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Ventilation with ProSeal Laryngeal Mask Airway during Short-Term Elective Gynecologic Surgery

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ABSTRACT

***Background**: The laryngeal mask airway (LMA) is a supraglottic airway device that can be used as a substitute for the standard endotracheal tube in emergency and difficult airway managements. However, the use of LMA for elective surgical procedures is still controversial. In most published studies, $ETCO_2$ and SPO_2 monitoring was applied to assess the adequacy of LMA placement. However, the most reliable method for evaluating ventilation and oxygenation is the measurement of arterial oxygen partial pressure (PaO_2) and arterial carbon dioxide partial pressure ($PaCO_2$) directly from an arterial blood sample. The purpose of this descriptive cross-sectional study was to evaluate ventilation and oxygenation with ProSeal laryngeal mask airway (PLMA) during short-term elective gynecologic surgery in paralyzed anesthetized patients.*

***Materials and Methods**: Fifteen ASA (American Society of Anesthesiologists) class I-II women undergoing short-term elective gynecologic operations under general anesthesia were included in the study. After induction of standard general anesthesia an appropriate size ProSeal LMA was inserted and controlled ventilation was established. Position of LMA was detected via auscultation of the lungs and epigastric area. Before the end of surgery, an arterial blood sample was withdrawn for blood gas analysis.*

***Results**: First attempted insertion of PLMA was successful in all patients. The position of PLMA was good in 11, acceptable in 2 and suspected in 2 patients. PaO_2, $PaCO_2$ and SaO_2 were within the normal limits in all situations. Duration of anesthesia (> 30 min and <30 min) had no effect on PaO_2.*

Conclusion**: We concluded that ventilation and oxygenation can be maintained through a PLMA during short-term elective gynecologic surgery under general anesthesia.* ***(Tanaffos 2006; 5(3): 19-23)

***Key words:** Ventilation, Oxygenation, ProSeal laryngeal mask airway, Short-term elective gynecologic surgery, Anesthetized patients.*

INTRODUCTION

Laryngeal mask airway (LMA) is a short tube with a cuff filled over the glottis (1).

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The ProSeal is a wire-reinforced laryngeal mask airway with an additional drain tube that leads to the distal tip of the laryngeal cuff.

The design improves the seal with the larynx, separates the esophagus from the glottic entrance and makes mechanical ventilation of the lungs possible

(2, 3). Generally, use of LMA is easier requiring less proficiency as compared to standard endotracheal tube.

Additionally, its insertion requires less muscle relaxation and lighter anesthesia (4). Therefore, it can be used as a substitute for the standard endotracheal tube in emergency, difficult airway managements, short-term surgical procedures, and to simplify fiberoptic bronchoscopy (1, 5).

In some previous studies, ventilation and oxygenation of patients were evaluated using $ETCO_2$ and SPO_2 non-invasive measurement methods (6, 7). In quantitative studies, a direct method was used for the measurement of arterial blood oxygen and CO_2 levels (8). At the present time, LMA is increasingly used in surgical procedures and emergencies with successful results. Also, the measurement of ETCO2 during the use of LMA may not be a reliable indicator for the patient's ventilation status. Therefore, this study was conducted aiming to evaluate the ventilation and oxygenation status during the use of ProSeal laryngeal mask airway in short-term elective gynecologic surgeries with general anesthesia through measuring the levels of $PaCO_2$, SaO_2, and PaO_2 by analyzing arterial blood gases.

MATERIALS AND METHODS

This study was approved by the ethic committee of the university and a written consent was obtained from all patients before the induction of anesthesia.

This was a descriptive cross-sectional prospective study conducted from February 2005 for a week at Javahery Gynecology Hospital. All female patients with ASA class I-II who required general anesthesia for short term non emergency gynecologic surgeries entered the study. Patients with a BMI>30 Kg/m^2, hiatal hernia or gastroesophageal reflux were excluded from the study. A total of 15 patients were studied. Standard monitorings such as SPO_2, ECG, and blood pressure measurements were performed.

Afterwards, anesthesia was induced with fentanyl 1-2 µg/kg, thiopental 4 mg/kg and succinylcholine 1 mg/kg. Then to establish an airway PLMA (made in UK) was used. The proper size of LMA (3 or 4) for the patient was selected. Its cuff was lubricated with gel and was guided towards the glottis by digital intraoral manipulation. After it was lodged in proper position, its cuff was inflated with adequate pressure. A controlled ventilation with 10 ml/ kg volume and 12 breaths per minute was established. Anesthesia was maintained with 0.5%-1% halothane in 50% oxygen, 50% N_2O and 0.25 mg/kg atracurium. During the surgery, all patients were placed in the lithotomy position. Proper PLMA placement was confirmed by presence of bilateral breath sounds and absence of leakage sounds into the stomach in the epigastric area. If the bilateral breath sounds were vesicular and clear and no leakage was heard over the stomach the PLMA placement was reported to be good. If the bilateral vesicular breath sounds were clear but the leakage sound was heard over the stomach PLMA placement was considered to be acceptable. If the bronchial sounds, crackle and wheezing were heard upon the auscultation of the lungs accompanied by the sound of air leakage into the stomach over the epigastric area its placement was reported to be suspected. In case SaO_2 dropped lower than 90% and absence of lung ventilation, PLMA was released; the patient was ventilated by mask and excluded from the study.

After completion of the procedure before awaking the patient, 1 ml heparinized arterial blood sample was obtained from the patients' radial artery by a 27 gauge needle and sent to the laboratory for measurement of $PaCO_2$, SaO_2 and PaO_2.

In all patients, analysis of the arterial blood gases was performed using AVL 995- S device (made in Austria). Afterwards, the muscle relaxant drug was reversed by administration of prostigmine along with atropine and all patients were awakened and extubated in the operating room.

Sample size was calculated based on the fact that with FIO_2 (Fractional Inspired Oxygen)= 0.5, 0.05 level of significance and confidence interval of 20%, $PaCO_2$, SaO_2, and PaO_2 levels in 80% of under study patients were within the normal range. This calculation demonstrated that a total number of 15 patients was sufficient for this study. Data are presented as mean ±SD.

RESULTS

The mean age of the patients was 30.6±5.5 yrs (range 25 to 40 yrs) surgical procedures included diagnostic and therapeutic dilatation and curettage (D&C), evacuation of the Bartholin's cysts, hystrotomy along with D&C and repair of rectocele. Duration of anaesthesia in 11 patients (73%) was less than 30 minutes and in 4 patients (27%) was between 30 to 60 minutes.

PLMA placement was favourable in 11 patients, acceptable and suspected each in 2 patients. Performing statistical analyses to compare the data was not feasible due to the small number of patients in each group.

In all study patients, mean percentage of SaO_2 was 98.92± 0.62% (range 98% to 99.9%). Mean PaO_2 and mean $PaCO_2$ were 177.5±41.5 mmHg (118 mmHg minimum and 278 mmHg maximum) and 34.3±4.3 mmHg (29.3 mmHg minimum and 43 mmHg maximum) respectively.

Mean PaO_2 in anesthesia time shorter and longer than 30 minutes was within the normal range (figure 1). Rates of SaO_2, PaO_2 and $PaCO_2$ in all three positions of PLMA were within the normal range (table 1).

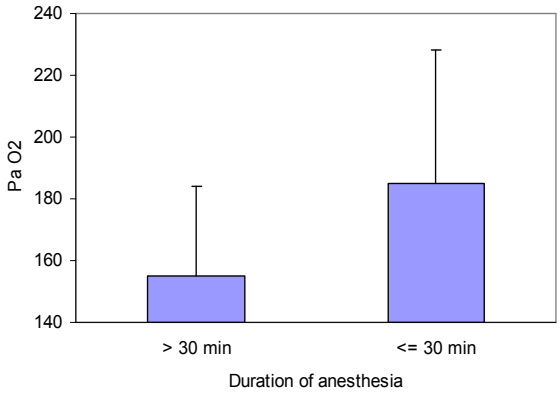

Figure 1. Rate of PaO_2 in anesthesia time shorter and longer than 30 minutes was 184.98±43.38 mmHg and 155.12±29.86 mmHg respectively.

Table 1. Rates of SaO_2, PaO_2 and $PaCO_2$ in three positions of PLMA placement. Data are presented as Mean ±SD.

	SaO_2 (%)	PaO_2 (mmHg)	$PaCO_2$ (mmHg)
Favorable	98.90±0.63	180.35±46.05	34.2±4.9
Acceptable	98.75±1.06	166.45±40.23	35.5±2.1
Suspected	99.20±0.28	169.25±28.63	34.1±3.1

DISCUSSION

The study results demonstrated that insertion of PLMA was successful on the first attempt in all cases and in 75%, its placement was detected to be favorable.

Also, this study revealed that the rates of $PaCO_2$, PaO_2 and SaO_2 were within the normal range in all patients with FIO_2=0.5 during general anesthesia by using PLMA. These findings are in accordance with other studies in regard to LMA placement and patients' ventilation status with LMA.

Lee and colleagues (9) in a descriptive study conducted with no control group regarding the insertion of classic LMA in 10 healthy awake volunteers, successfully managed the airway in the

first attempt in all cases. Local airway anesthesia was employed using local lidocaine; remifentanil was subsequently infused intravenously.

Maltby and coworkers (6) performed laparascopic cholecystectomy on 101 anesthetized patients with controlled ventilation. In this study, they compared the gastric distension, SPO_2, $ETCO_2$ and airway pressure in two groups of patients one with classic LMA and the other with standard endotracheal tube. They concluded that positive pressure ventilation with a correctly placed LMA-classic of appropriate size permitted adequate pulmonary ventilation.

Also, they noticed that gastric distension was similar in both groups and had no effect on the patient's ventilation.

Kurola and colleagues (7) compared the success of insertion, oxygenation, and ventilation of the intubating laryngeal mask (ILMA) in 96 anesthetized patients when used by inexperienced nursing students. They found that clinically inexperienced paramedical students can successfully use ILMA in anesthetized patients and the patients' ventilation was normal. In these two studies the ventilation status was evaluated in anesthetized patients with controlled ventilation by measuring SPO_2 and $ETCO_2$.

Iwama and colleagues (10) performed a prospective consecutive case series study on 112 patients. They used classic LMA for surgical procedures of the lower extremity, lower abdominal, and gynecology surgeries in anesthetized patients with spontaneous breathing and evaluated the patients' ventilation status by measuring $PaCO_2$ and PaO_2/FIO_2 respiratory indices. They concluded that the patients' ventilation can be maintained at an acceptable level during spontaneous breathing with the LMA. The results of these three studies in accordance with our study results demonstrated that adequate ventilation can be established for the patients during the use of LMA. In another study, it was demonstrated that PLMA could provide a safe reliable airway in short- term surgical procedures in obese patients (2). Considering the normal range of arterial blood gases in this study and previous research, it is concluded that for evaluation of the ventilation status and oxygenation during the use of LMA there is usually no need for direct invasive measurement of CO_2 and O_2 rates through arterial blood sampling; additionally, SPO_2 and $ETCO_2$ can be considered as reliable respiratory indices.

Being a descriptive study with no control group may be a weak point for this study. Performing randomized controlled double blind clinical trials are warranted in this regard comparing the rates of arterial blood gases in different surgical procedures during the use of LMA with those during the use of standard endotracheal tube, helping to achieve more definite reliable data regarding these indices. Till that time, conducting studies similar to this one, case reports, case series, and meta-analyses are helpful in justifying the safe use of LMA. In our opinion, anesthesiologists themselves can decide regarding the techniques and indications of LMA by analyzing the data and limited number of studies in this regard. In conclusion, this study demonstrated that a reliable airway for patients' ventilation and oxygenation can be established by using PLMA.

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