Brief Communication

Smart Airway Choices for Short Ophthalmic Surgeries: A Practical Perspective

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Introduction

The primary objective of anaesthetic care in elective ophthalmic surgery includes a pain free experience, facilitating optimal surgical conditions, enabling swift postoperative recovery, and minimizing anaesthesia related risks. While the majority of ophthalmic surgeries are performed as day care procedures under topical, regional or general anaesthesia, it is crucial to adopt strategies that support fast-tracked recovery and overall perioperative efficiency.

For certain short duration ophthalmic procedures, general anaesthesia may be preferred or required, particularly in paediatric patients, uncooperative adults, or those with specific medical needs. These cases often do not necessitate the use of muscle relaxants, yet demand a secure and reliable airway to ensure patient safety and surgical success.

This brief communication aims to identify different types of ophthalmic procedures typically performed under short-duration general anaesthesia and to outline practical considerations in selecting appropriate airway devices for these cases.

Selecting the correct airway device

1. Face mask: The face mask is one of the most long standing and adaptable tools in anaesthetic practice. It provides a straightforward, non-invasive means of delivering oxygen and volatile anaesthetic agents to the patient.[1] Commonly used during both induction and maintenance of general anaesthesia, it remains a valuable option for inhalational induction in the paediatric population to facilitate intravenous access in an uncooperative or anxious child. When selected appropriately based on the patient, procedure and surgical environment, face mask anaesthesia is a safe and effective option.

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Article History
Received: 1st May 2025
Revision: 7th May 2025
Accepted: 13th June 2025
Published: 30th June 2025

How to cite this article: Sujata R, Jaichandran V V. Smart Airway Choices for Short Ophthalmic Surgeries: A Practical Perspective. Indian J Ophthal Anaesth 2023;5(2):15-24

Shorter duration Ophthalmic Procedures Requiring General Anaesthesia Indications by Sub-specialty					
Cornea	**Oculoplasty**	**Glaucoma**	**Retina**	**Squint and paediatric**	**Miscellaneous**
Global developmental anomalies like Microophthalmia	Ocular Tumours like Retinoblastoma	Congenital and childhood glaucomas	ROP sequelae	Comprehensive examination of a one-eyed child	Performing diagnostic tests such as Electrophysiology, OCT, UBM, etc.
Anterior segment dysgenesis (including congenital corneal opacities)	Congenital naso-lacrimal duct obstruction		Inherited retinal disorders	Optic nerve head disorders	Unexplained visual loss, low vision
Examination and Management of Chemical and thermal injuries				Congenital and childhood cataract	Follow-up after intraocular surgery in children
Infants with aphakia				Developmental delay and children with special needs	

For short duration ophthalmic interventions such as foreign body removal, corneal scraping, or suture removal following cataract surgery, the face mask can be a convenient go-to device. To minimize interference with the surgical field, especially in eye surgeries, the mask can be secured with a head strap or harness, allowing for hands-free use and maintaining airway patency throughout the procedure (Figure 1).[2] Moreover, several studies have indicated that the risk of gastric insufflation or reflux remains comparable between face mask and supraglottic airway devices such as the LMA, even when controlled ventilation is employed. This reinforces the face mask as a reliable and well-tolerated option for brief general anaesthesia in suitable ophthalmic cases.[3,4]

Figure 1- Patient under general anaesthesia maintained on spontaneous respiration using a Jackson-Rees (JR) circuit. A face mask is securely held in place with a mask string, effectively functioning as a harness to provide a hands-free airway solution for a short ophthalmic procedure. For illustrative purposes, the JR circuit is positioned near the head end.

2. Dual Nasal Cannula: The dual nasal cannula, also referred to as dual nasal prongs, is a simple yet effective device used in anaesthesia for short-duration procedures. It serves a dual function of delivering supplemental oxygen while simultaneously enabling end-tidal CO_2 ($EtCO_2$) monitoring through separate channels (Figure 2). This setup is particularly suitable for brief, non-invasive ophthalmic procedures such as examinations under anaesthesia, where airway manipulation is minimal or unnecessary. A key advantage of the dual cannula is the preservation of spontaneous respiration, with continuous respiratory monitoring ensured by a visible $EtCO_2$ waveform (Figure 3).

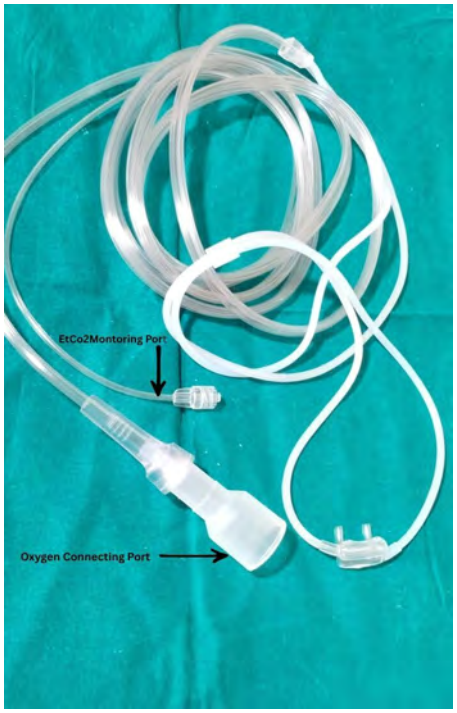

Figure 2: Figure showing dual nasal cannula: A. Oxygen delivery port connection B. End-tidal CO_2 ($EtCO_2$) monitoring port connection

Figure 3: Patient posted for examination under general anaesthesia, maintained on spontaneous respiration using a dual nasal cannula. Monitor displays a continuous $EtCO_2$ trace confirming airway patency.

This allows the anaesthetist to safely maintain the patient under total intravenous anaesthesia (TIVA) without the need for airway instrumentation. Additionally, as no airway device is inserted, patients benefit from faster recovery and minimal airway irritation, making it an efficient and well-tolerated choice for short ophthalmic interventions.

3. **Supraglottic Airway Devices (SGAs)**: Supraglottic airway devices have become a preferred choice for airway management in short ophthalmic procedures due to their ease of insertion, better patient tolerance, and reduced haemodynamic response during placement. A major advantage is that these devices can be inserted without the use of muscle relaxants, making them ideal for short-duration anaesthesia.[5] There is a wide array of SGAs available for clinical use (Figure 4).[6]

Figure 4: Supraglottic airway devices: (A) Intubating Laryngeal Mask Airway, (B) LMA Unique™, (C) Classic LMA, (D) Disposable Laryngeal Mask (Romsons). Extraglottic devices with both airway and gastric drain tube: (E) Baska Mask, (F) Ambu AuraGain™, (G) LMA Supreme™, (H) i-gel, and (I) ProSeal™ Laryngeal Mask Airway.[6]
Picture courtesy: Sharma B et al. Extraglottic airway devices: technology update. Med Devices (Auckl). 2017 Aug 17;10:189-205. doi: 10.2147/MDER.S110186.

While first-generation SGAs offer basic airway management, second-generation devices provide the added benefit of a gastric drainage channel, thereby reducing the risk of aspiration by separating the respiratory and alimentary tracts.[7]

However, one limitation in ophthalmic surgery is the potential for the vertical profile of some SGAs to interfere with the surgical field. Edwin et al. evaluated the vertical projection of commonly used SGAs for both first-generation devices such as the LMA Classic and Ambu AuraFlex and second-generation devices including the LMA ProSeal, LMA Supreme, LMA Protector, Ambu AuraGain, and I-gel in a manikin model. Their findings revealed that among the second-generation options, the LMA ProSeal had the lowest vertical projection and was thus more suitable for use in ophthalmic surgery (Figure 5).[8]

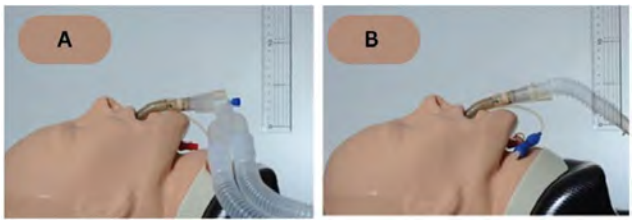

Figure 5: Images demonstrating the use of ProSeal LMA in a manikin model.
A. LMA ProSeal connected using an angled connector.
B. LMA ProSeal connected using a corrugated connector to reduce vertical projection and minimise surgical field interference.[8]
Picture courtesy: Seet E et al. Choosing the best supraglottic airway for ophthalmic general anaesthesia: a manikin study. J Clin Monit Comput. 2021 May;35(3):443-447. doi: 10.1007/s10877-020-00507.

To further address the challenge of surgical interference particularly with devices like the LMA Supreme and I-gel (Figure 6), Renu et al. proposed an innovative solution. They engineered a modified supraglottic device by combining two differently sized AMBU® AURA 40™ reusable laryngeal masks (sizes 1.0/1.5 and 1.5/2.0). The smaller LMA was cut just beyond the inflation line, and the curved portion of the larger mask was also modified.

Figure 6: Collage demonstrating the use of supraglottic airway devices in short ophthalmic procedures.
A. LMA Supreme™ in place for examination followed by paediatric cataract surgery.
B. i-gel® used for paediatric squint surgery, showing increased vertical projection, which can occasionally interfere with the surgeon's access during the procedure.

These two components were then joined to create a device with an altered angulation at the lip, redirecting the airway tube towards the chin. This design minimises the risk of surgical field interference while maintaining secure airway access (Figure 7). It is reported to be easy to insert and allows ophthalmologists to operate without obstruction or concern for device displacement.[9]

Figure 7: Image showing the novel airway device constructed by combining two differently sized AMBU® AURA 40™ reusable laryngeal masks (sizes 1.0/1.5 and 1.5/2.0) to increase angulation and minimise surgical interference.[9]
Picture courtesy: Sinha R et al. Novel supraglottic airway device for ophthalmic procedures. Indian J Anaesth. 2024 Oct;68(10):927-928. doi: 10.4103/ija.ija_537_24.

Other supraglottic airway devices worth mentioning include the Flexible LMA, Air-Q LMA and the BlockBuster LMA. The Flexible LMA, with its flexometallic shaft, offers enhanced adaptability and can be conveniently secured at the chin, reducing the likelihood of intraoperative displacement.[10] The Air-Q and BlockBuster LMA stand out not only for their lower vertical profile and minimising interference in the surgical field but also for their utility as potential rescue devices. In the event that a short procedure unexpectedly extends into a longer one, both allow for facilitated endotracheal intubation through the device, ensuring a smooth transition to a secured airway without requiring device removal or patient repositioning.[11,12]

Each airway device comes with its own set of benefits and limitations, and the choice must be individualised based on the clinical scenario. The table below outlines the pros and cons associated with commonly used devices

Advantages and Limitations of Commonly Used Airway Devices for Shorter duration Ophthalmic Surgeries

Device	Advantages	Limitations
Face Mask	1. Noninvasive. 2. Easily Available. 3. Allows inhalational induction in children. 4. Can offer hands free anesthesia with the use of Harness.	1. Requires constant monitoring or support if not strapped. 2. May interfere with surgical access. 3. Risk of IOP rise if ill-fitted 4. Not ideal for high aspiration risk 5. OT pollution due to gas leakage
Dual Nasal Cannula	1. Maintains spontaneous respiration 2. Allows $EtCO_2$ monitoring 3. Facilitates early recovery 4. No interference with surgical field	1. Not suitable for procedures needing airway control. 2. Requires high-flow oxygen source(>3 l/min) 3. Depth of anaesthesia must be well managed to avoid movement

Advantages and Limitations of Commonly Used Airway Devices for Shorter duration Ophthalmic Surgeries		
Device	**Advantages**	**Limitations**
LMA Supreme	1. 2nd generation SGA with gastric drainage channel. 2. Quick to insert. 3. Offers better airway seal than 1st generation LMAs	1. High vertical profile may interfere with surgical access. 2. Not ideal for shared head-end surgeries
I-gel	1. No inflatable cuff, hence faster insertion 2. Good airway seal and ease of placement 3. Disposable and cost-effective	1. Bulky and can encroach into the surgical field. 2. Limited ability to angle away from the surgeon's hand 3. Not ideal in all ophthalmic cases
LMA ProSeal	1. Provides better airway seal and allows gastric drainage. 2. Lower vertical profile compared to other 2nd generation SGAs thus suitable for ophthalmic procedures.	1. Slightly more complex insertion than classic LMA. 2. Reusable device needing proper sterilisation

Selecting the appropriate airway device

Choosing the most appropriate airway device is essential for ensuring patient safety and achieving optimal surgical outcomes. This decision hinges on multiple factors, including the nature of the surgery, patient characteristics, and intraoperative requirements. A thoughtful approach tailored to each scenario helps strike the right balance between airway security and surgical access.

1. Type and Duration of Surgery

The duration and complexity of the surgical procedure play a pivotal role in device selection. For procedures requiring significant manipulation such as strabismus correction or intraocular interventions a secure airway that ensures patency and facilitates ventilation is essential. In specific cases like congenital glaucoma, where accurate intraocular pressure (IOP) measurements are vital, using an ill-fitting face mask can inadvertently raise IOP due to

pressure on the globe or surrounding structures. Jaw manipulation during mask ventilation may also affect tonometric accuracy.[13] Hence, an alternative airway device that avoids pressure on the adnexa should be considered.

2. Risk of Aspiration

In patients with an increased risk of aspiration such as those with gastro-oesophageal reflux disease, obesity, delayed gastric emptying, or hiatal hernia, endotracheal intubation remains the gold standard. Although it has a significant effect on the IOP, it offers the most secure protection against regurgitation and aspiration of gastric contents, making it the preferred choice in such scenarios.[14]

3. Age and Airway Accessibility

Paediatric patients, particularly in ophthalmic procedures, present unique challenges. Given that the surgical drapes often restrict access to the airway, choosing an age-appropriate and secure device is crucial. Any need to adjust the airway during surgery could lead to hypoventilation, hypoxia, or surgical disruption.[8] For minimally invasive or diagnostic procedures like post-cataract suture removal or cycloplegic refraction in children with special needs, dual nasal cannulae can be a practical option. They allow spontaneous respiration while permitting easy monitoring of capnography. Since the head is often left undraped in these cases, any respiratory concerns can be addressed promptly. It's equally important to maintain adequate anaesthetic depth in these situations to avoid reflex responses such as coughing or laryngospasm.

4. Requirement for Muscle Relaxation or Controlled Ventilation

Some ophthalmic surgeries benefit from controlled ventilation and a still surgical field. For example, squint correction often requires muscle relaxation to optimize surgical conditions. In such cases, using a supraglottic airway device in conjunction with a short-acting neuromuscular blocker can provide excellent surgical access without the need for tracheal intubation. SGAs are associated with lower rises in IOP and a smoother emergence profile compared to endotracheal tubes, making them particularly suitable for short-duration procedures.[15]

5. Shared Surgical Field

Ophthalmic surgeries are typically performed from the head end, which is also the anaesthetist's workspace. This shared field can pose ergonomic challenges. Manually holding a face mask may interfere with the surgeon' s access and compromise anaesthesia delivery. In such scenarios, devices like nasal cannulae or supraglottic airways like LMA Proseal offer significant advantages.[8] They reduce clutter, enhance surgical visibility, and free the anaesthetist's hands for other tasks.

Emerging Trends and New Devices

1. **Baska mask**- It is a single-use supraglottic airway device designed with a self-sealing, non-inflatable cuff that conforms to the supraglottic anatomy during positive pressure ventilation. A notable feature is its extended hand-tab, which provides better control and ease of insertion by adjusting device flexion. Ghori et al. reported that the Baska mask outperformed the I-gel in sealing efficiency during short surgical procedures, without increasing laryngopharyngeal morbidity.[16]
2. **Totaltrack™** - It is an innovative video-guided laryngeal mask that integrates a supraglottic airway with a videolaryngoscope. In a study involving 300 patients, Gómez et al. observed that Totaltrack produced minimal haemodynamic response compared to direct laryngoscopy has an advantage in patients with limited physiological reserves, such as the morbidly obese or pregnant women.17

Conclusion

Short-duration ophthalmic procedures require a tailored airway management strategy that balances patient safety, surgical access, and rapid recovery. A clear understanding of the available airway devices, their suitability for specific procedures, and their limitations is essential. Institutions should adopt standardized airway protocols, ensure readiness of appropriate devices, and promote regular training and audits. These steps not only enhance perioperative care but also improves patient outcomes and surgical efficiency.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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