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SHORT COMMUNICATIONS

REGURGITATION OF GASTRIC CONTENTS DURING GENERAL ANAESTHESIA USING THE LARYNGEAL MASK AIRWAY†

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SUMMARY

We have investigated the incidence of regurgitation of gastric contents during general anaesthesia administered via a laryngeal mask airway (LMA) or face mask and Guedel airway in 56 patients with no risk factors for regurgitation. Patients swallowed a gelatine capsule containing methylene blue 10 min before induction of anaesthesia. Fibreoptic laryngoscopy in the LMA group or conventional laryngoscopy in the face mask group was performed at the end of surgery. Dye was observed within the laryngeal mask in seven of 28 patients (25%). No patients in the face mask–Guedel airway group regurgitated dye (P = 0.005). There was no evidence of aspiration of dye.

KEY WORDS

Anaesthesia: general. Complications: regurgitation. Equipment: laryngeal mask airway.

The laryngeal mask airway (LMA) is becoming widely used during general anaesthesia with spontaneous ventilation. Regurgitation of gastric contents has been reported in association with its use [1]. However, the incidence of regurgitation compared with other techniques is not known. Therefore, we have compared the incidence of regurgitation of gastric contents in patients during anaesthesia breathing spontaneously via a face mask and Guedel airway or LMA.

METHODS AND RESULTS

After obtaining local Ethics Committee approval and informed patient consent, we studied 56 patients (ASA I–II) undergoing minor surgery. Patients who were obese or had a history of oesophageal reflux, hiatus hernia or previous gastric surgery were excluded.

All patients were premedicated with temazepam 10–20 mg 1 h before surgery. Ten minutes before induction of anaesthesia, a gelatin capsule containing 325 mg of 25% methylene blue in lactose, was administered with 20 ml of water. The capsules were taken in the upright sitting position. A previous laboratory study had shown that the capsules dissolve within 5 min in water or in acids of pH 1–5.

Anaesthesia was induced with propofol 2 mg kg^{-1} and fentanyl 1 μg kg^{-1} and maintained with 2% halothane and 66% nitrous oxide in oxygen via a Magill breathing system. Before induction of anaesthesia, patients were allocated randomly to receive anaesthesia via an LMA or a face mask and Guedel oral airway. The LMA (females size 3; males size 4) was inserted by an anaesthetist experienced in the technique and the cuff inflated with air (size 3—20 ml; size 4—25–30 ml) [2]. An oral Guedel airway (females size 2; males size 3) was inserted in the other group and anaesthesia was maintained via a face mask. Patients who coughed or strained during insertion of the LMA or Guedel airway were withdrawn from the study. Patients were withdrawn also if more than one attempt was required to insert the LMA. If apnoea occurred, gentle manual inflation was continued until spontaneous breathing resumed.

At the end of surgery and before termination of anaesthesia, the larynx and pharynx were inspected for the presence of methylene blue. A flexible laryngoscope (Olympus LF1) was used for the LMA group before its removal, to inspect the inside of the laryngeal mask, and a Macintosh laryngoscope was used to inspect the pharynx after removal of the laryngeal mask and for inspection of the larynx and pharynx in the face mask group. The presence of methylene blue within the laryngeal mask in the LMA group or in the pharynx in the face mask group was taken to represent regurgitation of gastric contents. Where regurgitation of dye had occurred, fibreoptic tracheoscopy was performed.

Data were analysed using Student's *t* test and Fisher's exact test as appropriate.

The groups were comparable in age, weight, sex

TABLE I. *Patient characteristics, duration of surgery and dose of propofol (mean (range or SEM)). No significant differences*

	Laryngeal mask ($n = 28$)	Face mask + Guedel airway ($n = 28$)
Sex (M/F)	23/5	20/8
Age (yr)	51.1 (24–77)	51.2 (23–75)
Weight (kg)	69.9 (2.9)	70.3 (3.0)
Duration of surgery (min)	35.5 (1.7)	33.1 (2.3)
Propofol (mg)	150.4 (4.9)	142.9 (3.5)

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TABLE II. *Type of surgery and airway*

	Airway	
	Laryngeal mask (No.)	Face mask + Guedel airway (No.)
Inguinal hernia	13	12
Varicose veins	3	4
Minor orthopaedic	5	4
Breast lumpectomy	1	1
Testicular	6	3
Circumcision	0	2
Hysteroscopy	0	2

and duration and type of surgery (tables I and II). Two patients were withdrawn from the study because of coughing on insertion of the LMA and one patient was withdrawn because two attempts were required to place the LMA correctly.

Dye was observed within the LMA in seven (25%) patients (all male) in the LMA group. Dye was not seen in any patient in the face mask and Guedel airway group ($P = 0.005$). The oesophagus was visible through the LMA in two (7%) patients, one of whom had regurgitated dye. On no occasion was dye observed in the trachea.

COMMENT

In this study, no patient anaesthetized with a face mask and Guedel airway regurgitated gastric contents. However, 25% of patients in the LMA group regurgitated, although there was no evidence of tracheal soiling.

Regurgitation and aspiration of gastric contents can cause significant morbidity [3]. A previous study using dye-containing gelatin capsules demonstrated an incidence of regurgitation of 4.5% during anaesthesia using a face mask and oral airway [4]. Tracheal aspiration was detected in 17% of these. We found no incidence in our study, but this may be a result of the relatively small number of patients investigated.

It could be argued that these findings were the result of disintegration of capsules in the lower oesophagus. Indeed, the pharynx was not inspected before surgery as instrumentation at this stage was thought to increase the likelihood of regurgitation. However, this explanation is extremely unlikely, as patients with oesophageal symptoms or disorders were excluded and the capsule was taken in the upright sitting position 10 min before induction of anaesthesia. Furthermore, no dye was detected in the face mask group, compared with an incidence of 25% in the LMA group.

Both groups of patients were anaesthetized using identical doses of i.v. induction agent and inhalation anaesthetic agents to maintain anaesthesia, so it is unlikely that there would be any difference in the depth of anaesthesia or duration of apnoea.

Different techniques were used to assess the incidence of regurgitation, but this was felt to be unavoidable. It was thought essential to inspect the inside of the LMA for the presence of dye before its removal, making the use of a fibreoptic instrument obligatory. A conventional laryngoscope was used in the face mask group to ensure that pharynx and larynx were inspected fully, as with the smaller field of view of the fibreoptic laryngoscope it would be possible to miss areas. The pharynx in the LMA group was inspected after removal of the LMA, but only those patients in whom dye was visible at the fibreoptic inspection were said to have regurgitated dye. This second process of laryngoscopy and pharyngoscopy was performed to confirm that, when dye had been seen at fibreoptic inspection, it was also visible with the conventional laryngoscope (confirmation was obtained in every subject).

The explanation for the high incidence of regurgitation with the LMA is unclear. Recent provisional data [5] have demonstrated a decrease in lower oesophageal sphincter (LOS) pressure associated with the use of the LMA compared with the face mask and airway. It may be that the pharynx reacts to the LMA as if it were a bolus of food, resulting in reflex relaxation of the LOS with a subsequent decrease in barrier pressure. All patients who regurgitated in our study were male and it is possible that the larger mask may be more likely to elicit this reflex.

Ferguson and co-workers demonstrated a significant increase in resistance to breathing after insertion of the LMA under local anaesthesia in awake subjects [6]. This may occur during general anaesthesia and an increase in the thoracic negative pressure because of this effect, combined with a decrease in LOS pressure, may result in regurgitation of gastric contents. However, further work in patients under anaesthesia is required before any credence can be given to this speculation.

Gastric regurgitation was detected in 25% of patients in the LMA group in this study, despite the fact that they were at relatively low risk. These findings would suggest that further work is needed to assess the safety of the LMA with regard to aspiration of gastric contents and that LMA should not be used in patients with a high risk of aspiration.

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