Research Article

Study of Result Profile of Lacrimal Probing in Children

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Abstract

Objectives: To evaluate the outcome profile of lacrimal probing in children with congenital nasolacrimal duct obstruction (CNLDO) and to assess the relationship between age, number of probing sittings, and procedural success.

Methods: This prospective observational study was conducted in the Department of Ophthalmology, LLRM Medical College, Meerut, from May 2024 to April 2025. A total of 295 children (433 eyes) aged 9 to 60 months diagnosed with CNLDO were included. Patients were divided into three age groups: Group A (9–18 months), Group B (19–36 months), and Group C (37–60 months). Conservative treatment with lacrimal sac massage was advised initially in younger children, while persistent cases underwent nasolacrimal duct probing under aseptic precautions. Outcomes were assessed on the basis of resolution of watering and discharge during follow-up.

Results: Among 295 patients, 153 (51.87%) were males and 142 (48.12%) were females. Unilateral involvement was observed in 157 patients (53.28%), while 138 patients (46.71%) had bilateral disease. Conservative management with lacrimal sac massage showed improvement in 195 of 250 eyes (77.90%) in the 9 to 18 months age group. Primary probing was performed in 238 eyes and was successful in 162 eyes (68.20%). Repeat probing demonstrated comparatively lower success rates, particularly in older children. The overall success rate of probing was 92.17% among eyes completing follow-up.

Conclusion: CNLDO can be effectively managed with early diagnosis and timely intervention. Lacrimal sac massage is beneficial in younger children, while probing remains a safe and effective treatment for persistent cases. Earlier intervention is associated with higher success rates and reduced need for repeated procedures.

Keywords: Congenital nasolacrimal duct obstruction , Lacrimal probing, Epiphora, Pediatric ophthalmology.

Introduction

Congenital nasolacrimal duct obstruction (CNLDO) is one of the most frequently encountered lacrimal drainage abnormalities in infants and young children and represents a common cause of persistent epiphora during early childhood. The condition usually occurs due to incomplete canalization of the nasolacrimal duct, most commonly at the level of the distal valve of Hasner. Failure of ductal opening results in impaired tear drainage, leading to retention of tears and secondary mucous discharge.[1,2] The incidence of CNLDO has been reported to range between 6 and 20% among newborns, although many cases undergo spontaneous resolution during the first year of life as the lacrimal drainage system matures.[3,4]

Embryologically, the lacrimal drainage system develops from a solid cord of ectodermal cells situated between the lateral nasal and maxillary processes. Canalization begins centrally and progresses both proximally and distally, with the distal nasolacrimal duct being the final portion to canalize. Incomplete opening at the valve of Hasner is considered the most common anatomical cause of congenital obstruction.[5] Persistent membrane formation, narrow duct lumen, bony abnormalities, and inflammation-related fibrosis have also been implicated in resistant or complex cases.[6]

Clinically, children with CNLDO commonly present with excessive watering, crusting of eyelashes, recurrent

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mucopurulent discharge, and increased tear meniscus height. Symptoms are often unilateral but may be bilateral in a significant proportion of patients. Reflux of mucous material on pressure over the lacrimal sac area is considered a characteristic clinical sign and helps differentiate CNLDO from other causes of childhood epiphora.[7] Persistent obstruction may predispose affected children to recurrent conjunctivitis, acute dacryocystitis, preseptal cellulitis, and periocular skin excoriation due to chronic irritation.[8]

The diagnosis of CNLDO is primarily clinical and is based on detailed history and ocular examination. Ancillary investigations such as fluorescein dye disappearance test, lacrimal irrigation, and probing may be useful in selected cases to confirm the site and severity of obstruction. Differential diagnoses include congenital glaucoma, conjunctivitis, punctal agenesis, canalicular obstruction, and craniofacial anomalies associated with lacrimal drainage defects.[9,10] Early recognition and differentiation from other ocular disorders are important to prevent delayed management and complications.

Conservative management remains the initial treatment of choice during infancy because of the high rate of spontaneous resolution. Lacrimal sac massage using the Crigler technique aims to increase hydrostatic pressure within the lacrimal sac, thereby facilitating rupture of the membranous obstruction at the distal nasolacrimal duct.[11] Topical antibiotics are used only in the presence of secondary bacterial infection or significant mucopurulent discharge. Several studies have demonstrated spontaneous resolution rates ranging from 80 to 90% during the first year of life with conservative treatment alone.[12,13] The likelihood of spontaneous resolution decreases with increasing age, and persistent symptoms beyond infancy frequently require surgical intervention.

Probing of the nasolacrimal duct is regarded as the standard primary surgical procedure for persistent CNLDO and has shown excellent anatomical and functional success rates in various studies.[14] The procedure mechanically opens the obstructed duct and restores tear drainage. The success of probing is influenced by multiple factors including age at intervention, type and severity of obstruction, bilateral involvement, presence of infection, and the need for repeated procedures.[15,16] Earlier intervention is generally associated with better outcomes, whereas delayed treatment may lead to chronic inflammation, fibrosis, and formation of complex obstruction, thereby reducing the success rate of probing.[17]

In cases where primary probing fails, repeat probing, silicone intubation, balloon dacryoplasty, or dacryocystorhinostomy may be considered depending upon patient age and severity of obstruction. However, repeat procedures are generally associated with lower success rates compared to primary probing, especially in older children.[18]

The present study was undertaken to evaluate the outcome profile of lacrimal probing in children with congenital nasolacrimal duct obstruction and to assess the relationship between age at intervention, number of probing sittings, and procedural success. The study also aims to emphasize the importance of early diagnosis and timely management in improving treatment outcomes in pediatric CNLDO.

Materials and Methods

Study Design and Setting

This prospective observational study was conducted in the Department of Ophthalmology, LLRM Medical College, Meerut, Uttar Pradesh, India, over a period of one year from May 2024 to April 2025. The study was undertaken to evaluate the outcome of lacrimal probing in children diagnosed with congenital nasolacrimal duct obstruction (CNLDO).

Study Population

A total of 295 paediatric patients (433 eyes) aged between 9 and 60 months presenting with complaints of watering and/or discharge from the eyes suggestive of CNLDO were included in the study. Patients were selected consecutively from the outpatient department after obtaining written informed consent from their parents or guardians.

The patients were categorized into three age groups:

- Group A: 9–18 months
- Group B: 19–36 months
- Group C: 37–60 months

Inclusion Criteria

Children aged between 9 and 60 months with clinical features suggestive of congenital nasolacrimal duct obstruction, including persistent watering and discharge from the eyes, were included in the study.

Exclusion Criteria

Children with tearing secondary to other ocular or facial abnormalities such as facial malformations, eyelid malposition, abnormal nasal bone structure, punctal agenesis, ectopic lacrimal puncta, congenital lacrimal fistula, previous unsuccessful probing procedures, or complex nasolacrimal duct obstruction were excluded from the study. Cases in which parental consent could not be obtained were also excluded.

Clinical Evaluation

A detailed clinical history regarding the onset, duration, and nature of symptoms was obtained from the parents or guardians. All children underwent comprehensive ophthalmic examination, including assessment of tear meniscus height, type of discharge, regurgitation on pressure over the lacrimal sac (ROPLAS), and evaluation of the lacrimal drainage system.

Surgical Procedure

Children diagnosed with persistent CNLDO underwent lacrimal probing under aseptic precautions in the operation theatre. Primary probing was performed in children undergoing the procedure for the first time, while repeat probing was carried out in children with persistent symptoms following previous probing. The interval maintained for repeat probing was three weeks.

The probing procedure was performed using standard Bowman lacrimal probes under appropriate anaesthesia. The patency of the nasolacrimal duct was confirmed intraoperatively after completion of the procedure.

Outcome Measures and Follow-up

The outcome of probing was assessed on the basis of resolution of symptoms during follow-up visits. Successful outcome was defined as complete absence of watering and discharge following probing, whereas failure was considered when symptoms persisted and additional surgical intervention was required.

All patients were followed up at 1, 3, and 6 months after the procedure to assess symptom resolution and recurrence, if any.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee of LLRM Medical College, Meerut. Written informed consent was obtained from the parents or guardians of all participating children prior to enrolment in the study. Confidentiality of patient information was strictly maintained throughout the study in accordance with ethical guidelines for biomedical research involving human subjects.

Statistical Analysis

Data collected during the study were entered into Microsoft Excel spreadsheets (Microsoft Corporation, Redmond, Washington, USA) and analysed using Statistical Package for Social Sciences (SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA).

Descriptive statistical methods were used to summarize the data. Categorical variables such as sex distribution, laterality, type of discharge, probing outcomes, and age-group distribution were expressed as frequencies and percentages.

The success rate of probing among different age groups and according to the number of sittings required was analysed. Comparisons between categorical variables were performed using the Chi-square test wherever applicable. A *p-value* of less than 0.05 was considered statistically significant.

Results

A total of 295 pediatric patients comprising 433 eyes with congenital nasolacrimal duct obstruction (CNLDO) were included in the study. Among them, 153 patients (51.87%) were males and 142 patients (48.12%) were females, showing a slight male predominance in the study population.

Regarding laterality, unilateral involvement was observed in 157 patients (53.28%), while bilateral involvement was present in 138 patients (46.71%). Thus, unilateral CNLDO was slightly more common than bilateral disease (Table 1).

Analysis of clinical presentation showed that 139 eyes (33.28%) had mucopurulent discharge with positive regurgitation on pressure over lacrimal sac (ROPLAS), 144 eyes (33.28%) had mucoid discharge with negative ROPLAS, and 150 eyes (34.72%) presented with watering only without discharge. This distribution demonstrated variability in the clinical manifestations of CNLDO (Table 2). Age-wise distribution revealed that the majority of patients belonged to Group A (9–18 months), accounting for 171 patients (57.92%). Group B (19–36 months) included 71 patients (24.16%), while Group C (37–60 months) comprised 53 patients (17.92%). The frequency of CNLDO decreased progressively with increasing age.

Table 1: Laterality of patients

Laterality	*Number of patients*	*Number of eyes*	*Percentage %(N=295)*
Unilateral eye involvement	157	157	53.28%
Bilateral eye involvement	138	276	46.71%
Total	295	433	100

Table 2: Type of discharge distribution among patients

TYPE OF DISCHARGE	NUMBER OF EYES	PERCENTAGE% (n=433)
MUCOPURULENT DISCHARGE ROPLAS POSITIVE	139	32.00
MUCOID DISCHARGE ROPLAS NEGATIVE	144	33.28
NO DISCHARGE ONLY WATERING	150	34.72
TOTAL	433	100

The effect of conservative management with lacrimal sac massage was evaluated in children aged 9 to 18 months. Out of 250 eyes, improvement was observed in 195 eyes (77.90%), whereas 55 eyes (22.09%) did not show improvement. These findings indicate that lacrimal sac massage was effective in a large proportion of younger children (Table 3).

A total of 238 eyes underwent primary probing. Successful outcome was achieved in 162 eyes (68.20%), while probing was unsuccessful in 63 eyes (26.50%). Thirteen eyes (5.20%) were lost to follow-up. The highest success rate was observed in younger children, particularly in the 9 to 18 months age group, whereas success rates declined with advancing age.

Second probing was performed in 64 eyes with persistent symptoms after initial probing. Successful outcome was observed in 33 eyes (51.60%), while 25 eyes (38.40%) showed unsuccessful results. Six eyes (9.80%) were lost to follow-up. The success of repeat probing was higher in younger children and reduced significantly in older age groups.

Third probing was required in a limited number of cases. In the 9 to 18 months group, one eye underwent probing with successful outcome. In the 19 to 36 months group, one eye showed successful outcome, four eyes had unsuccessful results, and one patient was lost to follow-up. In the 37 to 60 months group, three eyes showed successful outcome, 13 eyes were unsuccessful, and two patients were lost to follow-up. The findings suggest a progressive decline in probing success with increasing age and repeated procedures.

Table 3: Effect of lacrimal massage (Age 9-18 Months)

AGE(9-18 MONTHS) GROUP A	NUMBER OF EYES	PERCENTAGE%
IMPROVEMENT AFTER LACRIMAL MASSAGE	195	77.90
NO IMPROVEMENT AFTER LACRIMAL MASSAGE	55	22.09
TOTAL	250	100

Table 4: Probing success rate in relation to number of sittings required

	No. of eyes (n=238)	*Percentage (%)*
Total probing successful	200	92.17% (n=217)
Total probing unsuccessful	17	7.83% (n=217)
Lost to follow up	21	8.82% (n=238)

Table 5: Advice given to patient for unsuccessful probing

Age Group(Months)	Unsuccessful Probing (No.of eyes)	Advise given
9-18 months Group A	0	0
19-36 months Group B	4	4(Follow up 6 monthly)
37-60 months Group C	13	13(follow up 6 monthly)

Overall, among 238 eyes included for probing, 217 eyes completed follow-up. Successful outcome was achieved in 200 eyes, giving an overall success rate of 92.17%, while 17 eyes (7.83%) had unsuccessful outcomes. Twenty-one eyes (8.82%) were lost to follow-up. The results demonstrate that probing is a highly effective intervention for CNLDO, particularly when performed at an earlier age (Table 4).

An age-related increase in probing failure was observed. No unsuccessful cases were noted in Group A (9–18 months). In Group B (19–36 months), four eyes showed failed outcomes, whereas Group C (37–60 months) had the highest number of unsuccessful cases with thirteen eyes.

All unsuccessful cases were advised regular follow-up and further management when required (Table 5). The higher failure rates in older children may be attributed to chronic inflammation, fibrosis, and longstanding obstruction.

Discussion

Congenital nasolacrimal duct obstruction (CNLDO) is one of the most common lacrimal drainage disorders encountered during infancy and early childhood, and nasolacrimal duct probing continues to remain the standard intervention for persistent obstruction. In the present study, conservative management with lacrimal sac massage showed improvement in 77.90% of eyes in children aged 9 to 18 months, highlighting the effectiveness of non-invasive management during early infancy. Similar findings have been reported by Nelson *et al.*[1] and Kushner[2], who demonstrated high spontaneous resolution rates with conservative treatment and Crigler massage during infancy.

The spontaneous resolution observed in younger infants may be attributed to continued maturation and canalization of the distal nasolacrimal duct. Paul and Shepherd[6] reported that the majority of CNLDO cases resolve spontaneously before one year of age when managed conservatively with massage and hygiene measures. Petersen and Robb[7] also observed that spontaneous resolution decreases progressively after infancy, thereby increasing the need for surgical intervention in older children.

The present study demonstrated that the success rate of probing decreased progressively with increasing age. The highest success rate was observed in Group A (9–18 months), whereas comparatively lower success rates were seen in older children, particularly in the 37–60 months age group. These findings are in agreement with studies conducted by Honavar *et al.*[8], Robb[11], and Ulaş *et al.*[9], who reported significantly better outcomes when probing was performed at an earlier age. Delayed intervention may lead to chronic inflammation, fibrosis, stenosis, and complex obstruction involving the lacrimal drainage pathway, thereby reducing the efficacy of probing procedures.

Several authors have emphasized that prolonged obstruction results in epithelial changes and fibrosis within the lacrimal drainage system, which may explain the reduced success rates in older children. Kashkouli *et al.*[14] observed that children older than three years frequently exhibit more complicated obstructions and may require additional procedures such as silicone intubation or dacryocystorhinostomy. Similar observations were made in the present study, where repeated procedures were more commonly required in older age groups.

Our study showed a slight male predominance, with males accounting for 51.87% of cases. However, no statistically significant gender-related difference in treatment outcome was observed. Similar findings have been documented by Sathiamoorthi *et al.*[4] and MacEwen *et al.*[15], who concluded that CNLDO does not demonstrate any consistent gender predisposition with regard to severity or treatment response.

With respect to laterality, unilateral involvement (53.28%) was slightly more common than bilateral disease (46.71%). Previous epidemiological studies have similarly identified unilateral disease as the predominant presentation in CNLDO.[12] However, bilateral cases are often associated with more severe anatomical obstruction and persistent symptoms. In the present study, bilateral obstruction appeared to be associated with relatively lower success rates, which may reflect greater anatomical complexity and delayed presentation.

Repeat probing was performed in children with persistent symptoms following primary probing. The success rate of

repeat probing in our study was lower than that of primary probing, with outcomes declining further in older age groups. These findings correlate with the observations of Katowitz *et al*.[10] and the Pediatric Eye Disease Investigator Group (PEDIG)[13], which demonstrated reduced efficacy of repeat probing procedures with increasing age and recurrent obstruction.

Various adjunctive procedures have been proposed for cases resistant to primary probing, including silicone tube intubation, balloon dacryoplasty, endoscopic-assisted probing, and dacryocystorhinostomy.[16,17] Silicone intubation has shown favorable results in children with complex or recurrent obstruction, particularly when associated with membranous stenosis or fibrosis. Endoscopic guidance has also improved the accuracy and success of probing in difficult cases by allowing direct visualization of intranasal anatomy.[18]

The overall success rate of probing in our study was high, confirming that probing remains an effective, safe, and minimally invasive procedure for the management of persistent CNLDO. Early diagnosis, timely intervention, and careful patient selection continue to play a major role in achieving favorable outcomes. Delayed presentation and recurrent obstruction remain important factors associated with treatment failure. Therefore, awareness among parents and primary healthcare providers regarding early referral and management of CNLDO is essential to reduce morbidity and improve functional outcomes in affected children.

Conclusion

Congenital nasolacrimal duct obstruction (CNLDO) can be effectively managed with early diagnosis and timely intervention. Conservative treatment with lacrimal sac massage showed good spontaneous resolution in younger children, particularly in the 9 to 18 months age group. Probing remained a safe and effective primary procedure for persistent CNLDO, with higher success rates observed in younger age groups.

A decline in probing success was noted with increasing age and repeated procedures, suggesting that delayed intervention may reduce treatment efficacy. Early and appropriate management is therefore essential for achieving favorable outcomes and reducing the need for additional surgical interventions in children with CNLDO.

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