Original Article

Risk factors for developing congenital nasolacrimal duct obstruction

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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

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Introduction

The nasolacrimal duct starts to develop during the fifth week of embryogenesis. 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. Around 90% of cases gain patency no longer than a year. 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%–7.

Risk factors for congenital anomalies may include maternal infections during pregnancy, exposure to radiation or consuming medications, and some occupational hazards;

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.

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...
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:

\[
\text{Samplesize} = \left(2 \times P \times (1 - P)\right)/C^2
\]

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 (284/756; 37.6%); however, 155 cases had tearing which commenced within the first 6 months of age. One hundred and twenty-nine mothers attending the pediatric clinic 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 diagnosis 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

| Character                      | CNLDO Yes (%) | CNLDO No (%) | \( p \)-Value |
|--------------------------------|---------------|--------------|--------------|
| Gender of the child            | Male          | Female       |              |
| Place of living                | Urban         | Non-urban    |              |
| Mother’s age                   | 11–25         | 25–35        | 35–40        | >40          |
| Mother’s education             | High school and below | University degree and above |              |
| Occupation of the mother       | Housewife     | Working      | In-doors     | Out-door     |
| Smoking status of the mother   | Yes           | No           |              |              |
| Smoking status of the father   | Yes           | No           |              |              |

Table 1. Sociodemographic factors of both groups with and without congenital nasolacrimal duct obstruction (CNLDO).
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. Other studies have also reported higher incidences of spontaneous resolution ranging between 80% and 95%. 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.

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. The current study showed an association between CNLDO and family history documented by higher rate 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.

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.

### 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                 | 19 (14.7) | 21 (3.3%) | <0.001 |
| Had infection in pregnancy                | 110 (85.3) | 606 (96.7%) |
|                                         | 23 (17.8) | 67 (10.7) | 0.022 |
| Had X-ray while pregnant                  | 106 (82.2) | 560 (89.3) |
|                                         | 38 (3.6) | 26 (4.1) | 0.305 |
| Had drugs in first trimester              | 121 (93.8) | 601 (95.9) |
|                                         | 24 (18.6) | 128 (20.4) | 0.640 |

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