Preventing Laryngospasm in Laryngeal Mask Airway Surgeries

Simone Ilardi, BSN
University of Pennsylvania Nurse Anesthesia Program

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simoneil@nursing.upenn.edu

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Laryngospasm is common anesthetic complication in surgeries involving a laryngeal mask airway (LMA). If not promptly recognized and treated, laryngospasm can cause potentially lethal morbidities such as hypoxemia, pulmonary aspiration and post-obstructive pulmonary edema.\(^1\) A deep plane of anesthesia is known to prevent laryngospasm by suppressing upper airway reflexes, but measurements of anesthetic depth cannot yet predict whether surgical stimuli will provoke laryngospasm in a particular case.\(^2\) New prophylactic therapies have been found to protect against laryngospasm, both at the point of LMA insertion and during surgical manipulation.

Case Report

A 42-year-old male, 173 cm tall and 102 kg, presented for microsurgical epididymal sperm extraction (MESA) due to absence of morphologically normal sperm in the ejaculate. A review of systems was negative with the exception of recent smoking cessation and hypertension, for which the patient was treated with daily valsartan with hydrochlorothiazide. His past surgical history included a childhood tonsillectomy and a colonoscopy with no anesthetic complications. A preoperative airway assessment revealed a Mallampati classification of 2, a thyromental distance of greater than 3 fingerbreadth, an oral opening of about 3 cm, intact dentition, ability to prognathe the mandible and full range of motion of the neck with no paresthesia of the hands. The anesthetic plan was general anesthesia with an LMA.

In the operating room, standard ASA monitors were applied, midazolam 2 mg for anxiolytic effect was administered, and pre-oxygenation was initiated with 100% oxygen via a facemask using 10 L/min flow and having the patient take 4 to 8 deep breaths. General anesthesia was induced with lidocaine 1% 50 mg, propofol 250 mg, and fentanyl 50 mcg. Mask ventilation was successfully attempted and a number 4 1/2 LMA was inserted. Proper placement of the LMA was confirmed by auscultation of bilateral breath sounds and end tidal carbon dioxide (ETCO\(_2\)) was noted. A positive pressure of 20 cm H\(_2\)O was manually applied trough partial closure of the pop off valve to check for an audible leak. General anesthesia was maintained with sevoflurane 2.5% and incremental doses of fentanyl 25 mcg. The patient spontaneously ventilated. Upon initial genital manipulation and incision by the surgeon, an audible inspiratory and expiratory sound was noted. Efforts were made to break the partial airway obstruction with positive airway
pressure and deepening the anesthetic with propofol 50 mg, but these attempts were unsuccessful. The patient was salivating excessively and the anesthesia provider was unable to ventilate via the LMA, as evidenced by a loss of the ETCO$_2$ waveform and oxygen desaturation into the high 70’s. After suctioning the oral cavity and administering succinylcholine 60 mg, the patient’s trachea was intubated by direct laryngoscopy with an 8.0 mm endotracheal tube. Placement of the endotracheal tube was confirmed by auscultation of bilateral breath sounds, ETCO$_2$ waveform and 100% oxygen saturation. Volume controlled ventilation was used to maintain ETCO$_2$ between 30 and 32 mmHg. General anesthesia was maintained with sevoflurane, fentanyl and oxygen. Decadron 8 mg was administered. No additional muscle relaxation was given.

Toward the end of the case, the patient was weaned from mechanical ventilation using pressure support ventilation. Additional fentanyl 75 mcg was administered incrementally based on the patient’s respiratory rate and tidal volume. Once the patient showed the ability to follow verbal commands and a regular respiratory pattern was demonstrated by tidal volumes of 450 to 550 mls, the patient was extubated with positive pressure. Shortly after extubation the patient was transferred to the post anesthesia care unit.

**Discussion**

In this case, the treatment for laryngospasm was appropriate in spite of being ineffective. The patient’s low oxygen saturation allowed little time for the use of positive pressure to stop the laryngospasm, so intubation was the safest course of action. It would be far preferable, however, to prevent laryngospasm in the first place, thus avoiding the risks associated with intubation.

No test yet exists that can confirm adequate depth of anesthesia for the prevention of laryngospasm.\(^3\) Bispectral index monitoring, for example, does not definitively indicate an anesthetic depth that will prevent intraoperative awareness or unwanted intraoperative reflexes.\(^2\) Uniformly increasing standard induction dosages of anesthetic medications or paralytic agents would carry significant risks of prolonged respiratory depression and even mortality. But with healthy adult patients who have a surgical history indicating no anesthetic allergies, the incidence of laryngospasm in LMA procedures may be decreased by either of two prophylactic medical interventions: administration of fentanyl 1 mcg/kg prior to induction, or succinylcholine 0.1 mg/kg during induction.\(^4,5,6\)

In one recent study, fentanyl 1 mcg/kg given 3 to 5 minutes prior to induction with propofol and LMA placement was found to reduce the incidence of movements and coughing in adults undergoing ambulatory surgeries. The rate of laryngospasm was 2% in the treatment group versus 4.3% in the control group, and laryngospasm was more frequent in current smokers versus non-smokers.\(^4\) Though the decreased rate of laryngospasm was not statistically significant, it echoes the results of a 2010 study in which a range of preinduction fentanyl doses from 0–2 mcg/kg was assessed for effects on what the researchers termed “optimal insertion conditions” of the LMA. This earlier study concluded that fentanyl 1 mcg/kg administered 4.5 minutes prior to LMA insertion was optimal for preventing LMA complications.\(^5\) Though both studies found that
Preinduction fentanyl increased frequency of apnea and duration of manual ventilation, these potential drawbacks could be offset by the protective effect against laryngospasm, especially in patients such as smokers who are more at risk for coughing.

Another, more experimental, intervention for this patient would have been succinylcholine 0.1 mg/kg administered after propofol and before LMA placement. Succinylcholine is a depolarizing muscle relaxant sometimes used for rapid-sequence intubation or as a treatment for laryngospasm. In a recent study, researchers found that succinylcholine 0.1 mg/kg given prior to LMA insertion for urological procedures was associated with zero incidence of laryngospasm, as opposed to a 36.6% incidence in the control group. Rates of intraoperative movements were also dramatically reduced, and the experimental group required far fewer additional doses of propofol than the group not receiving prophylactic succinylcholine. These researchers were focused on LMA insertion conditions, but they posited that the increased muscle relaxation caused by the succinylcholine resulted in less tissue damage during LMA insertion, thus reducing coughing and laryngospasm throughout surgery.

This finding in a relatively small sample of 60 patients should be replicated before influencing standards of care, which currently do not recommend giving paralyzing agents prior to LMA insertion. The risk of prolonged mechanical ventilation associated with succinylcholine and other paralytics would have to be weighed carefully against a patient’s comorbidities and risk factors for laryngospasm. In this particular case, the patient’s overall good health, his previous tobacco abuse and his surgical history including paralytics would suggest that succinylcholine 0.1 mg/kg would have been a safe and effective way to protect against laryngospasm.

Of these two prophylactic measures, pre-induction fentanyl is the more cautious and easily integrated into current practice, while succinylcholine prior to LMA placement has an increased potential for effectiveness. With adult patients with a history of smoking, reactive airway disease or other risk factors for laryngospasm, pre-induction fentanyl should be considered as a protective intervention against laryngospasm, until the results achieved with succinylcholine prior to LMA placement are confirmed.

References


**Mentor:** Kelly L. Wiltse Nicely, PhD, CRNA

*wiltse@nursing.upenn.edu*