



Efficacy & Safety of Inhalation Anesthetic Agent & Laryngeal Mask for Probing of Congenital Nasolacrimal Duct Obstruction in Children

Dr. MD Iftekhar Shamim¹, Dr. Md. Nasimul Gani Chowdhury², Jannatun Noor^{3*}, Dr. MD Shakibul Alam⁴, Dr. Nazia Alam⁵, Dr. Farzana Akter chowdhury⁶, Dr. Tasmin Akter⁷, Dr. Sharmin Akther⁷, Dr. Kazi Tahmina Akter⁶, Dr Mohammad Abdul Matin⁸

Abstract

Purpose: This article aims to demonstrate the efficacy and safety of administering inhalational anesthetic agent, Sevoflurane, as a sole anesthetic agent, in collaboration with Oxygen & N₂O, followed by Laryngeal Mask (LMA) insertion to pediatric patients following use of Intravenous (IV) anesthetic agents for short surgical optical procedure like probing and Syringing for CNLDO.

Methods: Selected 110 children with ASA-1 for bilateral CNLDO underwent probing over 12 months period with inhalation anesthesia and LMA insertion were monitored meticulously. Preoperative weight, medical conditions and respiratory status recorded in data sheet as standard monitoring. Data were collected during all three phase of pre, intra and post-operative period. Post-operative fluctuations of cardiac & respiratory status following 6 hours after procedure were also recorded.

Results: A total of 110 children aged 1–3 years with CNLDO underwent probing and syringing under inhalational anesthesia with Sevoflurane over a 12-month period. There were 50 males (45.16%) and 60 females (54.84%). Spontaneous respiration and heart rate remained within normal physiological parameters throughout the procedure, with no significant hemodynamic instability observed. Postoperative nausea and vomiting occurred in 10% of patients, while emergence from anesthesia was rapid, with mean awakening time of 2.5 ± 0.4 minutes. Oxygen saturation (SPO₂) remained >95% in 98% of patients. Minor mucosal trauma occurred in 4 patients (3.6%), while mild aspiration occurred in 3 patients (2.72%). No laryngospasm or bronchospasm was observed following LMA removal. No intravenous anesthetic drugs or muscle relaxants were required, and no patient required re-intubation.

Conclusion: Inhalational anesthesia (Sevoflurane) followed by LMA insertion can be accepted as a safe limit, child friendly, cost effective and measure for airway maintenance and anesthesia during Probing & Syringing of CNLDO patients with stable hemodynamic status and lesser complications.

Affiliation:

¹Associate Consultant, Anesthesia, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

²Professor and Chief Consultant, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

³Lecturer, Institute of Community Ophthalmology, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

⁴Senior Assistant Surgeon, Anesthesia, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

⁵Assistant Surgeon, Anesthesia, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

⁶Consultant, Department of Cataract, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh.

⁷Assistant Surgeon, Department of Paediatric Ophthalmology, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

⁸Assistant Professor, Anesthesia, Chittagong Maa-o-sishu & General Hospital, Chattogram, Bangladesh

*Corresponding author:

Jannatun Noor, Lecturer, Institute of Community Ophthalmology, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

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Introduction

Inhalation anesthesia entails administering anesthetic substances in gaseous or vaporized forms for the patient to breathe in. Typical inhalational

anesthesia agents comprise Sevoflurane, Isoflurane, desflurane, and nitrous oxide. Benefits of inhalation anesthesia feature quick onset of action, accurate adjustment of anesthetic depth, and swift reversibility after stopping [1,2]. Moreover, inhalation agents provide excellent regulation of anesthesia depth, rendering them appropriate for various surgical procedures, such as probing and syringing of congenital nasolacrimal duct obstruction [1,2]. This is one of the most common and straightforward interventions in ophthalmology, and it is crucial to emphasize that in most cases, the obstruction resolves spontaneously during the first year of life [3,4]. Inhalation anesthesia using LMA/intubation is essential for the Syringing & probing procedure, as it can risk airway compromise and prevent aspiration from syringing [5]. Proper specialized equipment for delivery, like vaporizers and anesthetic circuits, along with the presence of experienced anesthesiologists and supportive staff, is required to carry out this process effectively. Also it's important for anesthesiologists to appreciate the impact of preoperative anxiety in children. Not only does it cause suffering in many children prior to their surgical experience, it has a negative impact on their post-op recovery and possibly long afterwards [6,7]. The fear of needling during IV cannulation, isolation from parents, the O.T. environment which is completely unknown and frightening for the children escalates a massive negative impact and straining brings chaos to the O.T. [6,7]. To overcome these phobia and straining of children, inhalation anesthesia followed by LMA insertion and deeping of the patient only by admixture of O₂, N₂o with sevoflurane obliterates the use of IV anesthetic drugs which is very much cost effective, budget friendly, less hazardous to the children regarding cardio-respiratory effects, Smooth rapid Induction & early recovery post-operatively [2,8]. The use of Endotracheal tube (ETT) for a short surgical procedure often seems inappropriate due to risk of mucosal damage, Post-extubation complication, Use of muscle relaxants which lengthens the recovery phase. That's why LMA is an excellent choice which doesn't need any of muscle relaxant, children can breathe spontaneously all the time intra-operatively and less invasive compared to ETT which results in low risk of airway & mucosal damage along with minimum post-op complication [9-11]. To alleviate the child's phobia and anxiety during anesthesia induction, the use of face mask inhalation with Sevoflurane allows for a quick and smooth transition to deep anesthesia, eliminating the necessity for an intravenous induction agent. For safety reasons, IV cannulation was performed only after LMA insertion when the child was already in deep sedation.

Methods

It was a prospective cross-sectional study conducted at the Chittagong Eye infirmary and training complex, Chattogram from 1st June 2025 to 31st May 2026. Samples

were collected randomly. Informed written consent was taken from parents. Pre-operative assessment was done properly by both anesthetist & pediatrician including fitness of the patient for General Anesthesia, Evaluation of general health status of the children for excluding any type of upper/Lower Respiratory Tract Infection in recent days, Gross malnutrition, any neurological deficit and growth retardation. Principally, children were selected according to American Society of Anesthesiologists (ASA-I) category. All patients were kept NBM 6 hours prior surgery and no sedations also prescribed. To overcome the phobia of the IV cannulation, Induction was given by pediatric anesthesia circuit (Mapleson F) with O₂ (50%), N₂O (50%) & Sevoflurane (5-6%). After deep sedation, LMA with appropriate size was inserted, proper suctioning & airway protection was secured, and while patient was breathing spontaneously, IV Cannulation was done promptly only for managing any emergence. Monitoring parameters included SPO₂, HR & a Stetho over chest. All setup for proceeding any emergence maneuver like endotracheal intubation or cardio-respiratory resuscitation was taken prior. All the time skilled experienced anesthesia doctor & anesthesia Paramedics were present in the Operation Theater. Sevoflurane Inhalation rate was titrated according to the patient age (2-4% max). The LMA was inserted while patient was deep enough by nonreactive to bimanual jaw thrust maneuver (120s) LMA size was chosen according to standard weight sizing for pediatric patients (LMA 1.5 up to 10kg BW, 2 for 10-20 kg) inflation volume was 8-10 ml. The average surgical procedure was 4-10 minute. No IV drug was given. Patient kept on spontaneous ventilation. At the end of the procedure, Oxygen flow increased to 100% after Sevoflurane, N₂O was stopped. Adequate suction was given. After a slight hint of awakening, LMA was removed after deflating the cuff. Post-extubation LMA, O₂ was delivered via bag mask ventilation for 5 min and patient observed for bronchospasm, laryngospasm, mucosal trauma and aspiration up to 6 hours after completion of surgery. All quantitative data was processed using SPSS version 16.0 with the help of Microsoft office (excel and word). The descriptive data were analyzed in terms of frequencies and percentages. Both univariate and bivariate analysis were done to analyze the data to describe and show relationships.

Result

About 110 patients with CNLDO aged between 1 to 3 years underwent probing in 12 months period of time where male were 50 (45.16%) patients and female were 60 (54.84%). While all the patients was under inhalation Anesthesia with sevoflurane, and LMA insertion was Smooth in 99% of cases. Incidence of post-operative nausea and vomiting (PONV) was 10%, awakeness after operation was rapid 2.5 ± 0.4 minutes.

Table 1: Characteristics of study patients

Content	N	%
Total case	217	100
Age 1-3 years	110	100%
Sex		
Male	50	45.16
Female	60	54.84
Laterality		
Unilateral	19	17.51
Bilateral	91	82.49

SPO₂ was maintained >95% in 98% patients. Only 4 patients. Experienced Decreased SPO₂ by 90%, after inhalation anesthesia which was recovered promptly by 100% O₂ Flush. Only four (3.6%) patient experienced mucosal trauma and 3(2.72%) patients had mild aspiration. No Laryngo/bronchospasm was recorded after LMA Removal. Per-operative Spontaneous respiration and HR was With in Normal physical parameter. After the probing & Syringing procedure, adequate Suctioning was given. No IV Drugs, Muscle Relaxants was given, no re-intubation also needed for any patient. No massive hemodynamic changes were observed.

Table 2: Post-operative status of Study patients

Post-operative status	Sevoflurane & Laryngeal Mask
Post-operative nausea and vomiting	0.1
Awakeness after operation	2.5±0.4 minutes
SPO ₂	
>90%	0.98
<90%	0.02
Mucosal trauma	0.036
Mild aspiration	0.0272

Discussion

The management of congenital nasolacrimal duct obstruction (CNLDO) often requires surgical probing, necessitating an anesthetic approach that balances airway protection with rapid recovery [12]. Current findings utilizing LMA with spontaneous ventilation along with Sevoflurane in children aged 1–3 years indicate exceptional efficacy and safety. Key results include a 99% LMA insertion success rate, a mean emergence time of 2.5 ± 0.4 minutes, and low rates of trauma (3.6%) and aspiration (2.72%). These outcomes align with recent shifts in pediatric anesthesia favoring supraglottic devices for short procedures [13,14]. The 99% success rate for LMA placement observed in this cohort reflects the device's reliability and ease of use in pediatric populations. This high insertion success is consistent with literature reporting LMA

placement rates between 94% and 99.6% [15]. Furthermore, LMA usage significantly optimizes operating room workflow by providing shorter procedure times compared to ETT, which often requires muscle relaxants and more complex management [15,16]. The observed emergence time of 2.5 minutes is notably rapid, facilitating high-volume surgical throughput in tertiary centers [17]. Maintaining high oxygen saturation (SpO₂ >95%) is critical during pediatric airway management. The current technique achieved this in 98% of cases, mirroring findings that LMA maintains higher SpO₂ levels compared to tracheal intubation [18]. The low incidence of soft tissue trauma (3.6%) and aspiration (2.72%) compares favorably to broader pediatric audits and meta-analyses, which often report higher complication rates for more invasive techniques [16,19]. Specifically, the LMA provides superior glottic isolation compared to face masks, significantly reducing the risk of aspiration during lacrimal syringing [20]. The combination of spontaneous ventilation (SV) and Sevoflurane is optimal for short pediatric procedures due to its simplicity and controllability [17,21]. Sevoflurane's low blood-gas solubility ensures rapid awakening, while avoiding muscle relaxants eliminates the risk of residual neuromuscular blockade and minimizes hemodynamic stress. Unlike ETT, which triggers a significant pressor response, LMA placement maintains cardiovascular stability, with hemodynamic parameters returning to baseline faster than with intubation [19,22]. While the LMA-Sevoflurane-SV protocol is highly effective for children aged 1–3 years, its efficacy in neonates or infants under one year old remains less clear due to anatomical variations [23]. Additionally, while aspiration rates are low, the LMA does not offer the absolute protection provided by a cuffed ETT, suggesting a need for further evaluation in cases involving high-volume irrigation [24].

Conclusion

The use of the Laryngeal Mask Airway under spontaneous ventilation with Sevoflurane is an exceptionally effective strategy for pediatric nasolacrimal duct probing. The results of the current study—characterized by high procedural success, rapid recovery, and excellent safety—are strongly supported by existing clinical literature and meta-analyses. By avoiding the hemodynamic stress of intubation and the airway vulnerability of face mask techniques, this protocol optimizes both patient outcomes and institutional efficiency in high-volume ophthalmic centers. Given the minimal rates of trauma, aspiration, and PONV, LMA with spontaneous ventilation should be considered the preferred anesthetic management for children aged 1–3 undergoing pediatric nasolacrimal duct probing.

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