Saudi Journal of Ophthalmology (2014) 28, 58–60

Original Article

Risk factors for developing congenital nasolacrimal duct obstruction

Faisal D. Aldahash, MBBS; Muhammad F. Al-Mubarak, MBBS; Saad H. Alenizi, MBBS; Yasser H. Al-Faky, MD, FRCS *

Abstract

Objective: To identify potential risk factors for developing congenital nasolacrimal duct obstruction (CNLDO).
Study design and methods: A cross-sectional study. A quantitative questionnaire was distributed to a sample of mothers attending the Pediatrics Clinic at King Khalid University Hospital, Riyadh, Saudi Arabia.
Results: A total of 756 mothers responded to our questionnaire. Of the 756 filled questionnaires, 389 (51.67%) were male children. 5.3% of the mothers lived in non-urban settings. CNLDO was reported in the children attending the clinic by 17.1% (129/756) of their mothers. Average age (±SD) of infants when persistent tearing was noticed was 3.2 ± 2.7 months, while average age (±SD) of resolution was 9.6 ± 3.7 months. Of the children with CNLDO, 37.2% (48/129) still have persistent tearing at the time of distributing the questionnaire. Among the group with CNLDO, 17% (22/129) of their mothers have experienced an infection during pregnancy ($p = 0.022$). Within the same group, 14.7% (19/129) of the affected children were reported by their mothers to have other children with CNLDO which was statistically significant ($p = <0.001$).
Conclusion: CNLDO could have a genetic predisposition and maternal infection is a possible risk factor for developing CNLDO. Surgical management awareness should be emphasized to relieve children from this relatively common and benign condition.

Keywords: Congenital, Nasolacrimal duct, Obstruction, Risk factors

http://dx.doi.org/10.1016/j.sjopt.2013.09.007

Introduction

The nasolacrimal duct starts to develop during the fifth week of embryogenesis.[1] Congenital nasolacrimal duct obstruction (CNLDO) is due to incomplete canalization of the valve of Hasner at the distal part opening in the vast majority of cases.[2] Around 90% of cases gain patency no longer than a year.[3] Several studies have been done to estimate the incidence of CNLDO which yielded a varied range of results between 1.2% and 30%; probably the most widely accepted incidence to be 6%[3–7].

Risk factors for congenital anomalies may include maternal infections during pregnancy, exposure to radiation or consuming medications, and some occupational hazards[5]; these are similarly implicated in CNLDO. Moreover, the role of genetics has not been thoroughly investigated in CNLDO. In the literature, few familial cases were reported and among them being one set of twins with bilateral dacryocystocele.[8] There is a need to understand both impact and potential risk factors for CNLDO. We conducted our study to identify potential risk factors for developing CNLDO.

Study design and methods

A cross-sectional study design was adopted. The study was carried out in the Pediatrics Clinic at King Khalid University Hospital, Riyadh, Saudi Arabia and adhered with the declaration of Helsinki. Questionnaires were distributed

Received 19 September 2013; received in revised form 29 September 2013; accepted 30 September 2013; available online 10 October 2013.

Department of Ophthalmology, College of Medicine, King Saud University, Riyadh, Saudi Arabia

* Corresponding author. Address: Ophthalmology Department, College of Medicine, King Saud University, PO Box 245, Riyadh 11411, Saudi Arabia. Tel.: +966 01 477 57 23; fax: +966 01 477 57 24.
e-mail address: alfaky@gmail.com (Y.H. Al-Faky).

Peer review under responsibility of Saudi Ophthalmological Society, King Saud University

Production and hosting by Elsevier

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to a sample of the mothers attending the pediatric clinic from the period of July 10th through September 15th. Our sample size (n = 865) has been reached by applying the rule:

$$\text{Sample size} = \{Z^2 * P * (1 - P)\}/C^2$$

where: Z = Z value (1.96 for 95% confidence level).
P = 10% (the predicted prevalence of persistent tearing).
C = confidence interval ± 2%.

Confidence interval was relatively low in order to increase the power of the study.

A specially designed questionnaire divided into two sections was distributed. The first section of the questionnaire targeted the mother and father of the child. It explored age, occupation, place of living, and smoking. Antenatal risk factors were taken into consideration by asking about maternal infections, drugs taken during pregnancy, and exposure to X-ray. The second division was concerned with the presence of persistent tearing (with or without runny nose), the presence of yellowish discharge, the age of onset, and the age at resolution. Treatment options that had been offered were also explored, if any. A pilot study was conducted where 20 forms of our questionnaire were pretested in similar settings on similar basis to test the reliability and validity of the questionnaire. These 20 questionnaires were not included in the final results.

We used the software SPSS 18 to analyze our data. The P-value for Chi square test was calculated in all risk factors potentially associating with CNLDO.

Results

A total of 756 (out of 865) questionnaires have been satisfactory filled by a sample of mothers attending the pediatrics clinic. Almost one third of the mothers reported their child to have tearing (284/756; 37.6%); however, 155 cases had tearing coinciding only with an attack of common cold or after the first 6 months of age. One hundred and twenty-nine (17.1%) cases were reported by mothers to have persistent tearing which commenced within the first 6 months of age in the absence of upper respiratory tract infection which is characteristic of CNLDO. Associated yellowish discharge from the eye was reported in 35.7% (46/129) of infants with CNLDO. None of them had features of acute attack of dacryocystitis. Unilateral CNLDO was reported in 57.4% (74/129) of cases (the left eye was involved in 30 cases, right eye in 21 cases and mothers failed to recall which eye was in particularly affected in 23 eyes). Bilateral involvement was reported in 42.6% (55/129) of cases. Table 1 describes certain sociodemographic factors of such respondents.

Average age of infants with CNLDO was 3.2 ± 2.7 months, and the average age (±SD) of resolution was 9.6 ± 7.5 months. Almost one third of cases with CNLDO reported by mothers (48/129; represents 37.2%) had not been resolved at the time of the study (thirty children were still below the age of one year). Only 58.9% (76/129) of mothers tried hydrostatic massage to their infant's lacrimal sac. Spontaneous resolution without massage was reported in 32 children, while massage aided resolution in 48 children. Of note, only one case of persistent tearing (1/129; <1%) underwent a successful probing. No cases of silastic intubation have been reported in this study.

Nineteen reportedly affected patients (14.7%) had a first-degree relative with CNLDO (p = <0.001). Twenty-two mothers giving birth to an affected child (17.1%) reported an infection during pregnancy (p = 0.022). Other risk factors have been sought. However, none of them were statistically significant. These are reflected in Table 2.

Discussion

Our study showed 17.1% incidence of CNLDO which falls within many-reported incidence of CNLDO ranging from 1.2% to 30% depending on various criteria used in diagnosing persistent tearing.[5,6,9,10] In our study, the mean age of infants with persistent tearing was 3.2 months which correlates to the nature of the congenital disease. The current study showed 42.6% bilateral affection which is higher than what was reported by Kashkouli et al. (36.6%)[11], the Pediatric Eye Disease Investigator Group (33%),[12] and Lim et al. (17%).[13] It is worthy to mention our previous retrospective study that showed even higher percentage (45.8%) of bilateral affection as it is dealt with the same population [14].

CNLDO resolution without any surgical intervention was reported in 62% (80/129) of our series, in which ducts became patent spontaneously in 24.8% (32/129) and with the

Table 1. Sociodemographic factors of both groups with and without congenital nasolacrimal duct obstruction (CNLDO).

Character		CNLDO		p-Value
		Yes (%)	No (%)	
Gender of the child	Male	67 (51.9)	321 (51.2)	0.877
	Female	62 (48.1)	306 (48.8)	
Place of living	Urban	121 (93.8)	599 (95.5)	0.399
	Non-urban	8 (6.2)	28 (4.5)	
Mother's age	11–25	42 (32.6)	183 (29.2)	0.411
	25–35	63 (48.8)	299 (47.7)	
	35–40	15 (11.6)	109 (17.4)	
	>40	9 (7)	36 (5.7)	
Mother's education	High school and below	56 (43.4)	293 (46.7)	0.491
	University degree and above	73 (56.6)	334 (53.3)	
Occupation of the mother	Housewife	90 (69.8)	475 (75.8)	0.154
	Working	39 (30.2)	152 (24.2)	
Occupation of the father	In-doors	97 (75.2)	485 (77.4)	0.639
	Out-door	32 (24.8)	144 (22.6)	
Smoking status of the mother	Yes	0	0	N/A
	No	129	627	
Smoking status of the father	Yes	36 (27.9)	169 (27)	0.825
	No	93 (72.1)	458 (73)	

Table 2. Possible risk factors for developing congenital nasolacrimal duct obstruction (CNLDO) and their significance.

Possible risk factors		CNLDO		*p*-Value
		Yes (%)	No (%)	
Other children with CNLDO	Yes	19 (14.7)	21(3.3%)	<0.001
	No	110 (85.3)	606 (96.7%)	
Had infection in pregnancy	Yes	23 (17.8)	67 (10.7)	0.022
	No	106 (82.2)	560 (89.3)	
Had X-ray while pregnant	Yes	8 (6.2)	26 (4.1)	0.305
	No	121 (93.8)	601 (95.9)	
Had drugs in first trimester	Yes	24 (18.6)	128 (20.4)	0.640
	No	105 (81.4)	499 (79.6)	

aid of massage in 37.2% (48/129). This highlights the benign course of CNLDO. However, our data are notably less than MacEwen and Young's large series who found spontaneous resolution in 96% of cases during first year of life.[6] Other studies have also reported higher incidences of spontaneous resolution ranging between 80% and 95%.[5,10,15,16] The discrepancy between our data and others could be due to nature of our study design as we did not follow our patients and thirty (23.3%) unresolved children were still under the age of 1 year at the time of study which leaves the question open whether they are going to improve with time.

Despite reporting unresolved CNLDO in 18 children above the age of 1 year when the study was conducted, families did not seek medical advice. This highlights the need for educational program to increase the awareness of the nature of the disease and encourage families to seek for surgical intervention after the age of 1 year as CNLDO is unlikely to resolve spontaneously or with the aid of massage beyond this age [17].

Scarce reports have looked at the inheritance of CNLDO. For instance; Yie suggested sporadic or multiagency mode of inheritance while Barham et al. argued the inheritance of CNLDO.[8,18] The current study showed an association between CNLDO and family history documented by higher rate among first-degree siblings ($p = <0.001$). This association may support the presence of genetic basis of the disease. However, sound conclusion cannot be made with this study design. We also found that infection during pregnancy is a statistically significant risk factor ($p = 0.022$). Various studies have reported association between maternal infection and congenital anomalies, with respect to viral infection.[19,20] On the other hand, gender and age of the mother when giving birth to the affected child, X-ray exposure, drug intake during first trimester, gender of the child, place of living, parent's education, occupation, smoking status were not significant. This finding is consistent with the finding published by Noda et al.[3]

In summary, CNLDO could have a genetic predisposition and maternal infection may also predispose to CNLDO. Awareness should be emphasized on when intervention takes place in order to manage children with this relatively benign disease.

Conflict of interest

The authors declared that there is no conflict of interest.

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