

# The effect of cesarean section on the incidence of congenital nasolacrimal duct obstruction

Hafize Gökben Ulutaş<sup>1</sup>, Gamze Uçan Gündüz<sup>2</sup>

<sup>1</sup>Department of Ophthalmology, University of Health Sciences, Bursa Yüksek İhtisas Training and Research Hospital, Bursa, Turkey

<sup>2</sup>Department of Ophthalmology, Uludağ University School of Medicine, Bursa, Turkey

## ABSTRACT

**Objectives:** The aim of this study is to evaluate the effect of cesarean section (CS) on the incidence and recovery of congenital nasolacrimal duct obstruction (CNLDO).

**Methods:** The files of patients diagnosed with CNLDO, epiphora, and dacryocystitis under the age of 24 months were identified retrospectively. Patients were divided into 2 groups according to whether they were born via normal vaginal delivery (VD) or CS. Demographic data, gestational age, birth weight, application of lacrimal massage, and surgical treatment modalities were recorded from medical records.

**Results:** The study included 173 consecutive patients, 68 were females and 105 were males. Eighty-two (47.4%) patients were born via VD and 91 (52.6%) patients were born via CS. The frequency of CS delivery in children with CNLDO (47.4%) was significantly higher than the same hospital's total frequency of CS delivery (40.2%) ( $\chi^2 = 11$ ,  $df = 1$ ,  $p = 0.001$ ). At presentation, the mean age of the patients born via CS was lower than patients born via VD ( $9.4 \pm 6.8$  months vs  $12.07 \pm 8.8$  months) ( $p = 0.027$ ). In 40 patients who had a family history of CNLDO, 23 patients recovered through non-surgical treatment, while 17 patients had a surgical intervention, which was found to be statistically significant ( $p = 0.009$ ). The gestational age and birth weight of patients born via CS were significantly lower than patients born via VD ( $p < 0.001$  and  $p = 0.01$ , respectively).

**Conclusions:** Cesarean section delivery could increase the incidence of CNLDO.

**Keywords:** cesarean section; vaginal delivery; congenital nasolacrimal duct obstruction

Congenital nasolacrimal duct obstruction (CNLDO) is one of the most common eye disorder in infants with an incidence of 5.7% and 20% [1-3]. Symptoms begin in the first month after delivery in 95% of patients [2]. In addition to epiphora, bacterial infections can develop secondary to tear stasis, resulting in burrs and crusting of the eyelids [4]. The development of nasolacrimal canal ranges from 6th months of intrauterin life to weeks following birth. Hasner valve (HV) is located at the distal end of na-

solacrimal canal which opens into the inferior meatus. The most common cause of obstruction is the presence of the Hasner membrane (HM), a thin mucous membrane that persists after birth. Rarely, bony canal obstructions may also occur [5, 6]. It has been reported that in 70% of cases, the lacrimal canal opened spontaneously in the first 3 months and a total of 96% in the first year [7, 8].

The first line of treatment for CNLDO is lacrimal sac therapy massage (Crigler massage) for patients

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**Address for correspondence:** Hafize Gökben Ulutaş, MD., University of Health Sciences, Bursa Yüksek İhtisas Training and Research Hospital, Department of Ophthalmology, Mimar Sinan Mah., Emniyet Cad., No: 35, Yıldırım, 16310, Bursa, Turkey. E-mail: gokbenbilekulutas@gmail.com, Phone: +90 505 6058585

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younger than 12 months old. The massage is performed with the purpose of increasing the hydrostatic pressure, in order to open the obstruction by rupturing the membrane at the distal end of the canal. Lacrimal canal probing and irrigation is required in patients older than 12 months old. In case of the obstruction still persists after the lacrimal canal probing, silicone intubation and dacryocystorhinostomy are required [10].

The number of studies investigating the effect of cesarean section (CS) delivery on children's general health status has raised due to the increase of cesarean delivery rates in recent years. These studies suggested that babies born via CS delivery had a higher risk in the development of diseases such as obesity, diabetes mellitus, asthma, dermatitis, allergic diseases and immune system deficiencies [11]. Uterine contractions during normal vaginal delivery (VD) may naturally increase the hydrostatic pressure on the lacrimal sac which Crigler massage aims to mimic. Therefore, symptomatic nasolacrimal duct obstruction may be fewer in babies born via vaginal delivery. Some studies suggested that frequency of CNLDO was higher in children born via CS [12-15], whereas some data indicated no association between the mode of delivery and CNLDO [16-18]. The aim of this study is to evaluate the probable effect of mode of delivery, gestational age, and birth weight on CNLDO.

## METHODS

The records of children diagnosed with epiphora, CNLDO, and dacryocystitis between January 2016 and January 2020 at department of ophthalmology, were analyzed retrospectively. The study was approved by the Institutional Ethics Committee (2011-KAEK-26/269, dated 20.05.2020). All protocols adhered to the tenets of the Declaration of Helsinki. Patients that were under the age of 24 months were included to the study. Patients who had incomplete information about birth records and a history of ocular or nasolacrimal trauma, craniofacial malformation, and lacrimal system anomaly were excluded from the study.

Following the routine ophthalmologic examinations, fluorescein dye disappearance test was performed patients with epiphora. A 2% fluorescein

solution was dropped into the conjunctival sac. Delayed clearance of fluorescein dye within 5 minutes indicates lacrimal drainage system obstruction. The parents of the patients younger than 12 months were educated about the appropriate massage methods. Antibiotic eyedrops were added to the treatment in patients accompanying conjunctivitis. Lacrimal probing under short anesthesia was carried out in symptomatic patients older than 12 months and lacrimal irrigation was performed in order to ensure the obstruction was cleared up. Two months after the probing, if the epiphora was still persisting, the lacrimal probing was repeated. Monocanalicular silicone intubation was performed in patients whose epiphora persisted after the second probing.

Demographic data, mode of delivery, gestational age, birth weight, application of lacrimal massage, surgical treatment type, recovery age, and family history were recorded from the patient's file records.

## Statistical Analysis

The data was examined by the Shapiro Wilk test to verify whether or not it presented normal distribution. The results were presented as mean  $\pm$  standard deviation or frequency and percentage. Normally distributed data were compared with independent samples t-test. Categorical variables were compared using Pearson's chi-square test and Fisher's exact test between groups. Significance level was considered as  $p < 0.05$ . Statistical analyses were performed with IBM SPSS ver.23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.).

## RESULTS

Of the 173 consecutive patients, 68 were females and 105 were males. Of these, 82 (47.4%) were born via VD and 91 (52.6%) were born via CS. Frequency of CS delivery in the same hospital between the years of 2016 and 2020 was calculated as 40.2% from the reports of obstetrics clinic. Current hospital CS rates (40.2%) were found to be significantly lower ( $\chi^2 = 11$ ,  $df = 1$ ,  $p = 0.001$ ) than the rate of CS delivery (47.4%) in patients with CNLDO.

The mean age at presentation was significantly lower in patients born via CS than patients born via

**Table 1. Patient characteristics and clinical progression**

	Total	VD	CS	<i>p</i> value
Total, n (%)	173 (100)	82 (47.4)	91 (52.6)	0.400
Age (months)		12.07 ± 8.8	9.4 ± 6.8	0.027
Gender, n (%)				0.943
Female	68 (39.3)	32 (39.0)	36 (39.6)	
Male	105 (60.7)	50 (61.0)	55 (60.4)	
Birth weight (grams)		3411.87 ± 486.9	3171.94 ± 673.51	0.01
Gestational age (weeks)		39.4 ± 1.3	38.1 ± 2	0.001
Family history, n (%)				0.729
Yes	133 (76.9)	64 (78.0)	69 (75.8)	
No	40 (23.1)	18 (22.0)	22 (24.2)	
Recovery status, n (%)	69 (39.9)	30 (43.5)	39 (56.5)	0.400
Non-surgical				
Surgical	104 (60.1)	52 (50)	52 (50)	
Recovery age (months)		15.3 ± 9	14.5 ± 7.4	0.506

Data are shown as mean±standard deviation or n (%). VD = vaginal delivery, CS = cesarean delivery

VD ( $p = 0.027$ ). The gestational age and birth weight of patients born via CS were significantly lower than patients born via VD ( $p < 0.001$ ,  $p = 0.01$ , respectively) (Table 1).

Patients were divided into 2 groups in regard of their recovery status, 69 (39.9%) who recovered with non-surgical treatment (group 1) and 104 (69.1%) who underwent surgical intervention (group 2). In group 1, 30 patients (43.5%) were born via VD and 39 patients (56.5%) were born via CS. In group 2, 52 patients (50%) were born via VD and 52 patients (50%) were born via CS. There was no statistical difference between the mode of delivery and the recovery status ( $p = 0.40$ ) (Table 2).

The parents of the patients were questioned about the adherence of the lacrimal sac massage. The answers were indicated that 54 patients (31.2%) did not receive any massage, 34 patients (19.7%) received infrequent massage and 83 patients (48%) received regular massage. Forty patients had a family history of CNLDO. In these patients, while 7 of them (17.5%) did not receive any massage, 7 patients (17.5%) received infrequent massage and 26 patients (65%) received regular massage, which was found to be statistically significant ( $p = 0.042$ ). Twenty three of 40 patients recovered though non-surgical treatment while 17 had a surgical intervention, which was found to be statistically significant ( $p = 0.009$ ).

**Table 2. Association between mode of delivery and outcomes of surgical treatment**

Treatment	VD n (%)	CS n (%)	<i>p</i> value
Non-surgical	30 (43.5)	39 (56.5)	0.400
Surgical	52 (50)	52 (50)	0.553
First lacrimal probing	41 (50)	41 (50)	
Second lacrimal probing	5 (38.5)	8 (61.5)	
Silicone intubation	4 (57.1)	3 (42.9)	
Failed	2 (100)	0 (0)	

VD = vaginal delivery, CS = cesarean delivery, n = number

When patients were divided into two groups based on gestational age (over and under 37 months), in both groups, there was no relationship found between the mode of delivery and recovery status ( $p > 0.05$ ).

## DISCUSSION

In recent years, there has been a notable increase in CS delivery in all over the world. From 1960s to nowadays, CS delivery rates have raised from 5% to 50% [19]. In Turkey, it has been reported that CS delivery rates have increased up to 40-50% [20]. Respiratory complications are more frequent in babies born via personal preference cesarean. During the labor, intrauterine pressure raised up to 200 cmH<sub>2</sub>O compared to CS delivery in which the intrauterine pressure remains at 75 cmH<sub>2</sub>O. Due to the pressure not increasing during CS, fetal lung fluid retention and respiratory system diseases are more common in children born via CS [21, 22]. Lacrimal massage is the most effective method in treatment of CNLDO, and the rationale of this technique is depend on increasing the hydrostatic pressure in lacrimal sac. Through a similar mechanism, lacrimal irrigation can also open the HM. Since exposure to the intrauterine pressure is lower in babies born via CS compared to VD, the incidence of CNLDO may be higher in these children.

In this study, there was no difference between CS and VD rates in patients with CNLDO however, rates of CS delivery of CNLDO patients in our hospital was significantly higher than the rates of CS delivery in the study region overall. The mean presentation age of patients born via CS was significantly lower than patients born via VD. The delivery mode did not have an impact on the recovery status and response to surgical intervention.

Spaniol *et al.* [12] found no significant difference between the overall CS rate and incidence of CNLDO. Patients born via CS delivery were further divided to primary CS (elective and before the onset of labor) and secondary CS (after the active phase of the labor). The authors reported that the relative risk of CNLDO was 1.7-fold higher in patients born via primary CS compared to the patients born via vaginal delivery and via secondary CS [12]. Due to the lack of normal birth mechanisms in primary CS, they suggested that the risk of CNLDO was higher. In our study, primary and

secondary CS was not distinguished in patients born with CS. Despite this, CS delivery rate in patients with CNLDO (47.4%) was found higher than CS delivery rate in general population of the study region (40.2%). Some studies reported that the pressure created during normal delivery on the nose leads to nasal septal deviation. It is also believed that this compression due to the pressure also affects the nasolacrimal canal and HV [23, 24].

Fetus passing through the pelvic canal and increase in the intrauterine pressure cause certain mechanical changes in the soft tissue and facial structures as well as affecting the hydrostatic pressure in the lacrimal drainage system and could facilitate the opening the HM. Due to the fetus being exposed to the intrauterine pressures of normal vaginal delivery and, swallowing and aspirating the collagenolytic enzymes in the amniotic fluid into the nasal cavity, the opening of HM is facilitated. In the study conducted by Tavakoli *et al.* [13], CS delivery rate (60.6%) of 104 CNLDO patients was significantly higher than the CS delivery rate (47.9%) of the general population in their study region ( $p = 0.0097$ ). Patients born via CS presented to their institution at an earlier age than patients born via VD, which was also the case in our study. Patients born via VD had a tendency to improve with conservative treatment ( $p = 0.001$ ). In this study, the higher age at presentation of those born with VD might indicate that they recovered earlier with conservative treatment however, there was no statistical difference between CS and VD group in terms of tendency to improve with conservative treatment.

Karti *et al.* [25] found that almost half (45.5%) of the CNLDO patients who improved with conservative treatment were 6 months of age or younger, and 78.8% were 9 months or younger. Due to the mean age of the patients presenting at our hospital was  $10.7 \pm 8$  months, they passed the stage of high likelihood of improvement with conservative treatment. We believe that this is the reason of the lower than expected number of patients recovered with conservative treatments in our study.

In a recent study, first lacrimal probing procedure was failed in 29 of 50 patients. Twenty five of 29 patients who received additional treatment, were born via CS through an unclear mechanism, they believed that patients born with CS were more complex CNLDO cases and required more additional therapies



[13]. The absence of swallowing and aspirating the collagenolytic enzymes may result in a more resistant HM requiring additional intervention.

In our study there was no statistically significant difference between surgical success and mode of delivery. Our surgical success rate after the first probing was 78.8% which is consistent with the literature (72-97%) [26-28]. Similar to our study, Kuhli Hattelbach *et al.* [15] showed that cesarean delivery increased the prevalence of CNLDO however they did not find a relationship between the mode of delivery and surgical success. Palo *et al.* [16] found no relationship between mode of delivery and CNLDO in their study conducted with 200 patients (97 VD, 103 CS) who underwent surgical intervention. However, they found a significant relationship between the complex type CNLDO (n = 28) and cesarean delivery ( $p = 0.016$ ). Alakus *et al.* [17] suggested no relationship between CNLDO and CS delivery. However, in patients born via first delivery, the CS delivery rate in patients with CNLDO (58.7%) was significantly higher than those without CNLDO (20.7%) ( $p < 0.001$ ) [17]. They stated that permanent pelvic floor damage develops in the first vaginal delivery, which causes less labor pressure and fetus compression in the following vaginal deliveries.

In our study, the frequency of regular lacrimal massage was higher in patients who had a family history of CNLDO. Therefore, in this group of patients, the number of patients requiring surgery was less than the patients recovering spontaneously. We deduced that this outcome was due to the prior experience of the parents about the disease and lacrimal sac massage.

### Limitations

The limitations of the study include retrospective data collection, small number of patients and surgical interventions were performed by different surgeons. Also, patients who recovered with conservative treatment in earlier months of life could not be included to the study.

### CONCLUSION

CS delivery may increase the incidence of CNLDO. Prospective studies with larger patient series

are required for assessing the association between CNLDO and mode of delivery.

### Authors' Contribution

Study Conception: HGU, GUG; Study Design: HGU; Supervision: HGU, GUG; Funding: HGU; Materials: HGU; Data Collection and/or Processing: HGU, GUG; Statistical Analysis and/or Data Interpretation: HGU; Literature Review: HGU; Manuscript Preparation: HGU and Critical Review: GUG.

### Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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