CNLDO in both eyes in relation to the development of anisometropic amblyopia.

METHODOLOGY

This descriptive study was conducted in the Department of Pediatric Ophthalmology and Strabismus, Al-Shifa Trust Eye Hospital, Pakistan, from April 2014 to April 2016. The Institutional Ethical and Research Committee approved the current study. All the participants/legally acceptable guardians gave a written informed consent for this study. Cyclopentolate (1%) was administered topically in all the studied children and cycloplegic refraction was done afterwards by the same examiner. All children with increased tear lake, eye discharge, and epiphora from both eyes due to congenital nasolacrimal duct obstruction were enrolled in the study. All children with ptosis, strabismus, blepharophimosis syndrome, past surgical intervention for CNLDO, craniosynostosis, congenital glaucoma, conjunctivitis, and corneal abrasions were excluded. The most recent/latest refractive error assessed after cycloplegic refraction was labelled as the final refractive error. An interocular difference of \(\geq 1\) D between the two eyes was defined as anisometropia in the current study. The risk of developing amblyopia was determined using The American Association for Pediatric Ophthalmology...
and Strabismus (AAPOS) guidelines, which states that "anisometropia (spherical or cylindrical) greater than 1.5 D is an amblyopic risk factor in pre-school vision screening". All the data were analysed using SPSS version 23. The continuous data was tested for normality by using Kolmogorov-Smirnov test. As the continuous data were non-parametric, the Wilcoxon Signed Rank test was used to do comparison between the sphere (D), cylinder (D), and spherical equivalent (SE) (D) of the right and left eyes. All the data were presented as frequencies with percentages and median with inter-quartile values. At 5% significance level, the p-value <0.05 was considered as showing statistically significant results.

RESULTS

A total of one hundred and seventeen (n = 117) patients having CNLDO in both eyes were included in this study. The median age (IQR) of the patients with bilateral CNLDO was 32 (12) months. There were 69 males [n = 69 (59%)] and 48 females [n = 48 (41%)]. Majority of patients [n = 57 (48.7%)] with bilateral CNLDO presented between age of 25-48 months (Figure 1).

The Wilcoxon signed Rank Test revealed statistically insignificant difference between sphere (D) of right eyes [Median (IQR) = 1.00 (0.75)] and left eyes, [Median (IQR) = 1.00 (1.25)], Z = - 0.77, p = 0.44; and cylinder (D) of right eyes [Median (IQR) = 0.00 (0.00)] and left eyes [Median (IQR) = 0.00 (0.38)], Z = - 0.68, p = 0.49, in children with bilateral CNLDO. There was also a statistically non-significant difference between SE (D) of right eyes [Median (IQR) = 0.87 (0.63)] and left eyes [Median (IQR) = 0.75 (0.75)], Z = - 0.38, p = 0.71. These results indicate that bilateral congenital nasolacrimal duct obstruction influences the refractive status of both the eyes equally (Table I).

The rate of anisometropia was 5.98% (n = 7) in patients with bilateral CNLDO. Moreover, following AAPOS guidelines, 2.6% (n = 3) of the patients with bilateral CNLDO had risk factors for developing anisometropic amblyopia.

DISCUSSION

Most of the published international literatures have emphasised on the association of unilateral CNLDO and anisometropia, but has remained relatively silent on the association of bilateral CNLDO and anisometropia.\textsuperscript{5,6} Moreover, anisometropia is a well-known cause of amblyopia.\textsuperscript{9,10} Anisometric amblyopia severely impairs the visual potential.\textsuperscript{11} Chances of developing amblyopia increases with increased difference in the diopter power of anisometric eyes.\textsuperscript{12,13} In a recent study, Siddiqui et al. compared the anisometropia and refractive status in children with unilateral and bilateral CNLDO. In their study, patients with bilateral CNLDO had insignificant interocular difference in terms of spherical equivalent (SE) and cylindrical refractive errors. However, in their research the small sample size of patients with bilateral CNLDO (n = 46) warranted further research and deliberation into the subject to see the consistency of the results.\textsuperscript{14} The rationale of this manuscript was to exclusively explain the refractive error findings in a larger sample size of children diagnosed as having CNLDO in both eyes by a pediatric ophthalmologist.

During physiological emmetropization, focused retinal images are of prime importance.\textsuperscript{15} The endless and continual watering in the eyes caused by CNLDO may de-focus the retinal image. Moreover, the blur produced in the process can lead to the development of anisometropia by adversely affecting the physiological emmetropization.\textsuperscript{6} Anisometropia (≥1D between two eyes) can lead to amblyopia as it is a known risk factor.\textsuperscript{16} In pre-school vision screening, anisometropia (spherical or cylindrical) > 1.5 D is a risk factor for amblyopia, as mentioned in the guidelines published by AAPOS.\textsuperscript{17} Following these guidelines, in the present manuscript, 2.6% (n = 3) of the patients with bilateral CNLDO had risk factors for amblyopia.

![Figure 1: Frequency distribution of age of patients with bilateral CNLDO.](image)

| Table I: Wilcoxon signed rank test for comparing inter-ocular difference of sphere (D), cylinder (D) and SE (D) in patients with bilateral CNLDO. |
|-----------------|-----------------|-----------------|--------|--------|
|                | Right eyes | Left eyes |        |        |
| Sphere (D)     | N          | Median (IQR) | N      | Median (IQR) |
| 117            | 1.00 (0.75)|                | 117    | 1.00 (1.25) |
| Cylinder (D)   | 0.00 (0.00)|                | 0.00 (0.38)|         |
| SE (D)         | 0.87 (0.63)|                | 0.75 (0.75)|         |
| Z               | - 0.77    | p-value          | - 0.68 | 0.49   |
| p-value         | 0.44      |                 | 0.71   |        |
In the study conducted by Ellis et al., a statistically insignificant difference was seen between anisometropia and amblyopia in children having CNLDO in comparison with children who didn't have CNLDO. However; this claim was contradicted by Chalmers and Griffiths. They reviewed 130 children with unilateral CNLDO and in their study, anisometropic amblyopia was seen in 3.8% of the studied cases. This subject was reviewed again by Simon et al. in a case series of 5 children with CNLDO. Simon and colleagues showed that all the reported individuals had anisometropic amblyopia in the eye having CNLDO. Piotrowski et al. conducted a detailed analysis of 305 patients and found that 90% of the children having hyperopic anisometropia without amblyopia, had unilateral CNLDO and only 10% of the children, with hyperopic anisometropia had bilateral CNLDO. In their study, unilateral CNLDO contributed more towards anisometropia as compared to bilateral CNLDO; and hence, towards amblyogenicity.

Matta et al. showed that 22% children with unilateral CNLDO had amblyopia risk factors. Lacey et al., on the other hand, gave a more detailed age and gender matched group analysis of eyes with CNLDO for the presence of amblyopia; and showed that the eye with CNLDO, was more amblyopic than the eye without CNLDO.

In children with bilateral CNLDO, the rate of anisometropia was 5.98% (n = 7) in the present manuscript. Patients presenting with bilateral CNLDO in the current study showed statistically insignificant difference between SE (D) (p = 0.71) of both the eyes. These results indicate that bilateral CNLDO does not contribute towards the development of significant anisometropia since bilateral CNLDO influences the refractive status of both the eyes equally.

Therefore, the authors of the current study are of the view that in patients with bilateral CNLDO, early surgical intervention should be avoided and the clinical symptoms can be observed safely for spontaneous resolution for longer durations. This will spare the parents from emotional and psychological trauma associated with the early surgical intervention in young children. Moreover, unnecessary general anesthesia and its related complications can be avoided in young children. Avoidance of early surgical intervention in patients with bilateral CNLDO will lessen the surgical load in our pediatric ophthalmology clinics and will positively influence the health economics worldwide.

Variable timing of presentation and a wide range of management protocols cause differences in the approach towards a patient with bilateral CNLDO. Anisometropia affects the stereo-acuity and disturbs binocularity, thus making the treatment plan of patients with CNLDO difficult and time consuming. Anisometropic amblyopia, in comparison to strabismic and deprived amblyopia, remains asymptomatic in the early crucial years of life; with only 15% of the cases being diagnosed before the age of 5 years. Therefore, inconstant presentation, arduous clinical management and insidious course of the disease makes it a significant clinical problem, warranting due attention of pediatric ophthalmologists.

Another important variable influencing the severity of the disease and possible prognosis of a child's vision is the age of the patient with bilateral CNLDO. This factor was discussed in detail by Bagheri et al., when they analysed 94 children and concluded that each increasing month of age added 0.007D of interocular difference in both the eyes. This difference in both the eyes was more severe in children of age greater than 4 years. Higher age group children also required more number of procedures for the management of NLDO. In another study, age was discussed as an important variable to consider in CNLDO patients. It was also mentioned that children younger than 3 years of age have less severe anisometropia and better prognosis. The highest number of patients (n=57) with bilateral CNLDO presented between the age group of 25-48 months in this manuscript. In this study, the age presentation of children with CNLDO in both eyes could have contributed to insignificant anisometropia as proposed by Donahue. Furthermore, Kipp et al. compared the prevalence of anisometropia in unilateral and bilateral CNLDO cases. Anisometropia was present in 3.6% of the patients with bilateral CNLDO. The authors of the current manuscript studied anisometropia exclusively in patients having CNLDO in both eyes for the first time. After comparison of mean spherical error, mean astigmatic error, and mean spherical equivalents of both eyes, none of the differences proved to be statistically significant.

As mentioned earlier, the published international literatures have shed ample light on the association of unilateral CNLDO and anisometropia; but has remained relatively silent on the association of bilateral CNLDO and anisometropia. This study would, therefore, further strengthen the findings of the study conducted by Siddiqui et al. and would help the clinicians better understand the association of anisometropia and bilateral CNLDO and subsequent clinical management.

**CONCLUSION**

Unlike unilateral CNLDO, cases with bilateral CNLDO are at a much lower risk of developing significant anisometropia and thus anisometropic amblyopia. Patients with bilateral CNLDO can be reviewed on longer follow-up intervals and observed for spontaneous resolution of symptoms with much more ease than cases with unilateral CNLDO. Further, avoidance of early surgical intervention in children with bilateral CNLDO; and hence, towards amblyogenicity.
CNLDO will spare the parents from the emotional trauma and positively influence the health economics worldwide.

REFERENCES