Holmium:YAG Laser Fiberoptic Bronchoscopy Via Laryngeal Mask Airway

L Myers, S Bakthavachalam, T Thomason, K Klein

Abstract
The laryngeal mask airway (LMA) is a supraglottic device that is open to the laryngeal inlet and is used to maintain a patent airway during inhalational anesthesia. Use of an LMA in combination with a flexible fiberoptic bronchoscope (FFB) has opened new possibilities to safely and effectively visualize and manage lesions of the laryngo-tracheal region. Further, the LMA and FFB in combination with a fiberoptic laser have been described to successfully diagnose and treat airway lesions. We describe the application of this anesthetic technique for 8 patients undergoing holmium:YAG (yttrium aluminum garnet) laser bronchoscopy for glottic, subglottic, and tracheal lesions. For this patient population, we found this application to be an exceptionally versatile technique, providing adequate airway protection while permitting spontaneous and/or assisted ventilation without obscuring the airway lesions.

INTRODUCTION
Airway protection for patients with glottic or subglottic stenotic lesions requiring general anesthesia for treatment is crucial for patient safety. Endotracheal intubation, jet ventilation, and spontaneous ventilation under deep intravenous sedation are established anesthetic techniques used for advanced surgical management. Despite proper patient selection and thoughtful planning for the most appropriate anesthetic method, each of these techniques may still be less than optimal to appropriately manage a lesion of the upper airway.

The laryngeal mask airway (LMA) is a supraglottic device that is open to the laryngeal inlet and is used to maintain a patent airway during inhalational anesthesia. The LMA has shown that the supraglottic airway approach is not only feasible, but in many situations superior to tracheal intubation. Although the LMA initially was recommended as an alternative to the facemask, its use has expanded, benefiting patients undergoing a variety of diagnostic and therapeutic procedures. Use of an LMA in combination with a flexible fiberoptic bronchoscope (FFB) has opened new possibilities to safely and effectively visualize and manage lesions of the laryngo-tracheal region. Subsequently, the LMA and FFB in combination with a fiberoptic laser have been described to successfully diagnose and treat airway lesions.

DESCRIPTION OF TECHNIQUE
After the patient is transferred to the operating room suite, intravenous or inhalational anesthesia is induced. An LMA is then inserted in standard fashion to the level of the laryngeal inlet. The LMA cuff is then inflated to secure the airway and the LMA is connected to the ventilatory circuit. General inhalational anesthesia is maintained with sevofluorane or desfluorane with an FiO2 < 0.3. The patient is allowed to breathe either spontaneously or with mechanical assistance. A Portex® Fiberoptic Bronchoscope Swivel Adaptor (Smiths Medical ASD, Inc., Keene, NH) is placed between the LMA and ventilator tubing. This allows a flexible fiberoptic bronchoscope to be placed into a side port on the adaptor and advanced down the LMA lumen until the larynx is visualized. The Holmium:YAG laser fiber (Lumenis, Inc., Santa Clara, CA) is passed through the flexible bronchoscope until the tip of the fiber is visualized (Figure 1). The fiber tip is allowed to contact the lesion...
receiving ablation and the laser is activated. If obstruction of
the breathing circuit is becomes a problem, the
bronchoscope and laser fiber may be intermittently removed
in order to fully ventilate the patient and maintain adequate
arterial oxygenation. After completion of the procedure, the
patient emerges from anesthesia and the LMA is removed.
The patient is transferred to the post anesthesia care unit for
recovery.

RESULTS
We report 7 patients who underwent 8 holmium:YAG laser
fiberoptic bronchoscopies (HLFB) via LMA. Four patients
were female and 3 were male. The average age was 47.1
years (range 35.6 - 61.5 years). One patient had a glottic
lesion, 3 patients had subglottic stenosis, and 4 patients had
tracheal stenosis. One patient was treated for both tracheal
and subglottic stenosis on two separate procedures. Five
patients were treated as outpatients and 2 were managed as
inpatients. The average post-treatment hospital stay for the 2
inpatients was 1.5 days. Seven procedures were elective and
1 procedure was semi-urgent. The average power setting was
8 Watts (range 1.6 – 10 Watts) and the average total energy
used was 2.93 KJ (range .026 – 6.0 KJ).

There were no intraoperative complications noted, such as
loss of airway, migration of LMA from laryngeal inlet, need
to replace LMA, need to convert to endotracheal intubation,
uncontrollable hemorrhage, or airway fire.

DISCUSSION
The Holmium:YAG fiber laser can be used for ablation,
excision, incision, vaporization and immediate hemostasis of
soft tissues through endoscopic, laparoscopic and open
access for a wide variety of surgical applications and
procedures. Otolaryngic applications of the holmium laser
include partial turbinectomy, tonsillectomy/adenoidectomy,
polypectomy, endonasal and endoscopic sinus surgery, and
as described here, ablation of airway stenosis. The
VersaPulse PowerSuite holmium laser transmits energy
through flexible fibers, making it especially suited for
minimally invasive endoscopic procedures. The
Holmium:YAG laser has a 2100-nm wavelength in the
infrared spectrum with up to a 0.5 mm depth of penetration.
The energy can delivered through a variety of small diameter
disposable and re-useable delivery devices which allows for
precise delivery of laser energy.

The laryngeal mask airway is a supraglottic device that
allows for ventilation without tracheal intubation. The ability
to use the LMA in combination with a flexible fiberoptic
bronchoscope makes it a favorable device to manage the
airway while accessing lesions throughout the upper- and
large conducting-airway. The advantages of using a
laryngeal mask airway include attenuation of the
hypertensive response seen in conventional tracheal
intubation, decreased airway resistance, and facilitation of
smooth emergence from anesthesia. In combination with a
flexible bronchoscope, excellent visualization and
maneuverability can be achieved to precisely access areas in
the airway.

Although reported in the pediatric literature, there are
few reports of using FFB via LMA adult population.
Kanagalingam et al described using the LMA with flexible
bronchoscope in managing two adult patients with anterior
glottic lesions that were inaccessible using suspension
microlaryngoscopy.

Clear communication and respectful cooperation between
the anesthesia and surgical teams are crucial and must be
maintained throughout entire procedure. All personnel
involved must remain vigilant regarding the patient’s
oxygenation and ventilation.

SUMMARY
We present our favorable experience using an LMA coupled
with flexible bronchoscopy to treat upper airway and
tracheal lesions using the Holmium:YAG laser. We found
this combined technique to safely maintain the airway while
fully visualizing lesions in this region. In the properly
selected patient, the LMA coupled with flexible
bronchoscopy to treat upper airway and tracheal lesions
using the Holmium laser offers many advantages over non-
LMA anesthetic methods.
CORRESPONDENCE TO
Larry L. Myers, MD Department of Otolaryngology-Head and Neck Surgery University of Texas Southwestern Medical Center 5323 Harry Hines Boulevard Dallas, TX 75390-9035 214.648.5643 (office) 214.6489122 (faximile) Larry.myers@utsouthwestern.edu

References
Author Information

Larry L. Myers, M.D.
Department of Otolaryngology-Head and Neck Surgery, University of Texas Southwestern Medical Center

Sivi Bakthavachalam, M.D.
Department of Otolaryngology-Head and Neck Surgery, University of Texas Southwestern Medical Center

Timothy S. Thomason, M.D.
Department of Otolaryngology-Head and Neck Surgery, University of Texas Southwestern Medical Center

Kevin Klein, M.D.
Department of Anesthesiology, University of Texas Southwestern Medical Center