The reinforced laryngeal mask airway (RLMA) protects the airway in patients undergoing nasal surgery – an observational study of 200 patients

[Le masque laryngé renforcé (MLR) protège les voies aériennes chez les patients qui subissent une opération au nez – une étude par observation de 200 patients]

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Purpose: The laryngeal mask airway (LMA) is used in nasal surgery but there is some concern of tracheal or laryngeal contamination with blood and secretions. We have evaluated the ability of the LMA to prevent airway contamination until full emergence from anesthesia.

Methods: Two hundred adults, ASA I–III patients, undergoing nasal surgery under general anesthesia were included in a prospective observational study. A reinforced LMA, sizes 3–5, was used during surgery and removed with its cuff inflated, in recovery, when the patients awoke. The LMA was examined on its laryngeal aspect for contamination of blood and secretions and scored (0–3) independently by two observers according to soiling (score of 0 = no blood; score of 1 = staining on the cuff; score of 2 = staining on the inside of mask; score of 3 = blood in the tube).

Results: The contamination scores were [n (%)] : 0 = 174 (87%); 1 = 22 (11%); 2 = 4 (2%); 3 = 0 (0%).

Conclusion: Ninety-eight percent of patients had no or minimal contamination of the LMA. The 2% incidence of grade 2 LMA soiling is low and probably acceptable, since it did not result in symptoms of airway contamination. We suggest that the use of the LMA for nasal surgery may be appropriate.

Objectif : Le masque laryngé (ML) est utilisé en chirurgie nasale, mais on craint une contamination trachéale ou laryngée par le sang et les sécrétions. Nous avons évalué la capacité du ML à prévenir la contamination des voies aériennes avant le retour à la conscience.

Méthode : Deux cents adultes, ASA I–III, devant subir une intervention chirurgicale nasale sous anesthésie générale, ont participé à une étude prospective par observation. Un ML renforcé, de taille 3–5, a été utilisé pendant l'opération et retiré avec son ballonnet gonflé, au réveil du patient. La surface laryngée du ML a été examinée pour y

déceler toute trace de contamination par le sang et les sécrétions et cotée (0–3) par deux observateurs indépendants selon le degré de souillure (0 = pas de sang ; 1 = coloration sur le ballonnet ; 2 = coloration à l'intérieur du masque ; 3 = sang dans le tube).

Résultats : Les scores de contamination ont été [n (%)] : 0 = 174 (87 %) ; 1 = 22 (11 %) ; 2 = 4 (2 %) ; 3 = 0 (0 %).

Conclusion : Quatre-vingt-dix-huit pour cent des patients n'ont subi aucune contamination ou une contamination minimale du ML. L'incidence de 2 % de souillure de classe 2 du ML est faible et sans doute acceptable, puisqu'elle ne cause pas de symptômes de contamination des voies aériennes. Nous croyons que le ML est approprié pour la chirurgie nasale.

ANESTHESIA for nasal surgery ideally requires an airway device which is resistant to obstruction and displacement. It should also provide unobstructed access to the surgical field for the operator and protect the airway from blood and secretions from above. The reinforced laryngeal mask (RLMA) can be used in nasal surgery because it provides an unobstructed airway and forms a reliable seal across the oropharyngeal inlet¹ thus protecting the airway from blood and surgical debris from above.² At the end of surgery, the LMA can be left in place until the patient fully emerges from anesthesia and is able to protect his or her own airway. The time period between the end of surgery to full emergence from anesthesia may be associated with a continued risk of airway contamination. We describe the use of

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FIGURE A–D, Illustration of the contamination scores 0–3 used to grade soiling of the laryngeal aspect of the laryngeal mask airway. [A, no contamination (score 0); B, contamination on the cuff of the mask (score 1); C, contamination of the cup of the mask (score 2); D, contamination of the tube (score 3)].

the RLMA in a prospective study of 200 patients undergoing nasal sinus and septal surgery procedures where soiling of the inner aspect of laryngeal mask at full emergence from anesthesia was used as an indicator of laryngeal or tracheal soiling.

Patients and methods

Ethical approval and informed verbal consent for this prospective study was obtained. Over a period of 28 months all ASA I–III adult patients scheduled for elective nasal septal and nasal sinus procedures were included. Patients were excluded if they had a known history of hiatus hernia or reflux. Anesthesia was induced with propofol 2–2.5 mg·kg⁻¹ bolus injection and maintained either with sevoflurane (1–3%) with fentanyl (2 µg·kg⁻¹); sevoflurane (1–2%) with remifentanyl (0.07–0.15 µg·kg⁻¹·min⁻¹); or target controlled propofol infusion (Astra Zeneca, UK; 2.4–4 µg·L⁻¹) with remifentanyl (0.07–0.15 µg·kg⁻¹·min⁻¹) depending on the anesthesiologist's choice. RLMA's sizes 3–5, were used in all patients for the control of the airway. Cuffs were inflated in order to avoid air leaks when the anesthetic circuit was pressurized at 20 cm of water. Topical nasal application of 5% cocaine was used in all cases to reduce bleeding during surgery and no throat pack was used. Ventilation was controlled using a mechanical ventilator, a circle system and 50% oxygen in air gas mixture. Tidal volume was adjusted to keep end-tidal CO₂ between 4 to 5 KpA. Standard monitoring was applied.

At the end of the surgical procedure the oropharynx was cleared of secretions and blood by the surgeon under direct vision with a soft tip suction catheter. All anesthetic agents were stopped, 100% oxygen was given to the patients and they were taken to the recovery room in the supine position. In the recovery room, patients received 40% oxygen through a venturi driven "T" piece and their blood pressure, electrocardiogram and oxygen saturation were monitored throughout. No bite block was used. The laryngeal masks were removed when patients opened their eyes spontaneously. The laryngeal aspect of the laryngeal mask was examined by two observers for the degree of soiling and scored independently on a scale of 0 to 3 [0 = no blood or blood stained secretions seen on the laryngeal (anterior) aspect of the LMA; 1 = staining with blood or blood stained secretions on the anterior aspect of the cuff of the LMA; 2 = staining with blood or blood stained secretions inside the cup of the LMA; 3 = blood or blood stained secretions found in the tube with or without staining in the cuff] as shown in Figure 1. Other data obtained included age, weight, sex, size of LMA, surgical duration, time

TABLE I Comparison of patients with soiling scores 1 and 2 with patients with soiling score of 0

	<i>Patients with score 0</i>	<i>Patients with scores 1 and 2</i>
Age	41 ($\pm$ 14.7)	38.13 ($\pm$ 12.5)
Body weight	75.39 ($\pm$ 15.2)	73.09 ($\pm$ 8.5)
Operative time	29.59 ($\pm$ 15.7)	26.31 ($\pm$ 9.3)
Awakening time	5.5 ($\pm$ 2.4)	7.83 ($\pm$ 4.1)

All data reported as mean $\pm$ SD. There is no statistical difference in patient demographics in the two groups ($P \leq 0.05$).

TABLE II Anesthetic regimen used and breakdown of contamination scores

<i>Regimens</i>	<i>Number of patients</i>				
	<i>Total</i>	<i>Score 0</i>	<i>Score 1</i>	<i>Score 2</i>	<i>Score 3</i>
Sevoflurane and remifentanyl	117	106	9	2	0
Propofol and remifentanyl	14	11	2	1	0
Sevoflurane and fentanyl	69	57	11	1	0

There is no statistical difference between the regimen used and outcome scores ($P \leq 0.05$).

to awakening (time from end of surgery to eye opening), ASA classification, type of anesthetic, and any adverse events. The data were analyzed using SPSS version 9.0 statistical pack and Chi squared testing was performed as appropriate.

Results

Of the 200 patients included in the study 56 (8=28%) underwent sinus surgery, 29 (14.5%) underwent septal surgery and 115 (57.5%) patients had combined sinus and septal surgery. There were 110 male and 90 female patients. Patient characteristics [median (range)] were: age 43 (16–72) yr; weight 75 (44–129) kg; duration of operation 25 (10–120) min; time to awakening 5 (0–15) min. A size 3 LMA was used for all female patients except one who had a size 4 LMA, 105 male patients had size 4 LMA and five male patients had size 5 LMA used. No patient required tracheal intubation or repositioning of the RLMA. The contamination scores were [score = n (%): 0 = 174 (87%); 1 = 22 (11%); 2 = 4 (2%); 3 = 0 (0%).

There were no differences between the group of patients with soiling scores 1 and 2 and the group of patients with a soiling score 0 with regards to mean age, weight, duration of operation and time to awakening as shown in Table I. The types of anesthetics

used and the distribution of the contamination scores are shown in Table II.

No anesthetic or surgical complications occurred in any of the patients and all patients were discharged as planned.

Discussion

Acceptance of the LMA for upper airway surgery is increasing. We evaluated tracheal soiling in major nasal surgery at the end of anesthesia, when the patient is fully alert with all airway reflexes intact.

We found that in 87% ($n = 174$) of cases no blood or secretions were seen on the cuff or cup of the laryngeal mask (contamination score = 0) and that 11% ($n = 22$) had some blood on the cuff only (contamination score = 1). In these 196 patients (98% of cases), we concluded that contamination of the patient's airway from blood or secretions pooling from above was highly unlikely.

When compared with the tracheal tube, the LMA forms a reliable seal across the oropharynx¹ and protects the larynx and trachea from dye placed in the pharynx during anesthesia.² In addition, insertion of the laryngeal mask is associated with less tachycardia and hypertension than laryngoscopy and tracheal intubation.^{3–6} This may result in better control of blood pressure and intraoperative bleeding. The placement of a laryngeal mask does not require muscle relaxants, therefore common side effects of muscle relaxants are avoided. It is tolerated better at lighter levels of anesthesia.⁷ During emergence from anesthesia for nasal surgery, the laryngeal mask maintains an unobstructed airway better than the Guedel airway.⁸ It is potentially beneficial therefore to leave it in place until full emergence from anesthesia.

Daum and O'Reilly have evaluated the use of the laryngeal mask in a wide variety of otorhinolaryngology surgeries, including minor ear and nasal surgery, and major ear surgery.⁹ Their results show that in two out of 217 patients (1%) the LMA had to be replaced with an endotracheal tube but they did not formally evaluate the LMA for contamination. Williams, Thompson and Bailey⁸ compared the laryngeal mask with the tracheal tube in a small number of nasal surgery procedures. They noted airway contamination in five out of 36 patients (14%).

In our study only 2% ($n = 4$) of cases had soiling of the cup of the LMA and we did not observe soiling of the tube of the LMA. In these cases there is a theoretical possibility of contamination of the lower airway with blood or secretions. However, there were no clinical signs or symptoms of inhalation of blood or secretions e.g., stridor, breath holding, desaturation,

laryngospasm or coughing, intraoperatively or postoperatively in any of these four patients. We were able to discharge all patients as planned.

We used three different anesthetic techniques. It can be argued that different techniques in themselves may have influenced the contamination scores and the outcome of the study. The reasons for not adopting a single anesthetic technique included; 1) to allow freedom of choice for the anesthesiologist, according to the patient's clinical history; 2) to evaluate the RLMA in more clinically relevant situations. We were not aiming to compare different anesthetic techniques. However, there appears to be no difference in contamination scores with the three different techniques (Table II) used in this study.

The LMA contamination scoring system which we have used has not been previously described. Lack of blood inside the cup of the LMA (contamination score of 0 and 1) should always, in theory, correlate with a contamination free larynx. Blood in the cup of the LMA (a score of 2) may not necessarily result in actual laryngeal or tracheal contamination. John, Hill and Hughes² used LMA's in anesthetized patients and placed a dye in the oropharynx. They examined endoscopically the larynx and trachea for contamination and found no evidence of laryngeal contamination in any patient even though, in one, they saw pooling of dye in the cup of the LMA. Williams and Bailey¹⁰ compared the RLMA with the endotracheal tube in patients undergoing adeno-tonsillectomy. They examined the larynx at the end of surgery with a fibreoptic bronchoscope. In one patient in the laryngeal mask group they could see blood inside the cup of the LMA and yet there was no soiling of the larynx or trachea with blood.

Our results suggest that use of the RLMA for nasal surgery may be appropriate. It provides a reliable airway, and protects the airway from contamination until the patient is allowed to fully emerge from anesthesia.

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