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THE LARYNGEAL TUBE COMPARED WITH PROSEAL LARYNGEAL MASK AIRWAY FOR GYNECOLOGIC LAPAROSCOPY

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Abstract

We have compared the laryngeal tube (LT) and ProSeal laryngeal mask (PLMA) in 80 female patients for the success rate of insertion, gas leak pressure ,pulmonary ventilation and the incidence of gastric insufflation. In a randomized clinical study, the laryngeal tube and ProSeal laryngeal mask were inserted after induction of anaesthesia and neuromuscular block. The cuffs were inflated until the intracuff pressure reached 60 cm H_2O. We measured adequacy of ventilation and the minimum airway pressure at which gas leaked around the cuff. The presence or absence of gastric insufflation was studied at an inflation pressure of 20 cm H2O. Statistical analysis was with paired t test (parametric data), and Kruskal-Wallis test, Mann-Whitney rank sum test, and chi-square test (nonparametric data). P< 0.05 was considered significant.

In all cases, both airway devices were inserted successfully.It was possible to ventilate through the laryngeal tube and the ProSeal laryngeal mask in all patients. Peak airway pressure (P<0.05) and airway leak pressure (P<0.001) were significantly higher throughout the experiment when using the ProSeal laryngeal mask (PLMA) compared to the laryngeal tube (LT). The mean volume of air placed in the cuff to give the intracuff pressure of 60 cm H_2O was 75 (SD 8) ml for the laryngeal tube and 19 (SD 4) ml for the ProSeal laryngeal mask. Differences between PLMA and LT groups for SpO_2, FIO_2 and $P_{ET}CO_2$ were not statistically significant before or during peritoneal insufflation No patient required tracheal intubation. Gastric insufflation was not detected in any patient. Sore throat was rare and considered minor .

We concluded that the laryngeal tube and ProSeal laryngeal mask

provide adequate pulmonary ventilation and equal seal in the oropharynx as assessed by $PETCO_2$ without gastric distension during gynecologic laparoscopic surgery. The high airway pressure afforded by the PLMA and LT, and their separation of alimentary and respiratory tracts, represent significant advances for airway management.

Introduction

The original laryngeal mask airway LMA Classic(LMA-C; The Laryngeal Mask Company, Henley-on-Thames, UK) was designed for use with either spontaneous or positive pressure ventilation (PPV) (Brain, 1983). It challenged the gold standard of tracheal intubation with a cuffed endotracheal tube (ETT) for maintaining a clear airway and providing positive pressure ventilation (PPV). Brain described 16 cases of gynecologic laparoscopy with PPV in his first clinical series of 23 uses of a prototype LMA(Brain, 1983). It has been used with PPV for abdominal surgery, including gynecologic laparoscopy, with minimal morbidity in lean patients who did not have gastroesophageal reflux (GER) (Maltby et al., 1990; Verghese and Brimacombe, 1996; Simpson and Russell, 1999). These studies suggest that the clinical performance of a properly sized and seated LMA-C is comparable to that of an ETT.

The laryngeal tube (LT) (Figure 1) has been developed to secure a patent airway during spontaneous breathing or controlled ventilation. It consists of an airway tube with a small cuff attached at the tip (distal cuff) and a larger cuff in the middle of the tube (proximal cuff). The cuffs are inflated through a single pilot tube and balloon, through which the cuff pressure can be monitored. There is a standard 15-mm connector on the proximal end of the device so that it can be attached to a breathing system. The device is made of silicone and is reusable after sterilization in an autoclave. Six sizes are available, suitable for neonates to large adults. When the device is inserted, it lies along the length of the tongue, and the distal tip is positioned in the hypopharynx. The proximal cuff provides a seal by forming a plug in the upper pharynx and the distal

cuff seals the oesophageal inlet. There is a distal aperture in the tube between the two cuffs. Three black lines on the tube near the connector indicate adequate depth of insertion when aligned with the teeth. The laryngeal tube is now commercially available, but there have been only few clinical studies(Asai et al., 2000; D rges et al, 2000; Asai et al., 2002; Ocker et al., 2002; Asai et al., 2001; Agr et al., 2002; Miller et al., 2001). It had been previously shown that the LT is safe and efficient (D rges et al, 2000).

The ProSeal laryngeal mask (PLMA) (Figure 2) is a new laryngeal mask device was designed to permit higher airway pressure than the Classic laryngeal mask (LMA-C) (approximately 20 cm water) without leak of anesthetic gases with a cuff modified to improve the seal around the glottis and a drainage tube to provide a bypass channel for regurgitated gastric contents, prevent gastric insufflation, and allow the passage of a gastric tube. These features are designed to improve the safety of the mask and broaden its scope, especially when used with positive pressure ventilation (Brain et al., 2000). Two randomized crossover trials compared the PLMA with the classic laryngeal mask (LMA) in anaesthetized, paralysed, adults. The PLMA was as easy to insert as the LMA when the introducer tool was used and the airway sealing pressure was 8-11 cm H2O greater. Gastric tube placement was successful in all the patients. In both trials only size 4 masks were used (Brain et al., 2000; Brimacrombe and Keller, 2000).

The present study was suggested to compare the laryngeal tube (LT) with the ProSeal laryngeal mask airway (PLMA) in terms of the success of insertion, gas leak pressure, pulmonary ventilation and the incidence of gastric insufflation.

Patients and Methods

We studied eighty female consecutive patients, aged 18 yr or more, ASA physical status I—III, scheduled for elective gynecologic laparoscopy under general anesthesia. Patients with any abnormality of the neck, upper respiratory tract or upper alimentary tract, or at risk of regurgitation of

gastric contents were excluded. In the anaesthetic room, an electrocardiograph, a pulse oximeter and an arterial pressure cuff were attached and an i.v. cannula was inserted. A firm pad (7 cm in height) was placed under the patient's occiput. After the patient had breathed oxygen through a facemask for a minimum of 3 min, anaesthesia was induced with a sleep dose of propofol 2.0-3.0 mg/kg i.v., supplemented with fentanyl 2 ug/kg. We maintained anesthesia at 1.0-1.5 MAC with isoflurane and nitrous oxide in 30-50% oxygen with incremental doses of fentanyl and neuromuscular blockade with atracurium.

The sizes of laryngeal tube (Asai et al., 2000) and laryngeal mask (Brimacombe et al., 1999) according to the patient's height are shown in (Table 1). Both devices were deflated fully before insertion. The laryngeal tube was inserted into the oropharynx by the following method. Before insertion, the cuffs were deflated and a water-soluble lubricant (KY jelly) was applied to the cuffs. The patient's neck was extended ('sniffing position'). The tip of the laryngeal tube was placed against the hard palate behind the upper incisors and the device was slid down in the centre of the mouth until a resistance was felt or the second bold black line on the tube had just passed between the upper and lower teeth. The cuffs were inflated until the intracuff pressure reached approximately 60 cm H_2O (Asai et al., 2000). The ProSeal was inserted with either the ProSeal introducer tool or the index finger, as described in the manufacturer's product literature. After insertion, the cuff was inflated with air to a pressure of 60 cm H_2O. A blob of lubrication gel was placed over the proximal opening of the ProSeal drain tube. Positive pressure ventilation was started at a tidal volume of 8 ml/kg. Adequacy of ventilation was assessed by chest movement, the capnograph signal and the presence or absence of an audible leak. With the ProSeal, the drain tube was also observed for displacement of the gel. Seal pressure was measured by stopping ventilation, occluding the spill valve with a fresh flow rate of 5 litre/min until airway pressure reached a steady value (seal pressure). The airway

pressure was not allowed to exceed 40 cm H_2O. Seal pressure was observed and recorded. The device was fixed to the patient by the following methods: for the laryngeal tube, the bite block provided was inserted, the laryngeal tube snagged into its wedge and both were fixed using sticky tape. For the laryngeal mask, a wad of gauze was inserted into the patient's mouth and both were fixed using sticky tape. The adequacy of ventilation was scored in the five categories shown in (Table 3). The presence or absence of gastric insufflation was then studied at the inflation pressure of 20 cm H_2O by auscultation over the epigastrium. It has been shown that a volume of gas, as little as 5 ml, entering the stomach from the oesophagus can be detected (Asai et al., 1996; Brimacrombe et al., 2002). At the end of the surgical procedure, anaesthesia was discontinued and the cuff of the test device was then deflated and the device removed. as the patient's reflexes returned, in accordance with the manufacturer's recommendations. The volume of air withdrawn from the cuff was recorded. A checklist of complications relating to insertion, maintenance and removal was completed after use of each device.

Statistical analysis was with paired t test (parametric data), and Kruskal-Wallis test, Mann-Whitney rank sum test, and chi-square test (nonparametric data). $P<0.05$ was considered significant.

Results

Eighty patients ranging from 150 to 175 cm in height participated in our study. In all cases, both airway devices were inserted successfully (time of insertion for LT versus PLMA; median, 25 s versus 29s; P=not significant). The median (range) airway pressure during the leak test with continuous airway pressure immediately after inflation was 30±8cm water for the PLMA compared with 26 ± 5cm H2O for the laryngeal tube. Even when gas leaked at a low airway pressure (< 20 cm water) during the leak test, adequate airway pressure without gas leak was achieved with intermittent PPV during the laparoscopic procedure for both devices (Table 3). Peak airway pressure ($P<0.05$) and airway leak pressure ($P<0.001$) were

significantly higher throughout the experiment when using the PLMA compared to the LT. The mean volume of air placed in the cuff to give the intracuff pressure of 60 cm H2O was 75 ± 8 ml for the laryngeal tube and 19 ± 4 ml for the ProSeal laryngeal mask. Differences between PLMA and LT groups for SpO_2, FIO_2 and $P_{ET}CO_2$ were not statistically significant before or during peritoneal insufflation (Table 4).

No patient required tracheal intubation. Gastric insufflation was not detected in any patient. Sore throat was reported by 25% of patients in the recovery room, 85% described the sore throat as mild and 15% described it as moderate. The following day 12% of patients had a sore throat; 90% described the sore throat as mild and 10% described it as moderate. There were no statistical significance between of a severe sore throat, After device removal in the recovery area, a trace of blood was seen on the LT in one and on the PLMA mask in two cases (difference not significant). There were no cases of regurgitation or aspiration.

Table (1) : Size of laryngeal tube and laryngeal mask used

	Laryngeal tube	ProSeal laryngeal mask
Height more than 155 cm.		
male	4	5
female	4	4
Height less than 155 cm.		
male	3	4
female	3	3

Table(2) : Demographic data of the patients

Variables	Laryngeal tube	ProSeal laryngeal mask
Number (n)	40	40
Age (yr)	39 ± 8	41± 9
Height (cm)	158±16	156 ± 15
Weight (kg)	78±12	75±15
ASA classification (I/II/III)	20/15/5	22/14/4

Values are expressed as number (*n*), or mean (± SD).