

Mode of delivery, birth weight and the incidence of congenital nasolacrimal duct obstruction

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Abstract

• **AIM:** To study any possible association of congenital nasolacrimal duct obstruction (CNLDO) with mode of delivery, birth weight and gestational age.

• **METHODS:** We retrospectively reviewed charts of all patients ($n=2591$) under the age of 3y who were born between April 2015 and May 2017 and were examined at the Ophthalmology Clinic of Emsey Hospital Istanbul, Turkey. We identified patients ($n=105$) who were diagnosed as CNLDO. The mode of delivery, birth weight and gestational age along with any adverse event during or after delivery or any other health history were determined. Birth statistical data were obtained from the hospital's medical records database.

• **RESULTS:** Gestational age of babies who were born via cesarean section (CS) was lower than gestational age of babies who were born via normal spontaneous vaginal delivery (NSVD; $P=0.002$). Babies who were born via CS were found to have 3.75 times higher risk of developing NLDO when compared to babies who were born via NSVD (OR=3.754).

• **CONCLUSION:** There is a possible association between CS and CNLDO.

• **KEYWORDS:** congenital nasolacrimal duct obstruction; cesarian section; normal spontaneous vaginal delivery

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INTRODUCTION

Congenital nasolacrimal duct obstruction (CNLDO) is one of the most common reasons of pediatric ophthalmology clinic visits. Incidence is reported to be approximately 5.7%

approximately^[1]. It is the most common cause of epiphora in the first few months of life^[2]. The obstruction is due to either a membrane at the distal end of the duct, bony obstruction or narrowing of the duct with apposition of the nasal mucosa demonstrated by ultrahigh resolution computed tomography^[3]. The site of the obstruction is usually at the area of the Hasner valve; a one-way-valve at the entrance of the nasolacrimal duct obstruction to nose^[4-5]. Lorena *et al*^[6] reported association between prematurity and CNLDO in a report and reasoned that nasolacrimal duct is not fully developed until the eight month of gestation. Epiphora, secondary infection due to stasis of tears and matting of the lashes are classical symptoms with presentation at around 3-4 weeks of age. First line of treatment is lacrimal sac massage or topical antibiotics if there is any sign of infection. According to Pediatric Eye Disease Investigator Group (PEDIG) study the rate of resolution of nasolacrimal duct obstruction (NLDO) with these conservative measures in infants 6 to 10 months old within 6mo was 66%^[7-8].

There is significant rise in the rate of medically indicated and personal preference primary cesarean section (CS) in many countries especially Turkey^[9]. The 2008 report of Turkey Population Health Research (TPHR), reports rate of cesarean delivery as 45% which indicates a 24% increase since 2003^[10]. Rates of cesarean delivery according to 2010 reports by World Health Organization (WHO) in the United States is 30.2%, in England 22%, in Italy 37.4%, and in Brazil 41.3%^[11]. CS is thought to be associated with adverse effects in the offspring including metabolic syndrome, type 1 diabetes and asthma^[12]. There are a few studies that found an association between CS and increased prevalence of CNLDO^[13-14]. In accordance with increased CS rates all around the world, there might be a yet unrecognized emerging increased incidence of these associated problems. In this study our purpose was to investigate any possible relationship in the incidence of CNLDO and the mode of delivery.

SUBJECTS AND METHODS

Ethical Approval This study was conducted in accordance with the tenets of the Declaration of Helsinki. Informed consent was obtained from the subjects.

Charts of all patients under the age of 3y who were born between April 2015 and May 2017 and that were examined at the Ophthalmology Clinic of Emsey Hospital Istanbul, Turkey

were retrospectively reviewed ($n=2591$). Patients who were diagnosed as CNLDO and who met the inclusion criteria were identified ($n=105$).

Emsey Hospital accepts social security public insurance (SGK) as the primary insurance. SGK is the insurance most people carry in Turkey. In the past couple of years new regulations were instated by Turkish Ministry of Health in order to decrease the rate of elective CS across the country. These regulations not only order declining of reimbursement in elective CS but also limit the reimbursement of total CS to private hospitals when a certain number of CS at a certain time has been reached.

Majority of our study population was comprised of babies born *via* secondary CS. However in the setting of prior history of CS, mode of delivery preferred by obstetricians in general and in Emsey Hospital is almost always CS. So some of the CS babies in our study were born actually *via* non-elective primary CSs for this particular reason.

Turkish Pubic Health Association has guidelines in different disciplines of medicine for screening and well child check up purposes for infants, children and adolescents. According to Protocol 9A, they recommend routine complete ophthalmological exam to all infants between the ages of 0-3mo^[15]. Emsey Hospital follows these guidelines and all infants between 0-3 months of age undergo complete ophthalmological exam at the hospital.

All of the clinical examinations and the surgical procedures if needed had been performed by a single ophthalmologist at Emsey Hospital (Dolar Bilge A). Diagnosis had been based on the typical signs and symptoms of CNLDO including epiphora, mucoid mucopurulent discharge from the puncti upon pressure over the lacrimal sac area and matting of the eyelashes. In every patient clinical suspicion had been confirmed by dye disappearance test. Demographic characteristics of the patients including gender, gestational age, birth weight percentiles, mode of delivery, side of NLDO and surgical intervention done if needed were determined. Calculation of birth weight percentiles were done by using percentile scales reported for the Turkish population^[16]. For all of the patients who presented under the age of 1y, conservative treatment in the form of lacrimal sac massage and topical antibiotics if there is evidence of infection had been recommended ($n=79$). Surgical intervention, either probing alone or along with nasolacrimal duct intubation had been performed for those who had presented after the age of 1y ($n=24$). Twenty patients had been recommended probing and 4 Ritleng tube intubation. Among those 20 patients 6 of them refused the treatment and lost to follow up. One planned probing case had been cancelled because of relief of symptoms with recommended massage. A total of 13 patients had undergone probing and 4 had Ritleng tube intubation.

Inclusion criteria were as follows: 1) Age of presentation to the clinic between 0 and 3 and had been diagnosed as CNLDO; 2) No prior surgical treatment for CNLDO; 3) Patients with complete hospital records of birth including birth weight, gestational age, mode of delivery and any complication or health record related to birth; 4) No other ophthalmologic disease including but not limited to punctal agenesis, congenital entropion, congenital glaucoma, congenital cataract. Birth statistical data were obtained from the hospital's medical records department. Number Cruncher Statistical System (NCSS) 2007 Statistical Software (Utah, USA) program was used for the statistical analysis. During the evaluation of the study data, regarding the comparisons of quantitative data as well as descriptive statistical methods (mean, standard deviation, median, frequency, ratio), Student's *t*-test was used for the intergroup comparisons of parameters with normal distribution and Mann-Whitney *U* test was used for the determination of the group causing difference and in the evaluation of two groups. Fisher Freeman-Halton test and Pearson Chi-square tests were used for comparison of qualitative data. The results were evaluated in 95% confidence interval and at a significance level of $P<0.05$.

RESULTS

The study included a total of 105 babies who were diagnosed as CNLDO between April 2015 and May 2017 at Emsey Hospital Istanbul, Turkey. The 48.6% of these babies were female ($n=51$) and 51.4% ($n=54$) were male. Age range was between 0.10 and 29mo (mean \pm SD 5.56 \pm 7.08mo).

CS and normal spontaneous vaginal delivery (NSVD) rate among babies with a diagnosis of CNLDO ($n=105$) were compared with CS and NSVD rates among total live births in the same hospital at the corresponding period ($n=2591$). Among babies with CNLDO, rate of CS (8.0%) was higher than rate of NSVD (2.3%). Among live births at the hospital in the corresponding period the rate of NSVD (68.5%) was higher than the rate of CS (31.5%). Incidence of CNLDO in babies born *via* CS was higher than babies who were born *via* NSVD which was statistically significant ($P=0.001$). Odds ratio was 3.754 for CNLDO (95%CI: 2.509-5.618; Table 1).

Gestational age between the two groups showed significant difference. Gestational age of babies in CS group was lower than gestational age of babies in NSVD group which was statistically significant ($P=0.002$). However birth weight in relation to mode of delivery did not show a statistical difference ($P>0.05$). Percentile values were found to be high in CS group in comparison to NSVD group which was statistically significant ($P=0.026$). Percentile classifications were also differed between the two groups ($P<0.05$); 25-50 percentile in NSVD group; 51-75 percentile in CS group was statistically significant high (Table 2).

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Table 1 Nasolacrimal duct obstruction risk in relation to the mode of delivery

Parameters	Total live births at the hospital	NLDO (+)	NLDO (-)	OR (95%CI)	<i>n</i> (%)
Mode of delivery				3.754 (2.509-5.618)	0.001
CS	816 (31.5)	65 (8.0)	751 (92.0)		
NSVD	1775 (68.5)	40 (2.3)	1735 (97.7)		
Total	2591 (100)	105 (4.1)	2486 (95.9)		

NLDO: Nasolacrimal duct obstruction; CS: Cesarean section; NSVD: Normal spontaneous vaginal delivery; OR: Odds ratio. ^aPearson Chi-Square test.

Table 2 Gestational age, birth weight and percentile distributions in relation to the mode of delivery

Parameters	Total	CS (<i>n</i> =65)	NSVD (<i>n</i> =40)	<i>P</i>
Gestational age (wk)				
Mean±SD	38.73±1.26	38.43±1.30	39.21±1.03	0.002 ^a
Min-max (median)	35-41 (39)	35-41 (38)	37-41 (39)	
Birth weight (g)				
Mean±SD	3320.66±499.63	3339.85±566.99	3289.48±369.47	0.583 ^a
Min-max (median)	1980-4945 (3255)	1980-4945 (3255)	2500-4045 (3255)	
Percentiles in relation to gestational age				
Mean±SD	54.87±28.14	59.57±27.86	47.23±27.21	0.026 ^b
Min-max (median)	3-97 (50)	3-97 (50)	3-95 (50)	
0-24 percentile	12 (11.4)	8 (12.3)	4 (10.0)	
25-50 percentile	52 (49.5)	26 (40.0)	26 (65.0)	0.032 ^c
51-75 percentile	17 (16.2)	15 (23.1)	2 (5.0)	
>75 percentile	24 (22.9)	16 (24.6)	8 (20.0)	

^aStudent's *t*-test; ^bMann-Whitney *U* test; ^cFisher Freeman Halton test.

There was no statistically significant difference in the rate of NLDO among males and females ($P>0.05$). Rate of NLDO was 3.9% and 3.8% among females and males, respectively.

DISCUSSION

As the rates of patient preference CS have risen globally, the health impacts of this trend on the mother and the baby has been extensively studied^[17-18]. Some of the biological mechanisms that occur during the vaginal delivery but not during elective CS and possibly partially during secondary CS may include initiation of formation of microbiota of the neonate, increased intrauterine pressure transmitted to the neonate's body and exposure of the fetus to increased activity of collagenolytic enzymes in amniotic fluid which are released after rupture of membranes^[19-21]. The influence of CS on these biological mechanisms, whether primary or secondary before or after rupture of the membranes respectively, remain controversial. Especially during elective CS contact of fetus to maternal vaginal and intestinal flora is limited or even absent. Since early development of intestinal microbiota of infants is thought to be highly related to the development of the immune system; elective CS may be responsible from an observed increased incidence of respiratory infections and asthma in the offspring^[11].

Recently couple of studies investigated CS as a risk factor for

CNLDO^[13-14,19,22]. Spaniol *et al*^[14] retrospectively compared the incidence of delivery mode in 386 children with CNLDO with the incidence of delivery mode from a corresponding population. They were unable to find a significant association between overall incidence of CS and the incidence of CNLDO. However they found a significantly increased incidence of primary CS among patients with CNLDO (73.15%, $P<0.05$). And relative risk of CNLDO in children delivered *via* primary CS was 1.7. They proposed that increased uterine pressure during the stages of labor as well as increased activity of collagenolytic enzymes released after rupture of membranes might be contributing mechanisms for opening up of valve of Hasner. Digital massage as a successful mode of treatment for CNLDO is in accordance with this mechanical theory. When collagenolytic enzymes which help rupture of membranes get in contact with the nasal cavity through fetus swallowing the amniotic fluid, opening of Hasner valve might be happening as well. Kuhli-Hattenbach *et al*^[13] studied a total of 107 patients with CNLDO. They compared prevalence of CS in these patients and in 88 gestational age matched patients at the corresponding period of the same area in Germany. They found a statistically significant association between CNLDO and CS ($P=0.009$). Subgroup analysis revealed a significant association between primary CS and CNLDO ($P=0.00004$).

Palo *et al*^[22] prospectively studied 200 children with CNLDO and evaluated the patients in terms of delivery mode, elective or emergency CS, primary or secondary CSs, type of CNLDO (simple or complex) and did not find any significant association between the incidence of CNLDO and mode of delivery. Among the complex CNLDO group a significant association was found with CS delivery ($P=0.016$). In general, no significant association was found between the incidence of CNLDO and mode of delivery. Among the complex CNLDO subgroup ($n=28$), a significant association was found with delivery by CS ($P=0.016$); however, no such association was noted between vaginal delivery and types of CNLDO ($P=0.09$)^[22]. In this study the overall rate of CS in the hospital was approximately 31% which is comparable with the rates in the United States of America. We found incidence of CNLDO in the hospital as 4.1% which is a little lower than reported in the literature. We found that incidence of CNLDO in babies born *via* CS was significantly higher than babies born *via* NSVD ($P=0.001$). Babies born *via* CS carried 3.7 times higher risk of NLDO compared to babies born *via* NSVD. This finding is confounded^[22] by the fact that gestational age of CS babies (mean=38.43wk) were significantly lower in comparison to NSVD babies (mean=39.21wk). So in our study population actual reason of higher incidence of CNLDO in the CS group might be lower gestational age.

However although the difference is statistically significant, mean and minimum and maximum values of gestational age in the two groups did not show a big difference (Table 2). This may suggest either even slight immaturity may be contributing to higher risk of CNLDO or there actually is a strong association between CS and CNLDO. Another finding that supports this association in our study population is that birth weight in relation to mode of delivery did not show a statistical difference ($P>0.05$). So we are not sure whether these two findings contradict or support each other in order to state a strong association between CS and CNLDO. Or the reason of our findings is immaturity itself. Another weakness of this study is primary and secondary CS were not clearly separated as subgroup analysis. Most cases were secondary CSs and primary CSs because of a prior history of CS. This might be another confounding factor of our results.

Weaknesses of our study, retrospective, single institution, and inability to distinguish patients as primary and secondary CS.

In conclusion, although there are confounding factors of our results, we suggest a possible association between CS and CNLDO. Further studies with gestational age matching and prospective design are required to validate such an association.

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