The LMA CTrach™ system (The Laryngeal Mask Company, Singapore) was developed from the LMA Fastrach™ system (The Laryngeal Mask Company) and consists of an LMA CTrach™ airway with fiberoptic channels and a detachable liquid crystal display viewer cum light source. The LMA CTrach™ enables ventilation, glottis visualization, and tracheal intubation via a laryngeal mask conduit.¹ In this report, we describe our experience with the LMA CTrach™ in 48 patients with difficult airways.

**Case Report**

We obtained approval from the Domain Specific Review Board of the National University Health System, National Healthcare Group, Singapore, and the Human Subjects Review Committee of University of Washington, Seattle, Washington, to review with waiver of written consent the records of patients in whom the LMA CTrach™ was used to manage difficult airways in the operating room between March 2005 and December 2007. This case series of 48 patients does not include data that have previously been reported.²⁻⁵ The patients' characteristics and their main causes of difficult airway management are in table 1.

We used the LMA CTrach™ electively in 32 patients (66.7%) who were known to have or who were predicted to have difficult airways. In most of these patients, we induced anesthesia and checked that facemask ventilation was possible before inducing neuromuscular blockade and inserting the LMA CTrach™. In three morbidly obese patients, we lightly sedated the patients with midazolam and sprayed lidocaine to the oropharynx before using the LMA CTrach™. We used the LMA CTrach™ as a rescue device in 16 patients (33.3%) in whom tracheal intubation had unexpectedly failed with conventional laryngoscopy. This included emergent rescue in three patients in whom facemask ventilation, tracheal intubation, and LMA Proseal™ (The Laryngeal Mask Company) and LMA Classic™ (The Laryngeal Mask Company) insertion had all failed and the authors had been called upon to assist their colleagues. In 26 patients in whom laryngoscopy with a Macintosh laryngoscope (Heine Optotechnik, Herrsching, Germany) had been attempted before it was decided to use the LMA CTrach™, we considered laryngoscopy to be difficult when no part of the vocal cords could be seen even with the application of external laryngeal pressure.

We chose the LMA CTrach™ airway size according to the patients' body weight, in accordance with the manufacturer's recommendations.⁶ In patients with cervical spine pathology or trauma, an assistant applied manual inline stabilization throughout airway management. We removed rigid collars after applying stabilization, to facilitate airway management. We inserted the LMA CTrach™, checked our ability to ventilate the lungs, and attached the viewer. We optimized the LMA CTrach™ placement and view of the glottis, using the “up–down maneuver” to correct epiglottic downfolding, partial withdrawal if the LMA CTrach™ was too deeply inserted, and complete removal and cleaning of the LMA CTrach™ when secretions caused failed views.⁷ We then intubated the trachea under vision, confirmed correct intubation with end-tidal capnography, and removed the LMA CTrach™ over the endotracheal tube with the aid of a stabilizer rod. We used SPSS 16.0 (SPSS Inc., Chicago, IL) and STATA 7.0 (StataCorp LP, College Station, TX) for data analyses.

We were able to ventilate the lungs with the LMA CTrach™ in all 48 patients (100%; 95% confidence interval, 92.6–100%). We were able to optimize ventilation in 46 patients (95.8%; 95% confidence interval, 85.7–99.5%) such that gas leak was minimal and low inspiratory pressures less than 25 cm H₂O were required. In these 46 patients, we were able to view the glottis immediately after attachment of the LMA CTrach™ viewer in 23 patients (47.9%) and after adjustment of the LMA CTrach™ in 23 patients (47.9%). In all of these 46 patients, we succeeded in tracheal intubation through the LMA CTrach™ at the first attempt. In the 2 patients (4.2%) in whom we were unable to optimize ventilation, we also failed to view the glottis and did not attempt tracheal intubation with the LMA CTrach™. One patient was morbidly obese, and the other had marked retrognathia.

**Discussion**

The key features of the LMA CTrach™ are that it enables ventilation and tracheal intubation, and optimization of conduit placement under vision. The LMA CTrach™ may have a role when facemask ventilation and tracheal intubation have failed. Laryngeal mask airways feature in the American Society of Anaesthesiologists algorithm for such situations,⁸ but ventilation with the LMA Classic™ and LMA Proseal™ also failed in three of our patients. The ability to rapidly achieve some ventilation with the LMA CTrach™ was key to a safe outcome in these patients. Although we failed to visualize the glottis with the LMA CTrach™ in two of these patients, this helped us to decide against futile attempts at tracheal intubation through the LMA CTrach™.

In most patients with anatomical features such as retrognathia, maxillary overbite, and short, thick necks, these features did not cause difficulty with ventilation and visualization with the LMA CTrach™. Although we successfully used the LMA CTrach™ in patients with...
limited neck movement or who required manual stabilization, we have concerns about its use in patients with unstable cervical spine injuries. Cadaveric work with the LMA Fastrach™ showed that pressure on the upper cervical vertebrae can be substantial with posterior displacement of vertebrae. Insertion and manipulation of the LMA CTrach™ may similarly cause pressure on the spine, and neck movement may not be completely prevented by manual stabilization.

In morbidly obese patients, there may be better oxygenation during tracheal intubation with the LMA CTrach™ compared to with direct laryngoscopy, despite more time being needed with the LMA CTrach™. However, a recent report suggested that the manipulation of the LMA CTrach™ in a morbidly obese patient may have led to aspiration of regurgitated stomach contents. In partial, particular withdrawal of the LMA CTrach™ moves its cuff away from its protective position in the hypopharynx. Although the LMA CTrach™ can be used in awake patients, it has not been shown to prevent aspiration should regurgitation occur. Our data do not support any recommendations regarding the appropriateness of the LMA CTrach™ in patients at high risk for pulmonary aspiration.

Although we succeeded in tracheal intubation with the LMA CTrach™ in three post–head and neck radiation therapy patients, maneuvers to optimize glottis visualization and placement were difficult because of loss of tissue elasticity, limited mouth opening, and poor dentition. Similar difficulties have been reported with the LMA Fastrach™, and we advise caution in using intubating laryngeal mask airways in such patients.

Use of the LMA Fastrach™ has been validated in algorithms for the management of unexpected difficult airways in the operating room and out-of-hospital situations. The ability to optimize conduit placement and intubate the trachea under vision with the LMA CTrach™ may enhance the role of intubating laryngeal mask airways. Despite seemingly adequate ventilation through intubating laryngeal mask conduits, there can be problems with persistent epiglottic downfolding or endotracheal tube impingement on the arytenoids. Although visualization with the LMA CTrach™ takes time, ventilation and oxygenation can be maintained nearly continuously. Such visualization can enable a higher first attempt success rate of tracheal intubation with the LMA CTrach™ compared with the LMA Fastrach™. Use of a flexible bronchoscope with the LMA Fastrach™ also enables a high first attempt success rate of intubation, but this method required more time compared with the LMA CTrach™ in a manikin study.

Although the quality of images with the LMA CTrach™ is limited, the LMA CTrach™ may have advantages over videolaryngoscopes and flexible bronchoscopes that are used for managing difficult airways. Most important, the LMA CTrach™ enables ventilation. Even with good views of the airway with videolaryngoscopes and flexible bronchoscopes, it is frequently difficult to insert the endotracheal tube into the trachea, resulting in interruption of ventilation and oxygenation. With flexible bronchoscopic intubation, the endotracheal tube is advanced into the trachea over the bronchoscope, and the passage of the tube through the glottis cannot be seen. In comparison, the LMA CTrach™ conduit guides the endotracheal tube to the glottis, and the passage of tube through the glottis can be visualized.

The LMA CTrach™ has several limitations to its use. A minimum innerincisor distance of 3 cm is needed for its use. In patients with loose teeth or gaps in the teeth, LMA CTrach™ insertion and maneuvers can damage the teeth. It can be difficult to correct persistent epiglottic downfolding, particularly in very tall and/or obese patients. Secretions and blood in the oropharynx can cause repeated failed visualization, necessitating blind
intubation or abandonment of the procedure. Limitations of this case series are the possibility of selection bias by the anesthesiologists in deciding whether to use the LMA CTrach™. The numbers of patients with each of the different causes of difficult airways are not large. Further study is needed to ascertain the difficult airway situations in which use of the LMA CTrach™ is most appropriate.

In summary, we found high success rates of ventilation, glottis visualization, and tracheal intubation with the LMA CTrach™ in patients with different types of difficult airways.

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References


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Severe Retropharyngeal Abscess after the Use of a Reinforced Laryngeal Mask with a Bosworth Introducer


WE report an unusual case of postoperative retropharyngeal abscess with major morbidity in a patient who had general anesthesia and whose airway was managed with a flexible laryngeal mask airway inserted with the aid of a Bosworth introducer.

Case Report

A 57-year-old man was scheduled to undergo phacoemulsification of a cataract. General anesthesia was scheduled because the patient declined regional anesthesia after subjective discomfort during previous peribulbar anesthesia for contralateral cataract phacoemulsification. He had type 2 diabetes mellitus, hypertension, and hypercholesterolemia. He was not compliant with his medication regimen, and consequently, his glycemic control was chronically poor, as evidenced by his most recent hemoglobin A1c measurement of 11.5%. He was moderately obese (body mass index 29 kg/m²) and had no history of gastroesophageal reflux. He had poor dentition (multiple missing teeth and caries), a Mallampati grade 2 airway, and good mouth opening. Standard monitoring, including electrocardiography, noninvasive blood pressure monitoring, capnography, end-tidal vapor analysis, and pulse oximetry, were used. His anesthetic care was provided by an anesthe-tist with 13 yr of experience. Anesthesia was induced with 2 mg midazolam, 100 µg fentanyl, and 140 mg propofol and maintained with sevoflurane in an oxygen-air mixture via spontaneous ventilation. A size 4 flexible reinforced laryngeal mask airway (FRLMA) lubricated with a water-based gel was inserted partially inflated with the aid of a Bosworth introducer. The posterior aspect of the FRLMA and introducer were inserted along the hard palate. There was no documented difficulty with insertion of the laryngeal mask airway (LMA), and the introducer was removed with apparent ease. The cuff was inflated with 20 ml air, and the patient was allowed to breathe spontaneously. The operation lasted 30 min, and the LMA was removed awake with the cuff deflated, in postanesthesia care unit, with no evidence of blood on the LMA cuff. In postanesthesia care unit, the patient did