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Use of the Laryngeal Mask for Tracheal Intubation in Patients at Increased Risk of Aspiration of Gastric Contents

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The laryngeal mask (LM) has been used as an aid to tracheal intubation. Heath and Allagain[1] described blind intubation through the LM; Silk *et al.*[2] used a fiberoptic laryngoscope through the LM during general anesthesia; McCrirrick and Pracilio[3] described awake intubation using the LM. McCrirrick and Pracilio[3] inserted a LM under topical anesthesia, passed a gum elastic bougie blindly, and then removed the LM and intubated the trachea.

I describe two new techniques of tracheal intubation using the LM and the fiberoptic bronchoscope for patients at increased risk of pulmonary aspiration of gastric contents and evaluate the efficacy of these methods.

CASE REPORTS

Case 1. A 30-yr-old, 60-kg woman with antepartum hemorrhage with fetal death was scheduled for emergency cesarean section. The patient had no history of medical or surgical illness. On preanesthetic assessment, she was in distress because of abdominal pain and stated that she had vomited 1 h previously. No premedication was given.

Upon arrival in the operating room, her blood pressure was 120/60 mmHg; heart rate, 78 beats per min; and respiration rate, 18 breaths per min. After two intravenous cannulas had been inserted, 5 mg diazepam and 100 μg fentanyl in divided doses were administered intravenously; the patient became sedated but was responsive to command. About 2 ml 8% lidocaine was gently sprayed on the tongue and oropharynx.

A size-3 LM was easily inserted with minimal apparent discomfort to the patient. A 5.0-mm fiberoptic bronchoscope was passed through a 6.0-mm endotracheal tube with adjustable-angle tip (Endotrol®, Mallinckrodt, Athlone, Ireland), from which a controlling wire hook had been cut off. The combination was then inserted into the LM and passed through the grille. The glottis was well seen through the bronchoscope, which was further advanced into the trachea, and the endotracheal tube was then passed over the bronchoscope into the trachea. This caused coughing and straining; the blood pressure increased from 124/62 to 138/70 mmHg, and the heart rate increased from 80 to 92 beats per min. The cuff of the endotracheal tube was inflated immediately. After the bronchoscope had been removed, the anesthesia system was connected to the endotracheal tube and anesthesia was induced with 60 mg ketamine. The connectors of the LM and the tube were taped.

Anesthesia was maintained with isoflurane and nitrous oxide in O_2; muscle relaxation was achieved with vecuronium. Ventilation was controlled with airway pressure up to 20 cmH_2O.

During emergence from anesthesia, the patient vomited a large volume of gastric contents, which was successfully removed by suction. No pulmonary aspiration was observed by bronchoscopy. After the trachea had been extubated with the patient fully awake, she was transferred to the recovery room. Postoperative interview revealed no recollection of events during induction of anesthesia.

Case 2. A 59-yr-old, 45-kg woman was scheduled for repair of an intestinal obstruction. Her medical history included a colectomy 4 months previously, under general anesthesia, without complications. Preoperative abdominal x-ray showed gaseous distension of the large intestine; chest x-ray showed slight elevation of the diaphragm. Analysis of arterial blood gases revealed oxygen tension of 78 mmHg, carbon dioxide tension of 42 mmHg, and pH of 7.42. One-half milligram atropine and 50 mg hydroxyzine were given intramuscularly 45 min before induction of anesthesia.

Upon arrival in the operating room, she was awake and calm. Five milligrams diazepam and 100 μg fentanyl in divided doses were given intravenously. The patient became sedated but was responsive to command. The tongue and oropharynx were topically anesthetized with about 2 ml 8% lidocaine spray.

A size-3 LM was easily inserted with minimal apparent discomfort to the patient. A 6.0-mm endotracheal tube was connected to the anesthesia system with a swivel connector, and 6 L/min of O_2 was given. After a fiberoptic bronchoscope had been passed through the endotracheal tube, the combination was inserted into the LM and advanced through the grille. The glottis was easily seen. Under direct observation of the glottis through the bronchoscope, 200 mg thiamylal and 50 mg succinylcholine were administered intravenously in rapid sequence. Cricoid pressure was applied as soon as the patient lost consciousness. After the patient was paralyzed, the bronchoscope was advanced into the trachea, and the endotracheal tube then was passed over it. The cuff of the endotracheal tube was inflated immediately. At this point the pulse rate increased from 86 to 96 beats per min, but the blood pressure did not change. The bronchoscope was removed after proper placement of the endotracheal tube had been confirmed. Anesthesia was maintained with isoflurane in O_2, fentanyl, and diazepam. Ventilation was controlled with airway pressure up to 18 cmH_2O. Following uneventful anesthesia and surgery, the trachea was extubated without complications. The patient had no recollection of events during induction of anesthesia.

DISCUSSION

These cases illustrate the use of the LM as an aid to awake intubation (case 1) and to rapid-sequence induction-intubation (case 2).

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Several techniques of tracheal intubation for preventing aspiration have been described; however, all have drawbacks. Awake intubation with direct laryngoscopy is uncomfortable and stressful for the patient. Intubation is sometimes difficult since the patient may close the mouth, gag, or move vigorously, leading to prolonged procedures and injury to the soft tissues. Awake blind nasotracheal intubation can injure the nasal mucous membrane, and its success rate at the first attempt is low.[4] Fiberoptic intubation with the patient awake is a third alternative. Although this technique may be used for patients in whom difficult intubation is expected, it requires experience, and successful intubation sometimes requires several minutes even by skilled individuals.[5] Rapid-sequence induction and intubation with cricoid pressure is the most commonly used technique. However, if tracheal intubation presents unexpected difficulties after induction of anesthesia, the risk of pulmonary aspiration may increase.

The advantages of the techniques described are threefold. First, they are technically easy. The LM can be successfully inserted even in patients in whom intubation is difficult.[6] Since the distance between the grille of the LM and the glottis is a few centimeters, insertion of a fiberoptic bronchoscope into the trachea through the LM is easier than conventional fiberoptic oro- or nasotracheal intubation. Insertion of the endotracheal tube into the trachea over the bronchoscope is also easy, because obstacles, including the epiglottis, are bypassed by the LM. Second, using the rapid-sequence induction and intubation technique as described in the second case, the time between induction of anesthesia and tracheal intubation may be shorter than with conventional techniques. Thus, the risk of both hypoxia and pulmonary aspiration should be reduced. Finally, these techniques seemed to me less uncomfortable and less stressful for the patient. In my experience with more than 25 patients, no apparent grimace or marked increases in blood pressure have occurred.

The major disadvantage of these techniques is that aspiration may occur in sedated patients. However, although aspiration after administration of sedatives has been reported,[7] the airway reflex is thought to be intact after small doses of sedatives.[8,9] Vomiting may occur because of stimulation by the LM. However, in my experience the stimulation seems minimal, and no vomiting has occurred. Since sedatives are administered in these techniques, this use of the LM may not be suitable for obstetric patients. Other disadvantages are that a fiberoptic bronchoscope and assistants are required and that only a 6.0-mm endotracheal tube or smaller can be used in these techniques.

I selected the Endotrol® tube because it was the longest one that I could obtain at my university. Heath stated that, when the tracheal tube (oral [Mallinckrodt] or nasal tube [Portex, Kent, England]) is passed fully through the LM, the upper border of the cuff is likely to be about 3 cm beyond the vocal cords.[10] However, I believe that the distance between the vocal cords and the upper border of the cuff is less than she believes. I was concerned that if the tube was too short, the cuff would override the vocal cords, leading to incomplete prevention of aspiration or damage to the vocal cords. With the longer Endotrol® tube (about 29.5 cm in length), the margin of safety is therefore increased. I cut off the hook to enable the tube to be inserted in the LM.

An important factor in these procedures is to ensure that the tip of the bronchoscope and of the endotracheal tube are advanced through the grille of the LM before induction of anesthesia, because the tip of the endotracheal tube can impact upon the grille of the LM.[10]

The use of the LM in anesthetized patients with a full stomach is inappropriate, because the LM cannot prevent regurgitation effectively. However, since the airway reflexes are not impaired by the described techniques, I believe that the risk of pulmonary aspiration by the use of the LM described would not increase. If vomiting occurs, the LM should be removed immediately and vomitus removed.

In summary, I describe two new techniques using the LM as an aid to tracheal intubation in patients at risk of aspiration. Both techniques are technically easy and not stressful to the patient. I believe that these techniques are useful alternatives to conventional techniques of tracheal intubation in patients at risk of aspiration.

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