The use of a supraglottic airway, also called laryngeal mask airway (LMA), is gaining in popularity for delivery of general anesthesia in certain situations and is shown to be safe. Use of infraglottic airways (tracheal tubes) allows for positive pressure ventilation and maneuvers, such as holding continuous positive pressure in the airway to check for pleural and dural leaks.

We describe the successful use of the LMA (Teleflex Inc) for general anesthesia, in which continuous positive airway pressure of 15 cm H₂O held for 20 seconds allowed the neurosurgeon to identify the site of a cerebrospinal fluid (CSF) leak and successfully repair the leak. A well-seated LMA can be successfully used to produce continuous positive pressure in the airway not exceeding 20 cm H₂O for 20 seconds to facilitate surgical identification of CSF leaks.

Keywords: Dural leak, laryngeal mask airway, positive pressure, Valsalva maneuver.

Laryngeal Mask Airway and Valsalva Maneuver During Ophthalmic Surgery: A Case Report

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With the creation of the supraglottic airway device, commonly referred to as the laryngeal mask airway (LMA), many surgical cases that traditionally required general anesthesia via an endotracheal airway are now using the LMA device. A long history of safe and effective use has made the LMA a more standardized airway tool in anesthesia. Anesthesia providers now use this device in cases that historically would not have been given LMA consideration. In a recent ophthalmic surgical case with the use of an LMA at our institution, a Valsalva maneuver (VM) was requested. This brought about the question: Is it possible to safely perform a VM with an LMA in place? After an extensive literature review, little to no evidence focusing on the technique, its safety, or success was found.

This case report was designed to inform anesthesia providers that, with an adequately sealed LMA in place, a successful VM during an ophthalmic procedure can be performed. Because of the uncommon request for VM with a patient under general anesthesia with LMA, it is important that this case be reported to share the effectiveness of and the measures taken to achieve this maneuver. This report does not suggest that all VM should be done with an LMA. The authors’ intent is to show that the positive pressure ventilation (PPV) that is required to perform a VM can be produced safely when an LMA is in use.

Case Summary
A 72-year-old woman, with a height of 170 cm, weight of 87.5 kg, and ASA classification 3, presented to the operating room for repair of a left orbital socket defect requiring exoneration. She had previously undergone surgery and radiation therapy for orbital adenocystic carcinoma. Her current medications included acetaminophen, 350 mg as needed; aspirin, 81 mg daily; glimepiride, 4 mg daily; ibuprofen, 200 mg as needed; lisinopril, 20 mg daily; losartan, 100 mg daily; metformin, 500 mg twice daily; and omeprazole, 20 mg daily. During the preoperative interview, the patient was instructed to hold her antihyperglycemic medications (glimepiride and metformin) and continue with the antihypertensives (losartan and lisinopril) and proton pump inhibitor (omeprazole). These instructions were carried out properly as evidenced by the anesthesia interview on the day of surgery. The patient’s medical history included essential hypertension, stable type 2 diabetes mellitus, asymptomatic medication-controlled gastroesophageal reflux disease, and orbital adenocystic carcinoma. Her previous anesthetics were either monitored anesthesia care or general anesthesia via an endotracheal (ET) tube, each with no complications documented. Her airway classification was Mallampati 3 with an assessed small mouth opening.

For this case report, general anesthesia with an LMA was chosen after discussion among the nurse anesthetist, anesthesiologist, and the ophthalmic and neurosurgeons. Decreased stimulation with LMA insertion and speed of emergence were considered for this specific surgical intervention. It was also noted that the use of this airway device results in better hemodynamic and intraocular pressure stability. Furthermore, according to the manufacturer’s insertion guidelines, an LMA Unique (Teleflex Inc) with a mask size of 3 was chosen because of the patient’s airway assessment rather than the manu-
facturer’s weight-based recommendation. ³

After general anesthesia was induced with 60 mg of lidocaine and 150 mg of propofol, the LMA was easily inserted and the seal maintained according to usual practice. ¹,³ An adequate LMA seal was identified by capnography, tidal volume of 3 mL/kg, and the lack of an audible air leak at 15 to 17 cm H₂O pressure. ⁴ Capnography tracing and tidal volume were monitored with the patient’s return to spontaneous ventilation at a rate of 14 to 17/min. General anesthesia was maintained with inhaled sevoflurane and incremental doses of 25 µg of fentanyl, totaling 125 µg. After 45 minutes of surgery, the ophthalmic surgeon noted a small collection of clear fluid in the posterior aspect of the orbit. Despite continual blotting of the fluid, reaccumulation occurred. The consulted neurosurgeon was called on to evaluate a possible cerebrospinal fluid (CSF) leak.

During the neurosurgeon’s investigation, a VM was requested for diagnostic evaluation. Because the patient maintained spontaneous ventilation, the depth of anesthesia and control of respiratory effort would need immediate intervention. With a dose of 0.5 mg of hydromorphone (Dilaudid), continuous administration of sevoflurane, and a 60-mg bolus of propofol, a decreased respiratory rate of 7/min was achieved. At this point, a VM at 15 cm H₂O was cautiously established. The neurosurgeon identified a subtle trickle of clear fluid arising from the anteromedial aspect of the orbit. This area was reinforced with a dural sealant system (DuraSeal, Covidien, now Medtronic Minimally Invasive Therapies), subsequently halting the accumulation of clear fluid. The patient eventually returned to the previous rate of 15/min. At the conclusion of the surgery, the LMA was removed uneventfully, and hemodynamic parameters remained stable.

Discussion
Anesthesia practice is continuously evolving. With a focus on improving care and establishing efficiency, anesthesia providers must stay attentive to the most current trends and practice models. The LMA has been noted for its efficacy in anesthesia for many years. ¹ British anesthesiologist Archie Brain revealed his model of the first designed LMA in the early 1980s and spent the next 10 years perfecting this device. ¹ Since the 1990s, the LMA has been used for airway management in many types of surgery and is noted for its ease of induction and expeditious emergence times. ¹

In ophthalmic surgery, spontaneously ventilating a patient via an LMA has been recognized as an acceptable technique for patients having elective eye surgery. ² A plethora of evidence describes the advantages of the LMA, including fewer hemodynamic changes, decreased coughing and bucking during emergence and removal of the airway device, ⁴ and fewer changes in intraocular pressures; ² all of which are very important in ophthalmic surgery.

In this case report, when a dural leak was suspected and the VM was requested by the neurosurgeon, the risks and benefits of exchanging the LMA with an ET tube were evaluated. In theory, replacing the LMA with an ET tube could have been done, but the risks included loss of airway, laryngeal spasm, and elevated intracranial and ocular pressure while manipulating the airway. Additionally, the risk of contamination to the sterile field was considered. The anesthesia team understood the safe parameters for PPV with an LMA, and as long as it was adequately sealed and the appropriate recommended pressures were applied, the patient’s safety would not be compromised. ⁵ Therefore, the positive pressure VM was attempted and proved successful in the identification of a dural leak.

Positive pressure ventilation involves the movement of air, under a certain amount of pressure, entering the lungs and exiting via the atmosphere by mechanical ventilation. ⁶ This has been a mechanism of delivering anesthesia for many years and now is being used with LMA involvement. Its safety and the ability to improve patient outcomes compared with spontaneous ventilation have been noted. ⁷ Previous studies looked at safety and found that any pressures averaging 17 cm H₂O with tidal volumes below 10 mL/kg are safe parameters for PPV. ⁴,⁷ In following the manufacturer’s recommendations of keeping peak inspiratory airway pressures at 20 cm H₂O or below, patient safety was not compromised. ⁵ In a 1998 study of improved patient outcomes, Keller et al ⁷ compared PPV with patients spontaneously breathing with an LMA and noted that values of oxygen saturation measured by pulse oximetry were better with PPV (98.4% vs 97%, P < .001). They also found no comparable differences between spontaneous ventilation and PPV when it came to pulmonary aspiration. ⁷

There are disadvantages to using PPV with an LMA. Malposition of this device may make it difficult to maintain PPV and increase the risk of gastroesophageal insufflation. ¹ Cuff pressures above 60 cm H₂O may contribute to postoperative sore throat, dysphagia, and dysphonia. ¹,² Enforcing proper placement of the LMA with an adequate seal without a leak, maintaining cuff pressures below 60 cm H₂O, and limiting PPV to under 20 cm H₂O will reduce the risk of these complications. ¹,³,⁴,⁸

Performing a VM with an LMA has not been well described in the literature, to our knowledge. However, the VM with an ET tube has been documented. ⁹ Its ability to produce increases in intrathoracic, intracranial, and intraocular pressure has made it an important technique in neurosurgery. ¹⁰,¹¹ It has also been used for diagnosing surgical leaks and confirming adequate hemostasis after resection of a brain or spinal cord tumor, and is useful for confirming adequate dural closure. ¹²

The VM has its own complications. Valsalva retinopathy is a rare complication that presents with sudden vision changes after a VM performed during general
anesthesia. Patients present with a red-rimmed eye and describe seeing a “dark heart-shaped spot” in their visual field.\textsuperscript{13} Honemann and Brandt\textsuperscript{13} reported this outcome when a VM was conducted with an ET tube in place. Oxygen saturations were 93%, and recruitment maneuver with Valsalva was performed at 35 cm H\textsubscript{2}O. Saturations improved to 97%, and the remainder of the procedure was uneventful. It was not until 3 hours after surgery that the patient noted the already mentioned visual changes. It took 41 days for the patient’s sight to return to normal. No permanent damage was documented.\textsuperscript{13} Another complication was described by Pollack et al.\textsuperscript{14} evaluating massive suprachoroidal hemorrhage and its association with VM. Coughing, bucking, and light anesthesia were key components to this rare but potentially catastrophic event.\textsuperscript{14}

From the information provided, it is concluded that a VM with an LMA can be safely performed. The literature has noted that the LMA is not a first-line choice for airway management in a neurosurgical procedure; however, under the circumstances demonstrated, it was established to be effective and provided a safe manner for dural leak diagnosis. Risk factors were evaluated before making the decision to perform the VM with an LMA. Potential airway management risk and the maintenance of surgical site sterility were the 2 major determining factors for choosing to assess for a dural leak with the existing airway device. This mechanism was successful and proved to be valuable to the surgery. More research is necessary so that practitioners may feel confident when performing a VM with an LMA in their practice.

REFERENCES


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DISCLOSURES

The authors have declared they have no financial relationships with any commercial interest related to the content of this activity. The authors did not discuss off-label use within the article.