

**ADVANTAGES OF LARYNGEAL MASK AIRWAY USED DURING PROBING IN CHILDREN**

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**Abstract**

**Purpose:** To assess the anesthetic risk and benefits of using laryngeal mask airway during probing in patients with congenital nasolacrimal duct obstruction (CNLDO).

**Materials and methods:** A prospective study was conducted on 52 eyes of 40 children with CNLDO. All of them underwent “blind” probing according to a standard methodology under general anesthesia with the use of laryngeal mask airway (LMA) in the Ophthalmology Clinic of the University Hospital in Pleven. Checking the patency of the drainage system after probing was done with the method “metal to metal” and irrigation of physiology solution. The postoperative result after probing was established on the third month after the procedure.

**Results:** There were no anesthetic problems in the operated children related to the use of LMA. Pulmonary aspiration or bradycardia due to syringing of the lacrimal drainage system, were not observed in any of our patients. We found intraoperatively successful results in 43 (82.7%) eyes and unsuccessful in 9 (17.3%). The postoperative outcome was 49 (94.2%) resolved eyes and 3 (5.8%) with failure.

**Conclusion:** The use of laryngeal mask airway is a safe way to deliver general anesthesia during probing. It allows the surgeon to perform the procedure in a way that predicts its success rate.

**Keywords:** *congenital nasolacrimal duct obstruction, laryngeal mask airway, syringing and probing*

**Introduction**

The incidence of congenital nasolacrimal duct obstruction (CNLDO) varies widely between 1.2% and 30% [1, 2, 3].

This disease is initially treated conservatively with massage over the lacrimal sac [4, 5]. Probing of the nasolacrimal duct (NLD) is the first choice of surgical treatment if the conservative therapy fails. [6, 7]. A controversial question is whether the procedure should be performed in an outpatient setting or under general anesthesia in a hospital. According to some authors, probing with topical anesthesia can be performed easily, if the child is well fixed or wrapped [8, 9]. This method of anesthesia is recommended for patients up to 8 months of age [10, 11]. Others believe that ambulatory probing is an unnecessarily traumatic procedure for the child, parents, and the surgeon. Therefore, the procedure should be performed under general anesthesia in an operation room of a hospital, after assessing its safety [12].

Complications from general anesthesia have a frequency of 1 in 2131 anesthetics. Children and young patients are most often affected [13]. The risk is greater in children under 6 months of age [14, 15].

The probing also carries a risk of intraoperative complications related to mishandling of the probes or the application of brute force resulting in bleeding caused by the formation of a false path [16]. The patency of the nasolacrimal duct during probing under general anesthesia is established in three ways: 1) the method of “metal to metal” contact; 2) the direct observation of the probe under the lower concha using an endoscope (endoscopic guided probing); 3) irrigation of fluorescein-stained saline into the lacrimal drainage system and subsequent aspiration of the fluid with a suction catheter [6]. The injection of fluid after probing can also cause complications. During syringing under general anesthesia when the child is supine, it is sometimes difficult to aspirate fluid from the nasopharynx. Deeper aspiration in these cases may stimulate the vagus, leading to bradycardia or

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hypoxia from bronchospasm [17]. Aspiration pneumonia is a potentially serious complication during general anesthesia [18].

Endotracheal intubation, with continuous aspiration, is considered by some authors to be the best and safest method to ensure protection of the airways from injected fluid or blood [19].

Probing is done for about 5 to 10 minutes. During this short procedure, is appropriate for a light general inhalation anesthesia to be used. The anesthetic might be administered with a bag-valve- face mask ventilation or with laryngeal mask airway (LMA) [20]. The anesthesiologist Dr. Archi Brain designed the laryngeal mask airway as a supraglottic airway device which has been used as a method of elective ventilation in the operating room since 1988. It is a good alternative to the face mask ventilation with bag, freeing the hands of the provider. Another benefit of LMA vs bag-valve-mask ventilation is the less gastric distention. [21, 22]

Probing is performed in the area of the medial part of the eyelids, where the structures of the lacrimal drainage system are located, and therefore the face mask is inconvenient for both the surgeon and the anesthetist [23]. The previously cited tests for establishing the patency of the nasolacrimal duct during probing under general anesthesia require access to the nose [6]. Thus, the laryngeal mask is preferred as it provides simultaneous access to the operative field and the nasal cavity [24]. In addition, the risk of pulmonary aspiration with LMA is minimal, and comparable to using a face mask and endotracheal intubation [25].

The purpose of this study is to assess the anesthetic risk and benefits of using laryngeal mask airway during probing in patients with congenital nasolacrimal duct obstruction.

### Materials and methods

A prospective study for a period from January 2017 - December 2018 was undertaken at the Department of Ophthalmology, University Hospital, Pleven, Bulgaria. The protocol for it was approved by the Committee of the Ethics of Research Activities at the Medical University of Pleven.

The inclusion criteria in this research are clinically signs for CNLDO such as watering and discharge from the eyes. The parents signed informed consent for the participation of their child in this study. Exclusion criteria were the presence of tearing in children, unrelated to obstruction of the nasolacrimal duct, observed in conjunctivitis, intraocular inflammation, epiblepharon, entropion or ectropion, congenital glaucoma, corneal anomalies, presence of facial anomalies (frontonasal dysplasia, encephalocele, tumor).

For children with CNLDO, preoperative laboratory tests (complete blood count, coagulation status, and blood sugar) and a consultative examination by a pediatrician are performed. If the general health condition of the patient is good, the pediatrician gave permission for surgical treatment with general inhalation anesthesia. If not, probing is not performed until the child is recure.

During the study period of two years, 40 children (52 eyes) passed through the Ophthalmology Clinic – Pleven. On the day when patients came into the clinic for probing, they have not eaten or drank any liquids since the night before.

Pediatric Jackson Rees System for general inhalation anesthesia and an I-gel type laryngeal mask airway was used in all the included patients (Figure 1).

Anesthesia was induced by inhalational facial mask induction using sevoflurane 7.0 Vol %. Atropin Sulfate Injection 0.1 mg/10 kg i.v. was administered against sinus bradycardia and bronchospasm. Analgesia was provided by 15 mg/kg paracetamol i.v. The LMA with appropriate size was inserted and fixed after confirming a correct position by auscultation of the chest. The anesthesia was maintained with sevoflurane 3.5 Vol % with patients breathing spontaneously. Continuous suction with catheter into the hypopharynx was not maintained throughout the procedure because of the risk of bronchospasm and bradycardia in case of deeper aspiration. At the end of the procedure, LMA was removed when the patient was almost awake.

During the anesthesia, the patency of the lacrimal drainage system after the probing procedure is checked by two methods. The first one is the sensation of “metal to metal” contact in the nose

between the Baumann probe in the nasolacrimal duct with which the probing is performed, and another larger probe placed below the inferior concha in the nose (Figure 2). If the feeling of this contact is present, the nasolacrimal duct is patent. If not, there is still some kind of obstruction.

The second way for detection of the patency of the lacrimal drainage system is with syringing of saline with a straight needle for irrigation of the lacrimal canals. Irrigation is done with about 1 ml of physiological solution through the punctum and is inspected for reflux from the opposite punctum (Figure 3). If there is no reflux, patency of the NLD is present. If there is some reflux, then there is obstruction of the duct.

The postoperative result is evaluated at the third month after the procedure. Probing is successful in the absence of a history of watering and discharge from the eyes. In the presence of such complaints, the probing is considered unsuccessful.

The survey data were statistically processed and analyzed using Statgraphics Software 2.0.0.0. The non-parametric  $\chi^2$  - test was applied. The significance of the findings and conclusions was determined at a significance level of  $p < 0.05$ .

### Results

Fifty-two eyes of forty patients underwent probing of the nasolacrimal duct due to CNLDO. The median age of the children at the time of this manipulation was 17.5 months (from 7.0 to 48.0 months).

A mild general inhalational anesthesia with the use of LMA was done in all the patients.

In 5 (9.6%) of the eyes, a small amount of blood was found in the saline during irrigation of the lacrimal drainage system. The remaining 47 (90.4%) probed eyes had no evidence of intraoperative bleeding because of the manipulation. According to the results from the method “metal to metal” and irrigation of the drainage system, intraoperatively were established 43 (82.7%) eyes with a patent nasolacrimal duct and 9 (17.3%) eyes with some kind of obstruction of the duct.

Complications related to the syringing, such as aspiration pneumonia and bradycardia, were not observed in any of the operated children. There was no incidence of laryngospasm, desaturation, coughing, laryngitis, or sore throat in the postoperative period.

On the third month after the probing, we determined postoperative successful result in 49 (94.2%) eyes and unsuccessful procedure in 3 (5.8%) eyes.

Comparison of the intra- and postoperative outcome of the probing showed statistical significance ( $\chi^2 = 15.21$ ;  $Df=1$ ;  $p=0.0001$ ). The methods used for checking the patency of the drainage system gave a prognosis of the success of probing.

### Discussion

There are two types of anesthesia used in probing: topical in children aged 4 to 6 months, or general in older children [26]. All patients in our study were above 6 months old and were operated on under general inhalation anesthesia using a laryngeal mask airway.

General anesthesia was chosen by us because it provides a comfort of the surgeon and reduces the risk of iatrogenic injury to the lacrimal drainage system during probing compared to local anesthesia [8]. The anesthetic was delivered with LMA in our patients in order to provide access to the nose during examination of the patency of the lacrimal drainage system with the method of “metal to metal” contact.

Sunder and Joshi reported an accidental LMA displacement with subsequent coughing and desaturation during the recovery phase in one of their patients [23]. Gataure et al. [27] in their study have claimed that events such as coughing, gagging, retching, and biting all increase the possibility of regurgitation and aspiration while removing the LMA. No such complications due to using of LMA were encountered in the intra- and postoperative period among our patients.

Another complication due to probing under general anesthesia is the pulmonary aspiration of fluid during syringing [17]. As a result, patients might develop clinical symptoms of aspiration

pneumonia such as fever, tachypnea, rales or crepitations in the chest [23]. In our cases, the amount of physiological solution injected during irrigation is very small (about 1 ml) and practically cannot cause the described complication.

Probing carries certain risks of failure even when the surgeon is skilled. One of these is the formation of a false path with bleeding during the procedure [16]. Intraoperative bleeding was found in 9.6% (in 5 of 52 procedures) of our cases. Cibis and Jazbi [28] reported a 27% false path rate (in 15 of 56 procedures) in their study. This complication occurs less frequently in our practice. The reason of this, we believe, is because of using the “metal to metal” contact to check the patency of the lacrimal drainage system during the probing procedure, which establishes intraoperatively the correct position of the distal part of the probe at the exit of the nasolacrimal duct in the nose. This method is possible to be done because of using LMA for anesthetic delivery in our study. Mocan et al [29] demonstrated that “metal to metal” contact had a prognostic value for the success rate of probing. According to many authors, the combination of the method of “metal to metal” contact and irrigation of the lacrimal drainage system reduced the risk of unsuccessful probing [30,31]. Our study found the same relationship with statistical significance ( $p < 0.05$ ).

One limitation of our study is the absence of a staining dye in the saline during irrigation of the lacrimal drainage system. Some authors [6,23] suggest adding fluorescein or povidone-iodine to the physiological solution to facilitate the visualization of the fluid. The presence of the stained fluid in the nose or in the hypopharynx during syringing is further confirmatory sign of nasolacrimal duct patency. Another limitation is that we make “blind” probing without direct observation of the probe under the lower concha in the nose, which is possible in endoscopic guided probing. MacEwen and her colleagues [32] believe that nasal endoscopy provides better information about the nature of the obstruction, reduces the risk of false path formation, and provides opportunities for treatment during the procedure.

### Conclusion

Probing being a single day surgery favors the use of laryngeal mask airway. Based on the results of our study, we suggest that the use of LMA is a safe way to administrate general anesthesia during “blind” probing. It allows the surgeon to perform the procedure in a way that predicts its success rate.

I have no conflict of interest or financial disclosures to declare.

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Fig.1 I-Gel Type Single Use Supraglottic Laryngeal Mask Airway



Fig.2 “Metal to metal” contact



Fig.3 Syringing of the lacrimal drainage system