Brief Reports

Gastroesophageal reflux during spontaneous respiration with the laryngeal mask airway

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Purpose: To determine the incidence of gastroesophageal reflux during general anesthesia with the Laryngeal Mask Airway (LMA).

Methods: Twenty unpremedicated patients with no risk factors for reflux having day case anesthesia were included. Type of surgery was Orthopedic (n=8), General (n=7) and Gynecological (n=5). The average duration of anesthesia was 38.1 min, range 12 - 71 min. Anesthesia was induced with 1-2 $\mu\text{g}\cdot\text{kg}^{-1}$ fentanyl and 2-3 $\text{mg}\cdot\text{kg}^{-1}$ propofol and maintained with oxygen 33%, nitrous oxide 66% and isoflurane 1% (end-tidal). Ventilation by hand was performed until spontaneous respiration resumed. To facilitate surgery, 13 patients were placed in the supine and seven in the lithotomy positions. Two pH-sensitive electrodes were used to identify reflux. One was placed in the oesophagus 20 cm from the anterior nares to detect esophageal reflux and the other was placed through the bars of the LMA to detect refluxing material around the LMA.

Results: Esophageal reflux occurred in 12 patients (60%), in five of the 13 in the supine position and in all patients in the lithotomy position. The LMA electrode detected a decrease in pH in four cases (20%), all in the lithotomy position. The incidence reflux in the lithotomy and supine positions was different (Exact Probability test; $P = 0.01$).

Conclusion: This study suggests that the lithotomy position predisposes patients to a higher risk of aspiration than the supine position when using a LMA.

Objectif : Déterminer l'incidence de reflux gastro-oesophagien pendant l'anesthésie générale avec le masque laryngé (ML).

Méthode : Vingt patients admis pour une chirurgie ambulatoire, sans prémédication, et ne présentant pas de risque de reflux ont participé à l'étude. Les interventions relevaient de la chirurgie orthopédique (n = 8), générale (n = 7) et gynécologique (n = 5). La durée moyenne de l'anesthésie a été de 38,1 min et les limites de 12-71 min. L'anesthésie, induite avec 1-2 $\mu\text{g}\cdot\text{kg}^{-1}$ de fentanyl et 2-3 $\text{mg}\cdot\text{kg}^{-1}$ de propofol, a été maintenue avec 33 % d'oxygène, 66 % de protoxyde d'azote et 1 % d'isoflurane (de fin d'expiration). On a procédé à une ventilation manuelle jusqu'au retour de la respiration spontanée. Treize patients ont été placés en décubitus dorsal et sept en position gynécologique afin de faciliter la chirurgie. On a placé deux électrodes sensibles au pH pour identifier le reflux, l'une d'elles dans l'oesophage à 20 cm du bord antérieur des narines et l'autre au travers des bandes du ML pour détecter les matières de reflux autour.

Résultats : Le reflux oesophagien s'est produit chez 12 patients (60 %), chez 5 des 13 patients en décubitus dorsal et chez tous les patients en position gynécologique. L'électrode du ML a détecté une baisse du pH chez 4 patients (20 %), tous en position gynécologique. L'incidence du reflux différait selon la position (Test de probabilité exacte ; $P = 0,01$).

Conclusion : L'étude suggère que la position gynécologique prédispose les patients à un plus grand risque d'aspiration que la position couchée sur le dos lors de l'emploi du ML.

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THE LMA has greatly reduced the use of the face mask and the endotracheal tube, but is associated with a greater incidence of reflux than is the face mask.¹ Two large studies have testified to the low incidence of aspiration during anesthesia, but to important sequelae if it occurs.^{2,3} The incidence of clinically detectable regurgitation with the LMA has been quoted as 8.9:10,000, with an incidence of aspiration of 2:10,000.⁴

In this study we have determined the incidence of regurgitation into the upper esophagus and the frequency of regurgitating material passing anterior to the LMA during general anesthesia.

Methods

After hospital ethics committee approval 20 patients, ASA 1-2, undergoing day-case general anesthesia with an LMA, aged 20-69 yr were included. Exclusion criteria included pregnancy, obesity (body mass index > 28), a history of gastroesophageal reflux, upper gastrointestinal surgery, or ingestion of antacids, H₂ blockers, proton pump inhibitors, or any medication known to alter gastric motility.

Two monocrystalline antimony pH electrodes were used, one placed in the esophagus and one fixed at the aperture portion of the LMA (Figure 1). These electrodes were connected to a dual channel Digitrapp, which continuously recorded pH. A reference electrode was applied to the chest wall. The Digitrapp data was transferred to an IBM PC for storage and retrieval. Reflux was defined as a decrease in pH to ≤ 4.0 . Multiple reflux was defined as more than two episodes of reflux.

The patients were fasting and unpremedicated. After breathing oxygen, anesthesia was induced with 1-2 $\mu\text{g}\cdot\text{kg}^{-1}$ fentanyl and 2-3 $\text{mg}\cdot\text{kg}^{-1}$ propofol and maintained with oxygen 33%, nitrous oxide 66% and isoflurane 1% (end-tidal). After induction of anesthesia ventilation by hand was performed in all cases until spontaneous respiration resumed. The esophageal electrode was passed nasally into the stomach, where a decrease in pH confirmed placement. It was then withdrawn to 20 cm from the nares and fixed resting in the upper esophagus. The LMA with pH electrode *in situ* was then inserted by a single experienced operator (>750 uses). Patient position was changed to lithotomy after insertion of the pH electrodes (n=7).

If any patient moved, coughed, strained or swallowed during insertion of the esophageal electrode or the LMA or at any time during anesthesia the patient was excluded from the study. There was no evidence of "light anesthesia". The pH electrode monitoring ceased when isoflurane and nitrous oxide administra-

FIGURE 1 The pH electrode (arrow) protrudes through the grid of the laryngeal portion of the LMA.

FIGURE 2 Digitrapp recording: pH units on the vertical axis and time (min) on the horizontal axis. Lower trace - esophageal, upper - LMA electrode trace. The initial decrease in pH (A) is the esophageal electrode entering the stomach and then being withdrawn. Reflux occurred at 55 min (B) but the refluxing material did not pass anterior to the LMA as the LMA electrode did not show a reduction in pH.

TABLE I Type of surgery and patient position

Type of Surgery	Supine	Lithotomy
Orthopedic (n = 8)	8	0
General (n = 7)	2	5
Gynecological (n = 5)	3	2

TABLE II Reflux Characteristics

	No Reflux	Reflux	Multiple Reflux
Supine (n = 13)	8	5	4
Lithotomy (n = 7)	0	7*	5

The incidence of reflux was 60% (12 / 20). Mean time to first reflux was 20.5 min with a range of 5 -50 min. The exact probability test comparing the incidence of reflux between the lithotomy and supine positions resulted in $P=0.01^*$.

tion stopped. A continuous pH reading was available, so that reflux was immediately detected. After removal, the position of the LMA electrode was checked and, if displaced, the patient was excluded.

Figure 2 represents a typical Digitrapp recording. The Exact Probability test was used to compare reflux occurrences in the lithotomy and supine positions.

Results

Reflux into the upper esophagus occurred in 12 patients (60%) and the LMA electrode detected a decrease in pH in four of these (20%). All seven patients in the lithotomy position and five of the 13 patients in the supine position experienced reflux ($P = 0.01$).

The average duration of anesthesia was 38.1 min (range 12 - 71 min). Table I illustrates the type of surgery and patient position. Table II illustrates the reflux characteristics. Although patient position influenced the incidence of reflux, it did not influence multiple reflux which occurred in approximately equal proportions (4/5 in the supine group and 5/7 in the lithotomy group). None of the patients who refluxed demonstrated any clinical signs of associated morbidity and were discharged home without sequelae.

Discussion

The lithotomy position may cause an increase in intra-abdominal pressure⁵ which in conjunction with a possible LMA-induced reduction of lower esophageal sphincter tone⁶ and increase in negative intrathoracic pressure,⁷ may explain why all the patients in the lithotomy position demonstrated reflux to the upper esophagus. In four of these patients the LMA electrode detected reflux thereby suggesting a risk of aspi-

ration. The earliest occurrence of reflux was at five minutes allowing us to eliminate induction of anesthesia, passage of the esophageal pH electrode into the stomach during placement, and changing the patients position to lithotomy, as causes for reflux.

The reported incidence of reflux varies considerably. Owens¹ reported a 21.4% (20 cm from nares) incidence while Joshi⁸ reported no reflux at the hypopharynx using pH electrodes. Mikkatti, used a dye technique, demonstrated no reflux in a supine group of patients and a 3.3% incidence of reflux to the LMA in patients in the Trendelenberg and lithotomy positions.⁵

Our study suggests that reflux is common and is enhanced by the lithotomy position.

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