Retrospective analysis of congenital nasolacrimal duct obstruction outcomes in a tertiary referral center

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Summary

Background The aim of this study was to profile patients with simple and complex congenital nasolacrimal duct obstruction (CNLDO) and to determine the success rates of interventions at a third-level referral center.

Methods In this retrospective and comparative study, medical records of patients with CNLDO were reviewed. Demographic data, types of CNLDO, surgical approach, type of silicone intubation, as well as outcome were recorded up to 3 months after the intervention. Obstruction location was identified by probing and irrigation following the American Academy of Ophthalmology (AAO) approach. Success rates were calculated for treatment approach and age group.

Results Based on the outcome of 130 eyes with CNLDO, the overall success rate was 96%. The mean age of patients was 2.5 ± 2.2 months; 73% of cases were simple and 27% were complex CNLDO. Five children had to undergo reoperation; consequently, there was a lower success rate in the complex CNLDO (91%) than in the simple CNLDO subgroup (97%). There was a male predominance (61.5%), which was also present in the simple and complex CNLDO subgroups. The most frequent type of CNLDO was complete nasolacrimal duct obstruction (NLDO, 55.4%), followed by partial (17.7%) and bony NLDO (11.5%). In 87% of eyes, initial probing was performed followed by dacryocystorhinostomy (10%). Mono- or bicanalicular lacrimal drainage system intubation was used in 86% of eyes.

Conclusion The AAO-based diagnostic approach followed by an individualized treatment regimen yielded excellent success rates of 96% in unselected patients with CNLDO. These success rates were independent of patient age or gender.

Keywords CNLDO · Complex CNLDO · Congenital · Pediatric · Success rates

Zusammenfassung

Hintergrund Ziel der vorliegenden Studie war es, ein Profil der Patienten mit einfacher und komplexer kongenitaler Tränenwegsobstruktion zu erstellen und die Erfolgsraten der unterschiedlichen Interventionen in einem medizinischen Zentrum der Tertiärversorgung zu ermitteln.

Methoden In dieser retrospektiven Studie wurden die Krankenakten von Patienten mit kongenitaler Tränenwegsobstruktion (CNLDO) ausgewertet. Demografische Daten, Typ der CNLDO, chirurgischer Ansatz, Typ des Silikonschlauchs sowie die Ergebnisse wurden bis zu 3 Monate nach der Intervention dokumentiert. Der Ort der Obstruktion wurde durch Sondieren und Spülen gemäß dem Ansatz der American Academy of Ophthalmology (AAO) ermittelt. Die Erfolgsraten wurden entsprechend dem Behandlungsansatz und der Altersgruppe berechnet.

Ergebnisse Basierend auf den Ergebnissen von 130 Augen mit CNLDO betrug die Gesamterfolgsrate 96%. Im Mittel lag das Alter der Patienten bei 2,5 ± 2,2 Monaten; in 73% der Fälle bestand eine einfache und in
27% a complex CNLDO. One erane operation was performed in five children; therefore, the success rates in the lower group with complex CNLDO were lower (91%). Among those, there were more male patients (61.5%); there was also diversity in the lower groups with one and complex CNLDO at birth. Frequently, CNLDO-Type was a complete variant of the Ductus nasolacrimalis (NLDO; 55.4%), followed by partial (17.7%) and osseous NLDO (11.5%). The most frequent variant was a complete variant with a complex CNLDO (97%) and a complex CNLDO patient cohort (96%) in the unselected patient group with CNLDO. These success rates were independent of patient age. Schlussfolgerung: Der AAO-basierte diagnostische Ansatz mit anschließendem personalisierter Behandlungsschema erbrachte eine ausgezeichnete Erfolgsrate von 96% bei unselektionierten Patienten mit CNLDO. Diese Erfolgsrate war unabhängig vom Patientenalter oder Geschlecht.

Schlüsselwörter: CNLDO · Komplexe CNLDO · Kongenital · Pädiatrisch · Erfolgsraten

Introduction

Congenital tear duct obstruction and specifically congenital lacrimal duct obstruction (CNLDO), with its main symptom of epiphora, followed by discharge refractory to treatment, is relatively common in newborns [1–3]. According to previously published literature, between 1 and 12% of the affected infants become symptomatic [4, 5]. Studies differentiate between a simple variant, which is considered the most common reason for CNLDO [6], caused by the persistence of Hasner’s membrane [7], and more complex types of CNLDO [8, 9]. These account for up to 17% of cases in patients with CNLDO [6, 9] and are associated with syndromes or embryonic anomalies, comprising a myriad of entities such as aplasia of the punctum, partial or total canaliculus aplasia, combined or isolated canaliculus, lacrimal sac, and ductus nasolacrimalis aplasia as well as malformations of the canaliculus system [8, 10]. To date, male gender, older age at presentation, and poorer outcomes have been reported to characterize the complex CNLDO patient cohort [9, 11].

This retrospective analysis aimed to profile patients with CNLDO and determine the success rates of interventions at a third-level referral center. In these patients, the exact location of the obstruction was identified by probing and irrigation following the diagnostic approach of the American Academy of Ophthalmology (AAO; [12]).

Methods

This retrospective study was undertaken at the Department of Ophthalmology and Optometry, Medical University of Vienna, Austria. This study was approved by the Ethics Committee of the Medical University of Vienna (ClinicalTrials.gov Number: NCT04931186) and followed the tenets of the Declaration of Helsinki. Medical records of patients with CNLDO who were referred to the Department of Ophthalmology and Optometry, Medical University of Vienna, Austria, between 1 January 2013 and 31 December 2017 were reviewed.

Presence of facial malformations, eyelid position disorders, abnormal nasal bone structure, agenesis or ectopic lacrimal puncta, or congenital fistulas of the lacrimal sac were not considered exclusion criteria as this study investigated the whole spectrum of CNLDO.

The operation performed was based on age, clinical symptoms, and probing results. Examining the patients under general anesthesia helps to determine the exact location of the obstruction and consequently allows for differentiation between simple and complex CNLDO, which determines the surgical approach.

Examination of the lacrimal drainage system was conducted using a Bangerter cannula. Probe advancement (soft stop, hard stop) and irrigation were used to locate the site of obstruction, as illustrated by the AAO [12]. Consequently, we differentiated between:

1. Complete canalicular obstruction: The Bangerter cannula is advanced with difficulty, and irrigation fluid refluxes from the same canaliculus
2. Complete common canalicular obstruction: A “soft stop” is encountered at the level of the common canalculus, and irrigated fluid refluxes through the opposite punctum and sometimes partially from the same canalculus as well
3. Complete nasolacrimal duct obstruction (NLDO): The cannula is easily advanced to the medial wall of the lacrimal sac, then a “hard stop” is felt, and irrigation fluid refluxes through the opposite punctum. Often, the refluxed fluid contains mucus and/or pus
4. Partial NLDO: The cannula is easily placed, and irrigation fluid passes into the nose as well as refluxing through the opposite punctum [12]
5. Bony obstructions [9, 11, 13]: The cannula is easily advanced to the medial wall of the lacrimal sac, then a hard stop is felt, and irrigation fluid refluxes through the opposite punctum and sometimes partially from the same canalculus too. Turning the cannula by 90 degrees results in another hard stop and the cannula cannot be advanced any further. Again, irrigation fluid refluxes through the opposite punctum and sometimes partially from the same canalculus
6. Atresia of the punctum: No lacrimal punctum is visible upon investigation.
We pre-specified that complete and partial NLDO are considered simple CNLDO, all others are considered complex CNLDO.

All four surgeons performing the operations were trained ophthalmologists undergoing specialized surgical training for oculoplastics including pathologies of the lacrimal drainage system.

Data extracted from medical records comprising demographic data, data on the time between initial diagnosis and intervention, surgical approach, type of silicone tube utilized (mono- or bicanalicular silicone tube), silicone tube loss, clinical symptoms 1 week and 3 months after surgical treatment, as well as pre- and postsurgical medication were recorded. Also, re-references were recorded, as patients were instructed to report back to our center if symptoms reoccurred.

Treatment success was defined as the absence of clinical signs of lacrimal drainage system obstruction (epiphora, increased tear leak, mucous discharge).

Indication for re-treatment was defined as the presence of clinical signs of lacrimal drainage system obstruction, closure of DCR anastomosis, as well as wound dehiscence.

Success rates were calculated for the following approaches:

- Initial probing: insertion of a modified Bangerter lacrimal cannula to mechanically rupture Hasner’s valve or by additionally applying high-pressure irrigation
- DCR [14]: creation of a new tear drain between the lacrimal sac and the nose through the bone to the nasal cavity
- Canalicular curettage [15]: Using a curettage, the canaliculus is freed from debris
- Punctoplasty: A 1- to 3-snip procedure [16] was used

Results are reported for different predefined age groups, which are based on studies and Kaplan–Maier analysis reporting success rates in different age groups: patients aged between 2 and 6 months (group A); patients aged between 6 and 12 months (group B); patients older than 1 year (group C); and patients aged over 2 years (group D; [17–19]).

As the data of this subgroup analysis are part of an analysis including all age groups (see: Clinical-trials.gov NCT04931186), sample-size calculation was initially performed for the difference in success rates between endoluminal and external procedures. Only one eye was analyzed in patients with bilateral symptoms to avoid dependent bias. If both eyes were affected, the more severely affected laterality was included. Analysis was performed using SPSS Statistics (IBM SPSS Statistics for Windows, Version 26.0, IBM Corp., Armonk, NY, USA). Data are presented descriptively—number of patients (n), median ± confidence interval (CI), or mean ± standard deviation (SD). Success rates are reported as the percent number of patients with complete resolution of symptoms. Normal distribution of metric variables was assessed using the Shapiro–Wilk test. A univariate ANOVA model was used to test for differences between groups. A Bonferroni corrected post hoc test was used for comparison between groups, while a chi-square test was used to compare success rates between groups.

Table 1  Demographic profile of children with CNLDO at initial presentation at a third-level referral center

|         | Group A (2–6 months) | Group B (6–12 months) | Group C (1–2 years) | Group D (> 2 years) |
|---------|----------------------|-----------------------|---------------------|---------------------|
| Cases   | 8                    | 12                    | 54                  | 56                  |
| Female/male | 5/3                  | 5/7                   | 18/36               | 22/34               |
| Median age (CI; months) | 4.1 (3.7–4.6)        | 10.3 (8.4–11.3)       | 16.8 (16.8–20.3)    | 32 (27.2–50.2)      |
| OD/OS (n) | 2/6                  | 8/4                   | 30/24               | 28/28               |

CI confidence interval, OD right eye, OS left eye

Results

A total of 130 eyes of 130 children with CNLDO were evaluated in this retrospective analysis; 50 were female (38.5%) and 80 were male (61.5%).

Overall, 46 patients (35.4%) had bilateral symptoms, and 84 (64.6%) were unilateral. Selecting the more severely affected eye shows that 68 (52.3%) were right eyes and 62 (47.8%) were left eyes.

The demographic profile of all four age groups A–D is summarized in Table 1.

Upon referral to our institution, 103 eyes (79.2%) were treatment-naïve, except for Crigler’s lacrimal sac compression. In total, 27 eyes (20.8%) were referred to us receiving additional treatment after an undetermined period of unsuccessful Crigler’s lacrimal sac compression; two eyes (1.5%) were treated with topical antibiotics (gentamicin), 13 eyes (10.0%) received constringent eye drops (naphazoline in water and artificial tears; Oculotect fluid, Thea Pharma GmbH, Vienna, Austria), and 12 eyes were treated with combination therapy: in eight eyes (6.2%) topical antibiotics and constringent eye drops were prescribed, three eyes (2.3%) were treated with continued lacrimal sac massage combined with constringent eye drops, and
one patient (0.8%) received systemic antibiotics with topical antibiotics as well as constringent eye drops. All eyes scheduled for intervention were examined under general anesthesia (100%), which enabled precise differentiation between simple CNLDO (73.1%, 95 eyes) and complex CNLDO (26.9%, 35 eyes), which are presented in detail in Fig. 1. Complex CNLDO comprised bony NLDO (11.5%, 15), complete canalicular obstruction (7.7%, 10), atresia of the punctum (5.4%, 7), as well as complete common canalicular obstruction (2.3%, 3). There was no statistically significant difference in age between the simple and complex groups ($p = 0.08$).

The two most common approaches used were initial probing (86.9%, 113 eyes) and DCR (10%, 13 eyes; see Fig. 1). But punctoplasty (2.3%, 3 eyes) and canalicular curettage (0.8%, 1 eye) were also applied.

Figure 2 shows lacrimal drainage system intubations used. Bicanalicular silicone intubation (BSI) was most commonly applied (46.9%, 61 eyes), followed by monocanalicular intubation (Monoka; FCI S.A.S. France; 35.4%, 46 eyes); 23 eyes (17.7%) did not receive intubation of the lacrimal drainage system.

There were statistically significant differences between age groups regarding the time until intervention ($p<0.0001$, ANOVA). Patients aged between two and 6 months (group A) at initial presentation were scheduled for surgical intervention after a median time of 270 (CI: 178–452) days. Patients aged between 6 and 12 months (group B), older than 1 year (group C), and patients aged over 2 years (group D) had a similar waiting time for surgical intervention of 122 (68–135) days, 135 (97–176) days, and 161 (127–215) days, respectively. Statistically significant differences between groups were only found when comparing group A with all other groups (all $p<0.0001$).

A detailed summary of treatment prescribed postoperatively is given in Table 2. The most frequent postoperative medication used was a combination of dexamethasone and gentamicin with naphazoline eye drops (36.9%), antibiotic ointment (29.2%), or dexamethasone and gentamicin eye drops (16.2%).

Regarding clinical appearance 1 month after surgical intervention, no occurrences were noted in 85.9% of eyes. In nine of 61 eyes (14.8%) receiving BSI, the

Table 2 Topical treatment following surgical intervention. Missing values ($n = 7$, 5.4%); Baneocin ointment is a combination of neomycin and bacitracin

| Treatment                                      | n  | %    |
|------------------------------------------------|----|------|
| Dexamethasone + gentamicin with naphazoline eye drops | 48 | 36.9 |
| Dexamethasone + gentamicin eye drops            | 21 | 16.2 |
| Dexamethasone + gentamicin ointment with paraffin gauze dressing | 3  | 2.3  |
| Gentamicin or Baneocin ointment with paraffin gauze dressing | 10 | 7.7  |
| Gentamicin or ofloxacin or Baneocin ointment    | 38 | 29.2 |
| Naphazoline eye drops                           | 3  | 2.3  |
bicanalicular silicone tube used was lost; 6.2% (8 eyes) presented with local inflammation, swelling, or dislocation of the silicone tube. One patient experienced bleeding (0.8%).

The most frequent symptoms reported 3 months after surgical intervention were epiphora (6.9%, nine children), NLDO (6.2%, eight children), local inflammation (3.8%, five children), and closure of the lacrimal punctum (2.3%, three children).

Of the eight children scheduled for re-operation, six were planned to undergo balloon dacryoplasty with BSI and two received an appointment for conjunctivodacryocystorhinostomy (CDCR). Of these eight children, only five (two for CDCR and three for balloon dacryoplasty with BSI) appeared for reoperation; in three, the problems resolved with no need for further treatment.

Consequently, we calculated an overall success rate of 96% based on the evaluation of 130 eyes. Table 3 summarizes the success rates for groups A–D. There is no statistically significant difference in success rates between simple and complex NLDO (p = 0.13). There is also no statistically significant difference in success rates between surgeons (p = 0.72).

Discussion

This study presents a comparative profile of patients referred to a tertiary eye center for CNLDO. The location of the obstruction was identified by probing and irrigation following the AAO approach [12]. We retrospectively analyzed charts aiming at reporting success rates for simple (73.1%) and complex (26.9%) cases of CNLDO as well as characterizing the patients’ profiles in a cohort of 130 patients, with a mean age of 2.5 ± 2.2 years. As previously described [20–22], we found an overall male predominance (61.5%), which is also true when grouping for simple (62.0%) and complex (60.0%) CNLDO.

The predominant type of CNLDO was complete NLDO (55.4%, see Fig. 1), which is classified as a reflux of fluid through the opposite punctum after the advancement of the cannula ends with a “hard stop” [12].

The overall success rate was 96% in this patient’s collective. In accordance with previous studies [21, 22] as well as a study with a similarly large patient cohort (138 eyes of 101 patients; [20]), lower success rates were found in complex versus simple CNLDO, which also applies to our study (91% and 97%, respectively). However, the difference in success rate did not reach the level of significance. Caution is advised when comparing results, as the included patients represent a very heterogeneous group.

We could not confirm the low success rates of initial probing in age groups C and D (1–2 years, > 2 years, respectively) published in the literature [7, 19, 21], ranging between 94 and 98% in our patient collective. Also, Valcheva et al. and Lin et al., both could not show an association of success rates with age [23, 24]. Yet, it should be mentioned that most of our patients undergoing initial probing in age groups C and D received additional lacrimal drainage system intubation (81% and 86%, respectively) in order to increase success rates.

It is well documented that there are several confounders influencing success rates in complex CNLDO; these are older age (> 36 months), failed conservative treatment, failed initial probing, or bony obstructions, e.g., in craniofacial anomalies [20–22]. In our patient cohort we did not find a statistically significant difference between simple and complex CNLDO groups regarding age (p = 0.08); however, there was a tendency toward older age in the group with complex CNLDO. Further, we cannot confirm results referred to earlier that unsuccessful conservative pretreatment lowers success rates. Of 27 eyes receiving unsuccessful conservative pretreatment, only one patient (3.8%) was scheduled for re-treatment after initial surgical intervention, whereas seven (7.3%) out of 103 eyes without pretreatment were scheduled for re-treatment (p = 0.55). Further, we could not show that bony NLDO is associated with lower success rates. This may be due to the fact that out of 15 eyes with bony NLDO, we treated 13 (86.7%) with primary DCR combined with silicone intubation. This approach is supported by previous studies. First, a meta-analysis, which shows that DCR success rates improve by 5% as soon as silicone intubation is performed. Second, a study showing DCR outcome and complication rates to be the same between pediatric and adult patients [25], ranging between 77 and 95% [25, 26]. For all the patients undergoing primary DCR included in this study, an underlying condition was recorded, involving different types of syndromic craniosynostosis [27] and one patient with Goldenhar syndrome [28].

In 86% of eyes, lacrimal drainage system intubation was used. This was most commonly performed by BSI.
or monolacrimal intubation (see Fig. 2). Consequently, 23 patients did not receive lacrimal drainage system intubation. The data show that the decision not to use any intubation means was clearly based on age. In only three patients in the 0–12 months age group, but in 20 patients aged >1 years or older, intubation was omitted.

Patients aged between 2 and 6 months had to wait statistically significantly longer (median 312 days) than all other groups. This is due to the fact that Kaplan–Meier analysis shows spontaneous resolution plateaus of between 40 and 50% resolution after 9 months of age [19]. However, there were no spontaneous resolutions recorded in this patient collective. The overall median time until intervention was 142 days (92–192), which is different from previous studies in which the time ranges up to 600 days [29]. However, few data are reported in this regard.

Three months after intervention, the most common symptoms reported were epiphora (9.8%) and NLDO (8.7%). Yet, not all of these patients needed re-treatment, leading to an overall success rate of 96% (see Table 3).

**Limitations**

Our study has some limitations that warrant further comment; it is of retrospective nature and only a 3-month follow-up is available. This is due to the fact that after the 3-month follow-up, patients are discharged to the referring ophthalmologist with the premise to report back to our institution in the case of symptom worsening. Furthermore, the CNLDO classification is based on the AAO probing approach [12], which supports precise identification of the obstruction when performed by experienced surgeons.

**Conclusion**

This retrospective analysis of patients referred to a tertiary center shows that the American Academy of Ophthalmology-based diagnostic approach followed by an individualized treatment regimen yields excellent success rates of 96% in unselected patients with congenital nasolacrimal duct obstruction. These success rates are independent of patient age or gender.

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**References**

1. Dantas RR. Lacrimal drainage system obstruction. Semin Ophthalmol. 2010;25(3):98–103.
2. Grossmann T, Putz R. Anatomy, consequences and treatment of congenital stenosis of the lacrimal passage in newborn infants. Klin Monbl Augenheilkd. 1972;160(5):563–72.
3. MacEwen CJ, Young JD. Epiphora during the first year of life. Eye (Lond). 1991;5(Pt 5):596–600.
4. Cassidy JV. Developmental anatomy of nasolacrimal duct. AMA Arch Ophthalmol. 1952;47(2):141–58.
5. Grigler LW. The treatment of congenital dacryocystitis. JAMA. 1923;81(1):23–4.
6. Das AV, et al. The incidence of lacrimal drainage disorders across a tertiary eye care network: customization of an indigenously developed electronic medical record system-eyesmart. Ophthalmic Plast Reconstr Surg. 2019;35(4):354–6.
7. Karti O, et al. The natural process of congenital nasolacrimal duct obstruction and effect of lacrimal sac massage. Int Ophthalmol. 2016;36(6):845–9.
8. Kushner BJ. The management of nasolacrimal duct obstruction in children between 18 months and 4 years old. JAAPOS. 1998;2(1):57–60.
9. Bansal O, et al. Congenital nasolacrimal duct obstruction update study (CUP study): paper II—profile and outcomes of complex CNLDO and masquerades. Int J Pediatr Otorhinolaryngol. 2020;139:110407.
10. Busse H, Müller KM, Mewe L. The therapy of congenital dacryostenosis. Klin Monbl Augenheilkd. 1981;178(5):341–6.
11. Ali MJ, et al. Simple vs complex congenital nasolacrimal duct obstructions: etiology, management and outcomes. Int Forum Allergy Rhinol. 2015;5(2):174–7.
12. American Academy of Ophthalmology. Lacrimal drainage system irrigation. 2021. https://www.aao.org/image/new-media beacon-item-66. Accessed 5.1.2022.
13. Ali MJ, Paulsen F. Syndromic and nonsyndromic systemic associations of congenital lacrimal drainage anomalies: a major review. Ophthalmic Plast Reconstr Surg. 2017;33(6):399–407.
14. Ulrich K, Malhotra R, Patel BC. Dacryocystorhinostomy. Treasure Island: StatPearls; 2021.
15. Bothra N, et al. Punctal dilatation and non-incisional canaliculic curettage in the management of infectious canaliculitis. Orbit. 2020;39(6):408–12.
16. Caesar RH, McNab AA. A brief history of punctoplasty: the 3-snip revisited. Eye (Lond). 2005;19(1):16–8.
17. Honkura Y, et al. Nasolacrimal duct opening to the inferior nasal meatus in human fetuses. Okajimas Folia Anat Jpn. 2017;94(3):101–8.
18. Kashkouli MB, Karimi N, Khademi B. Surgical management of congenital nasolacrimal duct obstruction: one procedure for all versus all procedures for one. Curr Opin Ophthalmol. 2019;30(5):364–71.
19. Sathiamoorthi S, Frank RD, Mohney BG. Spontaneous resolution and timing of intervention in congenital CNLDO.
nasolacrimal duct obstruction. JAMA Ophthalmol. 2018;136(11):1281–6.
20. Kashkouli MB, et al. Late and very late initial probing for congenital nasolacrimal duct obstruction: What is the cause of failure? Br J Ophthalmol. 2003;87(9):1151–3.
21. Kashkouli MB, Kassaee A, Tabatabaei K. Initial nasolacrimal duct probing in children under age 5: cure rate and factors affecting success. J AAPOS. 2002;6(6):360–3.
22. Maheshwari R. Success rate and cause of failure for late probing for congenital nasolacrimal duct obstruction. J Pediatr Ophthalmol Strabismus. 2008;45(3):168–71.
23. Lin AE, et al. Comparison of treatment for congenital nasolacrimal duct obstruction: a systematic review and meta-analysis. Can J Ophthalmol. 2016;51(1):34–40.
24. Valcheva KP, Murgova SV, and Krivoshiiska EK. Success rate of probing for congenital nasolacrimal duct obstruction in children. Folia Med (Plovdiv). 2019;61(1):97–103.
25. Limbu B, et al. Comparing outcomes of pediatric and adult external dacryocystorhinostomy in Nepal: Is age a prognostic factor? Orbit. 2017;36(4):237–42.
26. Edsel B, et al. Meta-analysis of randomized controlled trials in dacryocystorhinostomy with and without silicone intubation. Can J Ophthalmol. 2018;53(5):466–70.
27. Wang JC, Nagy L, Demke JC. Syndromic craniosynostosis. Facial Plast Surg Clin North Am. 2016;24(4):531–43.
28. Schmitzer S, et al. Goldenhar Syndrome—ophthalmologist’s perspective. Rom J Ophthalmol. 2018;62(2):96–104.
29. Farrokhi S, et al. Congenital nasolacrimal duct obstruction: a real-life study from the first symptoms to the results of surgical treatment. Ophthalmologe. 2020; https://doi.org/10.1007/s00347-020-01263-7.

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