Incidences Of Nasal Septal Deviation And Its Effect On Surgical Success In Patients With Congenital Nasolacrimal Dacryostenosis

fatma esin özdemir (fatmaesin79@hotmail.com)
İstanbul Kanuni Sultan Suleyman Training and Research Hospital: Istanbul Kanuni Sultan Suleyman Eğitim ve Arastirma Hastanesi

selin Üstün Bezgin
İstanbul Kanuni Sultan Suleyman Training and Research Hospital: Istanbul Kanuni Sultan Suleyman Eğitim ve Arastirma Hastanesi

Zeliha Karademir
İstanbul Kanuni Sultan Suleyman Training and Research Hospital: Istanbul Kanuni Sultan Suleyman Eğitim ve Arastirma Hastanesi

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Research Article

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Abstract

OBJECTIVE: An investigation of incidences of nasal septal deviation (NSD) and its effect on surgical success in patients with congenital nasolacrimal dacryostenosis (CNLDO).

METHODS: A retrospective review was made of the medical records of patients who presented to the ophthalmology clinic due to epiphora, were diagnosed with CNLDO and underwent probing. The diagnosis was established by history, clinical examination, and fluorescein disappearance test (FDT). Patients with FDT grade 2 and 3 underwent surgery. Success was defined as postoperative FDT grade 0–1. The patients were assessed in terms of gestational week, birth weight, type of delivery, nasal endoscopic examination findings (presence of NSD), time of surgery, treatments received, recurrence and complications.

RESULTS: The study comprised 72 eyes of 58 patients who were diagnosed with CNLDO and underwent surgical treatment. Of the patients, 44 (75.86%) had unilateral, and 14 (24.14%) had bilateral CNLDO; 41 (56.94%) were female and 31 (43.06%) were male. The mean gestational age at birth was 38.01 weeks (32–41 weeks), the mean birth weight was 3321.25 (2020–4500 g), the number of cases delivered by cesarean section was 40 (55.56%), and 32 (44.44%) were vaginal deliveries. There were 13 (18.06%) patients with detected NSD after endonasal examination and 59 (81.94%) patients with normal endonasal examination in the Otorhinolaryngology (ORL) department. The time of surgery was 10 –34 months (mean: 19.06 months, SD: 5.73), the length of follow-up was 6–16 months (mean: 9.90 months, SD: 2.58). The rate of probing success was 80.6% (58 eyes), and there was recurrence in 19.4% (14 eyes).

The success rate of the probing did not statistically significantly differ by gender (p=0.323), the mean birth week (p=0.123), the mean birth weight (p=0.186), the involved eye (p=0.891), the type of delivery (p=0.891), the mean length of follow-up (months) (p=0.701), the mean month of surgery (p=0.607), and the side of NSD (p=0.853). The incidence of NSD was statistically significantly higher in the group in which the probing failed, than in the group in which the probing was successful (p=0.004).

CONCLUSION: NSD was identified in 18% of the patients who were diagnosed with CNLDO and underwent surgery. The incidence of NSD was significantly higher in the group where the probing procedure failed. Pre-treatment nasal endoscopy is important for the treatment planning and prognosis of CNLDO patients.

Introduction

Congenital nasolacrimal duct obstruction (CNLDO) is the most common congenital anomaly of the lacrimal system. The nasolacrimal system begins with the puncta, continues along the lacrimal canaliculi and lacrimal sac, and terminates in the nasolacrimal duct and inferior nasal meatus. Although CNLDO may be congenitally symptomatic, it most frequently occurs during the first few weeks of life when tear production matures. The incidence is approximately 2–6%. CNLDO, the most common cause of epiphora in the pediatric age group, is known to spontaneously resolve itself or with massage and topical
antibiotics, particularly within the first year of life\textsuperscript{3–4}. Probing is the first choice of treatment for patients aged > 1 year with persistent epiphora. The purpose of this technique is to reach the distal end of the nasolacrimal duct and to open the obstruction by drilling the Hasner’s membrane. \textsuperscript{5}

The bony structures of the nasolacrimal duct are located in the lateral nasal wall, suggesting that the structural abnormalities of this duct system may be affected by pathologies of the nasal cavity.\textsuperscript{6} In a previous study on adult patients, a statistically significant relationship was found between acquired nasolacrimal duct obstruction (acquired NLDO) and NSD. \textsuperscript{7} There are other studies that examined nasal pathologies and nasolacrimal duct obstruction in adult patients.\textsuperscript{8–11} In the literature, there is only one study in which nasal endoscopic examinations were assessed in patients requiring surgical intervention due to CNLDO. The said study examined 100 pediatric patients undergoing surgery for epiphora (probing and syringing of the nasolacrimal ducts) and in each case detected nasal septal deviation.\textsuperscript{11} In our clinical practice, we consult with the ORL department for the nasal examination and assessment of every patient presenting with epiphora who are suspected to have CNLDO.

In this study, our objective was to retrospectively assess the demographic characteristics of patients, the incidence of NSD via nasal endoscopic examination and its effect on surgical success.

**Materials And Methods**

This is a retrospective study that was conducted in accordance with the principles of the Declaration of Helsinki. Ethics committee approval was obtained. All patients were informed prior to the operation. The advantages and disadvantages of the operation were explained and surely parents or carers signed an informed consent form.

The study retrospectively reviewed the medical records of children aged 12–36 months, who were referred to the oculoplasty outpatient clinic of our hospital’s ophthalmology department, due to epiphora and a diagnosis of CNLDO after ophthalmological examination between 2017 and 2019. The patients who had their initial surgery after 12 months of age and who were followed up for at least 6 months were included in the study. Patients with punctal anomalies, canalicular stenosis, valvular malformation, a history of trauma, and aged > 36 months at the time of probing were excluded from the study.

All cases had a full ophthalmological examination. The differential diagnosis of CNLDO should include conjunctivitis (e.g., discharge, tearing, light sensitivity, foreign body sensation, redness), corneal abrasion (e.g., pain, irritation, tearing, significant light sensitivity, history of trauma), and glaucoma (e.g., tearing, light sensitivity, excessive blinking, cloudy cornea). Other causes include corneal or conjunctival foreign bodies, allergies, meningeal irritation, central nervous system tumors, abnormalities of the lids and lashes, or any other disorder of the cornea (congenital herpes) or conjunctiva causing irritation. The diagnosis was established by history, clinical examination, and fluorescein disappearance test.
The FDT was performed by instilling one drop of 2% fluorescein into the unanesthetized conjunctival fornix of each eye. After 5 minutes, the thickness of the fluorescence of the tear meniscus was measured with the help of a cobalt-blue filter. This is because it normally takes 5 minutes for the tears to drain down the system. This is an excellent quantitative test for measuring lacrimal drainage function, especially in children. In this study, the following grading was used:

- • 0 - no fluorescence in the conjunctival sac
- • 1 - thin fluorescing marginal tear strip persists
- • 2 - more fluorescein persists, between 1 and 3
- • 3 - wide, brightly fluorescing tear strip

Patients with FDT grade 2 and 3 were considered to have CNLDO and underwent surgery. All patients diagnosed with CNLDO received an ORL examination and nasal endoscopy. The presence/absence of NSD on nasal endoscopy was recorded. Patients with detected allergic rhinitis at ORL examination were treated preoperatively. All surgeries were performed under general anesthesia.

**Surgical technique**

For the probing procedure, the inferior and superior puncta were first dilated. Lacrimal irrigation was performed with saline. The probe was introduced vertically until the ampulla, and then rotated horizontally 90 degrees. The probe was advanced up to the nasal wall of the lacrimal sac (until reaching the bone). The probe was then directed 90 degrees downward until the membrane rupture was felt. The same procedure was performed through the inferior punctum. The lavage fluid prepared with rifampicin (1 ml rifampicin, 125 mg/3ml, toxic dose of rifampicin in children 600 mg) was administered into the nasolacrimal system to check for the patency and the fluid was aspirated from the nasal cavity. The procedure was considered to be successful upon observing the discharge of the rifampicin solution. The lacrimal system was then irrigated with a dexamethasone solution. In patients with bilateral obstruction, lavage and probing were performed on both eyes in the same session. Topical antibiotics (tobramycin four times daily), a fluorometholone steroid (four times daily) for postoperative two weeks and nasal xylometazoline spray was applied (twice daily).

The patients attended control visits at postoperative day 1, week 1, week 2, month 1, month 3, and every three months thereafter. The complaint of epiphora was queried at the control visits, and FDT was performed. Patients with no symptomatic epiphora and with FDT grade 0 and 1 at the first-month follow-up visit were considered to have a successful surgery. Intraoperative and postoperative complications were assessed.

Patients with a failure in the initial probing underwent a repeat probing 2 months later, and silicone intubation was performed in the same session. Patients with a failure in silicon intubation then underwent external dacryocystorhinostomy.
The relationships of NSD with gestational age at birth, birth weight, type of delivery were evaluated. The relationship between NSD and surgical success was evaluated. Complications, recurrences and treatments for recurrences were examined.

**Statistical Analysis**

The NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA) was used for statistical analyses of the study data. Aside from descriptive statistical methods (mean, standard deviation) used to assess the data, the Shapiro-Wilk test for normality was used to analyze the distribution of variables, the Independent Samples t-test for the paired comparison of normally distributed variables and the Chi-square test for the comparison of qualitative data. The results were evaluated at a significance level of $p < 0.05$.

**Results**

The study included 72 eyes of 58 patients who were diagnosed with CNLDO and underwent surgical treatment. Of the patients, 44 (75.86%) had unilateral, and 14 (24.14%) had bilateral CNLDO; 41 (56.94%) were female and 31 (43.06%) were male. The mean gestational age at birth was 38.01 weeks (32–41 weeks), the mean birth weight was 3321.25 (2020–4500 g), the number of babies delivered by cesarean section was 40 (55.56%), and 32 (44.44%) were vaginal deliveries. There were 13 (18.06%) patients with detected NSD after endonasal examination and 59 (81.94%) patients with normal endonasal examination in the ORL department. In these 13 patients, the NSD was on the left in 9 (69.2%) eyes, and on the right in 4 (30.8%) eyes, and the CNLDO was on the deviated side in all the eyes. The time of surgery was 10–34 months (mean: 19.06 months, SD: 5.73) and the length of follow-up was 6–16 months (mean: 9.90 months, MD: 2.58). None of the patients developed complications during probing. Probing was considered successful in the patients with FDT grade 0–1 in the ophthalmologic examination performed at 1 month postoperatively. The rate of probing success was 80.6% (58 eyes). Recurrence was detected in 19.4% (14 eyes) of the patients.

Probing success did not statistically significantly differ by gender ($p = 0.323$), the mean birth week ($p = 0.123$), the mean birth weight ($p = 0.186$), the involved (right/left) eye ($p = 0.891$), the type of delivery ($p = 0.891$), the mean length of follow-up (months) ($p = 0.701$), the mean month of surgery ($p = 0.607$), and the side of NSD ($p = 0.853$). The incidence of NSD was statistically significantly higher in the group with failed probing than in the group with successful probing ($p = 0.004$) (Table 1).
Table 1
*Independent Samples t-test + Chi-square test

|                        | Unsuccessful | Successful | p   |
|------------------------|--------------|------------|-----|
| **Bilateral**          |              |            |     |
| Bilateral              | 10           | 83.33%     | 34  |
| Bilateral              | 2            | 16.67%     | 12  |
| **Gender**             |              |            |     |
| Female                 | 9            | 69.23%     | 32  |
| Male                   | 4            | 30.77%     | 27  |
| **Gestational Age at Birth** | 38.69 ± 1.97 | 38.69 ± 1.97 | 0.123* |
| **Weight**             |              |            |     |
|                        | 3461.54 ± 553.08 | 3461.54 ± 553.08 | 0.186* |
| **Type of Delivery**   |              |            |     |
| Cesarean               | 7            | 53.85%     | 33  |
| Vaginal                | 6            | 46.15%     | 26  |
| **Septal Deviation**   |              |            |     |
| No                     | 7            | 53.85%     | 52  |
| Yes                    | 6            | 46.15%     | 7   |
| **Side of Deviation**  |              |            |     |
| Left Eye               | 4            | 66.67%     | 5   |
| Right Eye              | 2            | 33.33%     | 2   |
| **Month of Op.**       | 18.31 ± 5.6  | 18.31 ± 5.6 | 0.607* |
| **Length of Follow-up (months)** | 10.15 ± 2.97 | 10.15 ± 2.97 | 0.701* |
| **Eye**                |              |            |     |
| Left Eye               | 6            | 46.15%     | 29  |
| Right Eye              | 7            | 53.85%     | 30  |

Fourteen patients with recurrence underwent repeat probing and silicone intubation two months after the initial surgery. While the procedure was successful in 10 (71.14%) of these patients, two patients were found to have a further recurrence and were scheduled for external dacryocystorhinostomy.

**Discussion**

CNLDO is the most common lacrimal system abnormality, occurring in up to 6% of all newborns. The most common cause is incomplete canalization at the caudal end of the nasolacrimal duct, leaving an imperforate membrane at the valve of Hasner. Infants often present only once tear production matures with chronic epiphora, eyelash matting, increased tear lake, or an accumulation of mucoid discharge from the stasis of the tear lake and reflux of tears back into the lacrimal sac.\textsuperscript{12–13} Among the reported risk factors for CNLDO are maternal infections during pregnancy, radiation exposure, medication use during
pregnancy, and some occupational hazards that also cause congenital anomalies. However, the etiopathogenesis is still unclear.\textsuperscript{14}

The lacrimal system comprises two main components: the secretory and drainage systems. The drainage system begins at the punctum, continues along the canaliculi, lacrimal sac and nasolacrimal duct and terminates in the sinus ostium. There is a close relationship between the nose and the tear drainage system. This relationship may cause the nasolacrimal system to be affected by intranasal pathologies. Any obstruction in the nasolacrimal system drainage causes epiphora. The nasolacrimal system is most often obstructed in the inferior nasal region. Nasal pathologies such as septal deviation, turbinate hypertrophy, and concha bullosa that were suspected to affect this region were believed to cause nasal duct obstruction, and studies were conducted in this regard.\textsuperscript{15–18}

The first line treatment is considered to be the administration of hydrostatic Crigler massage and topical antibiotics to the lacrimal sac in infants with CNLDO, which has been reported to achieve a success rate of around 90%.\textsuperscript{19–20} In cases with CNLDO that cannot be opened using Crigler massage and topical antibiotic therapy, the first choice of treatment is probing. The success rate of probing ranges from 75–100% with a tendency to decrease with increasing age.\textsuperscript{21–23} According to the reports of the PEDIG study, the success rate of primary intubation was 92% for age 12–24 months and 84% for age 24–25 months.\textsuperscript{24–25} We performed probing on all patients after 1 year of age. We did not include patients who underwent probing at an age > 3 years. The success rate of probing was 80.6% (58 eyes) in our case series. The goal of treatment in CNLDO is to achieve maximum success with minimum surgery. The first probing was failed in 14 (19.4%) of our patients. Fourteen patients with recurrence underwent repeat probing and silicone intubation two months after the initial surgery. Ten (71.14%) of these cases had successful outcomes. The incidence of NSD was also statistically significantly higher in the group with failed probing than in the group with successful probing (p = 0.004). This finding suggests that septal deviation is a significant factor that affect the success of probing.

Despite several studies in the literature regarding acquired NLDO and nasal pathologies, we came across only one study in which Gray treated 100 cases that were related to nasal pathologies in congenital dacryostenosis in children.\textsuperscript{11} This may be due to the difficulty of nasal examination, especially in patients under 2 years of age, as well as the avoidance of tomographic imaging that reveals the paranasal anatomy in detail because of radiation exposure in this age group.

The study by Kallman et al. on adult cases examined coronal CT scans of patients with sinonasal abnormalities (osteomeatal complex disease, ethmoidal opacification, agger nasi cell opacification, concha bullosa and NSD) and reported acquired NLDO in 87% of the group with sinonasal abnormalities, compared with 63% in the control group (p < 0.05). The incidence of NSD, in particular, was statistically significantly higher in the acquired NLDO group than in the control group (p < 0.05).\textsuperscript{16}

Yazıcı et al. compared the paranasal sinus CT findings of patients with unilateral acquired NLDO with those of the healthy side. The authors evaluated the paranasal sinus CT scans in terms of septal
deviation, inferior turbinate thickness, presence of agger nasi cells, concha bullosa, maxillary and ethmoid sinusitis, and osteomeatal pathology, which were believed to cause NLDO, and compared the findings between two groups. The authors reported that there was no statistically significant difference in findings between the healthy side and the side with acquired NLDO. However, in addition the authors found that only the side of the septal deviation was correlated with the side of the acquired NLDO (p = 0.008).

Dikici et al. examined the relationship between NSD and paranasal abnormalities in the etiology of primary acquired NLDO. The authors established a statistically significant relationship between acquired NLDO and the axial location of NSD classification, axial angle of septal deviation classification, paradoxical middle turbinate, angle between the bony inferior turbinate and medial wall of the maxillary sinus and inferior meatus measure.

Lee et al. examined the relationship between unilateral acquired NLDO and facial asymmetry. The authors reported that the septum tended to deviate towards the rudimentary side of the face and that this side had a higher incidence of acquired NLDO than the other side. The authors emphasized the importance of combining inspection and endonasal examination with an ophthalmological examination as facial asymmetry and septal deviation could be the cause of acquired NLDO. One of our patients had cleft palate anomaly. None of the patients had significant facial asymmetry.

The study by Habeşoğlu et al., which investigated the relationship of sinonasal abnormalities in the etiology of acquired NLDO, examined 41 cases with unilateral acquired NLDO and the anterior rhinoscopy, endoscopic nasal examination, and paranasal sinus computed tomography (CT) findings as well as the findings of the healthy sides. The authors found that the concha bullosa, inferior turbinate hypertrophy, osteomeatal complex disease, and maxillary sinusitis findings were significantly more on the acquired NLDO side than in the control group (p<0.05). NSD, irregularity of the middle turbinate, paradoxical middle turbinate, ethmoidal sinusitis, and Onodi cell and agger nasi cell incidence, were found high in the study group. However, none of the increases were statistically significant (p ≥ 0.05).

In our study, nasal septal deviation was evaluated by anterior rhinoscopy and endoscopic nasal examination. During the examination, the turbinates were also evaluated, but the results on the hypertrophy status of the turbinates were not included in the study due to the difficulty of grading turbinate hypertrophies, as our patients were very young. Our study did not utilize imaging methods, as in studies conducted on adult patients. Therefore, we do not have findings for other sinonasal pathologies.

In the literature, Bhattacharjee reported the incidence of NSD as 14.5% in newborns, and Bhatia (1982) as 15.4%. Goyal (1987), while examining 100 neonates, found the incidence of septal deviation higher in babies with an increased birth weight. The author further found a significantly high (50%) incidence of septal deviation in neonates born with breech presentation as compared to occiput anterior position. The study by Jeppesen and Windfield showed septal dislocation in newborns (3.19%). Incidence was reported
to be 21% by Perth (1963, 1964), 1.25% by Jazbi (1977), 25% by Sookhnandan and 21.8% by Saim and Said.\textsuperscript{17} In our case series, the incidence of NSD was 18.06%.

We could identify only one study in the literature that examined the relationship between NSD and CNLDO in the pediatric population. In the said study, Gray examined 100 children with blocked nasolacrimal ducts and observed that septal deformity or deviation was correlated with blockage in 100% of cases. For comparison, the author reported that the incidence of septal deformity in 2308 consecutive births was 42%. He postulated that septal deformity or deviation in the narrow pediatric nose compresses the anterior end of the inferior turbinate, thereby occluding the nasolacrimal duct orifice.\textsuperscript{11} Similarly, Bernstein noted that dacryocystitis and even conjunctivitis were seen in the pediatric patient as a complication of chronic sinusitis. He speculated that the direct spread of infection from the nose and paranasal sinuses into the orbit, a well-accepted common cause of orbital cellulitis, might also be involved in the development of dacryocystitis secondary to sinus disease.\textsuperscript{18}

In our study, the incidence of NSD in our CNLDO cases was 18.06%. All NSD cases had CNLDO on the same side. Compared to Gray’s study, the rate of NSD in patients undergoing surgery was low. However, the incidence of NSD was significantly higher in patients with failed surgery than in those with successful surgery. This finding indicates the importance of preoperative nasal examination. With a nasal examination, the patients and their relatives can be informed better, and the information can involve the possibility of operation failure and the potential upper-line interventions, and even the priority of the interventions to the nasal pathologies before the eye operation in adult patients. In addition, we believe that the addition of silicone tube intubation to the probing as the primary treatment in NSD cases may decrease recurrences and thereby increase success.

Our study also examined birth weight, delivery type and gestational age at birth. In terms of these parameters, there was no statistical difference between the groups with successful and unsuccessful surgery. The study by Battacharjee et al. that examined the relationship of NSD with birth weight and delivery type reported that the incidence of NSD in vaginal deliveries increased with an increasing birth weight. Podoshin et al., in turn, reported no significant relationship between birth weight and NSD development. Jeppesen and Windfield found incidence higher in neonates born to primipara as compared to multipara.\textsuperscript{17}

None of our patients were from multiple pregnancies, and therefore the relationship between multiple pregnancies and NSD could not be evaluated.

**Conclusion**

We believe that it is important to reveal nasal pathologies via nasal endoscopic examination before deciding on surgical treatment in CNLDO patients, as it would be a guide for patient information and the treatment decision. Therefore, it is important that ophthalmologists and otorhinolaryngologists work together in the management of CNLDO patients.
Declarations

Conflict of Interest: None.

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