

# Prevalence of amblyopia in children undergoing nasolacrimal duct irrigation and probing

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**Purpose:** To investigate amblyopia and amblyopia risk factors of children who underwent nasolacrimal duct (NLD) irrigation and probing for congenital nasolacrimal duct obstruction (CNLDO). **Materials and Methods:** The medical records of patients who had undergone NLD irrigation and probing for CNLDO at an age of 3 years or younger were reviewed, and 51 of the patients were recalled between October 1 and December 31, 2011 for a detailed ophthalmic examination to determine amblyopia or amblyopia risk factors. Amblyopia was accepted as difference in visual acuity of two or more Snellen lines between the two eyes or visual acuity of 20/30 or worse in either eye. **Results:** The median age of the 51 patients to whom NLD irrigation and probing were attempted for CNLDO was 23 months. CNLDO affected a total of 70 eyes. All patients were reviewed for best-corrected visual acuity, refractive errors, and strabismus at a median age of 70.5 months (range 31-95 months). Amblyopia or amblyopia risk factors were identified in 14 patients (27.5%). One child (7.15%) had only strabismus, six children (42.8%) had only amblyogenic refractive errors, two (14.3%) had a combination of two, one child (7.15%) had a family history for amblyopia, but four children (28.6%) had no amblyopia risk factors but had amblyopia. **Conclusion:** Amblyogenic risk factors are found higher in patients with CNLDO and patients undergoing NLD irrigation and probing in comparison to normal population. Therefore, we recommend these children to routinely undergo cycloplegic refractions and full ophthalmic examinations.

**Key words:** Amblyopia, nasolacrimal duct obstruction, probing

Amblyopia affects approximately 1.6-3.6% of general population.<sup>[1]</sup> Aside from refractive errors, many risk factors may be amblyogenic.<sup>[2]</sup> Studies indicated that children with congenital nasolacrimal duct obstruction (CNLDO) have a higher prevalence of amblyopia but it is unknown what role, if any, CNLDO has in the visual development of children. The authors of recent studies suggested that children with this condition should undergo a full ophthalmologic examination.<sup>[3]</sup> The aim of this study is to investigate amblyopia and amblyopia risk factors of children who underwent nasolacrimal duct (NLD) irrigation and probing for CNLDO.

## Materials and Methods

The medical records of patients who had undergone NLD irrigation and probing for CNLDO at an age of 3 years or younger were reviewed, and 51 of the patients were recalled between October 1 and December 31, 2011 for a detailed ophthalmic examination to determine amblyopia or amblyopia risk factors like strabismus, high refractive error, ptosis and any media opacities. Patients had a history of NLD irrigation and probing for CNLDO between January 2005 and September 2008. Informed consent form had been obtained from all parents of the patients who underwent probing and NLD irrigation. One author had performed ophthalmic examination, including cycloplegic refraction, on all children.

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Amblyopia was accepted as difference in visual acuity of two or more Snellen lines between the two eyes or visual acuity of 20/30 or worse in either eye. Preverbal children were classified as having amblyopia risk factors based on the American Association for Pediatric Ophthalmology and Strabismus referral criteria.<sup>[4]</sup> These criteria are shown in Table 1.

## Results

The median age of the 51 patients to whom NLD irrigation and probing were attempted for CNLDO was 23 months (range, 9-36 months). CNLDO affected a total of 70 eyes. CNLDO was present in both eyes in 19 (37%), on the left only in 15 (30%), and on the only right in 17 (33%) patients.

All patients were reviewed for best-corrected visual acuity, refractive errors, and strabismus at a median age of 70.5 months (range 31-95 months). Amblyopia or amblyopia risk factors were identified in 14 patients (27.5%), and the clinical characteristics of these patients are given in Table 2.

**Table 1: Referral criteria for amblyopia risk factors based on the American Association for Pediatric Ophthalmology and Strabismus**

Anisometropia (spherical or cylindrical)>1.5 D
Any manifest strabismus
Hyperopia>3.5 D in any meridian
Myopia magnitude>3.0 D in any meridian
Any media opacity>1 mm in size
Astigmatism>1.5 D at 90° or 180° >1.0 D in oblique axis (more than 10° from 90° or 180°)
Ptosis ≤ 1 mm margin reflex distance

Two of fourteen patients (14.3%) underwent NLD irrigation and probing for CNLDO on both sides, four (28.6%) on the left and eight (57.1%) on the right. In six (42.85%) patients, amblyopia or amblyopia risk factors were in the same eye, as the eye which underwent probing and NLD irrigation. In six patients (42.85%), there were amblyopia risk factors or amblyopia in both eyes despite one eye of probing; in one patient (7.15%), there was amblyopia risk factor on the contralateral eye of probing; and one patient (7.15%), despite both eyes undergoing probing had amblyopia in only one eye.

Amblyopia risk factors were identified as follows: One child (7.15%) had only strabismus (double elevator palsy), six children (42.8%) had only amblyogenic refractive errors, two (14.3%) had a combination of both, one child (7.15%) had a family history for amblyopia, but four children (28.6%) had no amblyopia risk factors but had amblyopia.

Of the eight children (57.14%) with high refractive error, five had (62.5%) hyperopia, one had (12.5%) significant astigmatism, one had (12.5%) hyperopic astigmatism, and one had (12.5%) anisometropia [Table 3]. No patient had myopia, media opacity, but there was mild ptosis in the patient with double elevator palsy. Seven patients (50%) had a best corrected visual acuity of 20/30 or lower in their amblyopic eye, three patients were not cooperated to measure visual acuity and four had no amblyopia but had amblyopia risk factors [Table 4].

## Discussion

Generally, CNLDO is considered to have significantly no adverse association with visual development.<sup>[4]</sup> More than 90% of children with CNLDO undergo spontaneous resolution by 1 year of age, but those who continue to have symptoms need to go under probing and NLD irrigation.<sup>[5]</sup>

Amblyopia affects approximately 1.6 - 3.6% of normal population.<sup>[1]</sup> Besides well-known amblyogenic risk factors, there are a number of risk factors that increase the likelihood that a patient will be amblyopic. These are heredity, low birth weight, mental retardation, craniosynostosis, hydrocephalus, and low socioeconomic factors.<sup>[2,6-8]</sup> Some authors reported a greater than expected rate of amblyopia risk factors among patients with CNLDO.<sup>[2,9-11]</sup>

First, Chalmers and Griffiths reported five cases of anisometropic amblyopia among 130 cases of CNLDO (3.8%), with severe hyperopia occurring in the same eye with epiphora.<sup>[12]</sup> However, Ellis *et al.* reported no significant difference between the prevalence of amblyopia or hyperopic anisometropia in children with CNLDO and a control group.<sup>[4]</sup> The prevalence of anisometropia range between 1.4 and 3.4%, and anisometropic amblyopia between 0.65 and 1.25% in normal population.<sup>[13-17]</sup> Piotrowsky *et al.* reported a 9.8% prevalence rate of anisometropia and a 5.2% prevalence rate of anisometropic amblyopia in children who had CNLDO, a rate that is higher than reported for general population. They also noted that 87.5% of children with hyperopic anisometropia developed amblyopia in the eye with epiphora. Additionally, 90% of the children with hyperopic anisometropia without amblyopia developed more severe hyperopia ipsilateral to their epiphora. They hypothesized that distortion of retinal images from persistent tearing in CNLDO may result with ametropia, and the partial disruption of emmetropization may be the cause of

**Table 2: Clinical characteristics of 14 patients with amblyopia or amblyogenic risk factors**

Characteristics	Value
Sex, male/female, No. (%)	8/6 (57/43)
Age at CNLDO treatment, median (range), month	23.5 (9-36)
Laterality of CNLDO treatment, No.(%)	
Both	2 (14.3)
Right eye	8 (57.1)
Left eye	4 (28.6)
Age at examination for amblyopia, median (range), month	59 (31-83)
Laterality of amblyopia or risk factors, No. (%)	
Both	7 (50)
Right eye	5 (35.7)
Left eye	2 (14.3)

CNLDO: Congenital nasolacrimal duct obstruction

**Table 3: Amblyopia or amblyogenic risk factors in 51 children with a history of CNLDO\***

Finding	Unit	Percentage
Patients with amblyopia or amblyogenic risk factors	14	27.5
Refractive error alone	6	42.8
Strabismus alone (double elevator palsy)	1	7.15
Strabismus+refractive error	2	14.3
Family history	1	7.15
Amblyopia without amblyogenic risk factors	4	28.6
Patients with amblyogenic refractive errors	8	57.2
Hyperopia	5	62.5
Astigmatism	1	12.5
Hyperopic astigmatism	1	12.5
Anisometropia	1	12.5
Patients without amblyopia or amblyogenic risk factors	37	72.5
Total	51	100

\*CNLDO: Congenital nasolacrimal duct obstruction

the increased prevalence of hyperopic anisometropia.<sup>[11]</sup> In our study, hyperopic anisometropia was found only in one child, but hyperopia was found significantly higher (62.5% of amblyogenic refractive errors), which was similar to the study of Matta *et al.*

Piotrowsky *et al.* reported a rate of 13.1% amblyogenic risk factors in patients with CNLDO.<sup>[11]</sup> Matta *et al.* identified amblyopia risk factors in 88 children (22%) of 402 patients with CNLDO. They reported amblyogenic refractive error in 65 (74%), strabismus in 9 (10%), and a combination of two in 14 (16%).<sup>[3]</sup> In our study, 27.5% of the children undergoing NLD irrigation and probing had amblyogenic risk factors. Among the patients with amblyogenic risk factors, 42.8% of our patients had only amblyogenic refractive errors, one child (7.15%) had only strabismus, and two (14.3%) had a combination of both. But 28.4% had no amblyogenic risk factors but had amblyopia. Payman *et al.* reported an amblyogenic risk factor prevalence of 2.1% for hyperopia, 0.1% for myopia, 5.0% for astigmatism, 0.9% for anisometropia, and 1.2% for strabismus in children

**Table 4: Refraction and findings of 14 children with amblyopia or amblyogenic risk factors**

NLDI/P eye	Right eye			Left eye			Visual acuity		Comments
	Spheric	Cyl	Axe (°)	Spheric	Cyl	Axe (°)	OD	OS	
OD	+1,75	+0,25	150	+1,50	-	-	20/30	20/20	Family history
OD	+2,50	+1,25	110	+1,75	+1,00	80	n/a	n/a	ET, hyperopic astigmatism
OD	+2,50	+0,50	10	+2,00	+0,25	160	20/30	20/20	No risk factor
OD	+2.50	+0.75	90	+3.25	+1.00	90	n/a	n/a	Hyperopia
OU	+0,75	+0,50	115	0,00	-0,50	120	20/30	20/25	Double elevator palsy
OD	+2,25	+1,00	90	+2,75	+0,75	95	20/40	20/25	Hyperopia
OU	+1,00	+0,25	55	+0,75	+0,50	100	20/20	20/25	No risk factor
OS	+1,25	+1,00	90	+1,25	+1,00	85	20/30	20/30	No risk factor
OD	+1,00	+1,25	85	+1,25	+0,25	75	20/40	20/30	No risk factor
OD	+3,25	+0,50	120	+1,75	+0,50	90	20/40	20/25	Hyperopia+anisometropia
OS	+1,25	-1,50	10	+2,25	-2,25	170	20/35	20/35	Bilateral astigmatism
OD	+3.75	+0.50	90	+3.50	+0.75	75	20/20	20/20	Bilateral hyperopia
OS	+4.00	+0.25	180	+3.75	+0.75	180	20/20	20/20	Bilateral hyperopia
OS	+5,50	-	-	+6,00	-	-	n/a	n/a	Bilateral high, hyperopia, ET

NLDI/P: Nasolacrimal duct irrigation/probing, Cyl: Cylindrical, OD: Right eye; OS: Left eye; OU: Both eyes; ET: Esotropia

entering school. They also reported that overall 6.4% were at the risk of amblyopia, and of these 81% had high refractive errors, 11% had strabismus and 8% had both.<sup>[15]</sup> Similarly, amblyogenic refractive errors are the leading cause of risk in our patients going under NLD irrigation and probing. But amblyogenic risk factors are found much higher than general population.

Both Matta *et al.* and Piotrowski *et al.* found a correlation of anisometropia in the eye with NLD obstruction.<sup>[2,11]</sup> In our study, 42.85% of our patients had amblyopia or amblyopia risk factors in the same eye which underwent probing and NLD irrigation. In six patients (42.85%), there were amblyopia risk factors in both eyes despite one eye of probing; in one patient (7.15%), there was amblyopia risk factor on the contra lateral eye of probing; and 1 patient (7.15%), despite both eyes undergoing probing, had amblyopia in only one eye.

In conclusion, amblyogenic risk factors are found higher in patients with CNLDO and patients undergoing NLD irrigation and probing in comparison to normal population. Amblyogenic risk factors may be seen in the ipsi or contra lateral eye undergoing probing. Therefore, we recommend infants and children with symptoms of dacryostenosis routinely to undergo cycloplegic refractions and full ophthalmic examinations.

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