Original Article

Removal of Laryngeal Mask Airway: Awake or Deep Anesthesia?

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ABSTRACT

Background: The aim of this study was to study the influence of depth of anesthesia (awake or deep anesthesia) and choice of anesthetic drug (halothane or propofol) on the incidence and severity of airway hyperreactivity associated with Laryngeal Mask Airway (LMA) removal.

Methods: A prospective, randomized, double blind study was done in 156 ASA physical status I and II patients, aged 18-65 years, who had under gone short time elective surgery (<1 hour). Patients were randomly assigned in one of the four subgroups: *Hal-Aw (*anesthesia maintenance with halothane and LMA removal in awaked state*), Hal-Deep (*anesthesia maintenance with halothane and LMA removal in deep anesthesia), *Pro-Aw (*anesthesia maintenance with propofol and LMA removal in awaked state), and *Pro-Deep (*anesthesia maintenance with propofol and LMA removal in deep anesthesia). The incidence of cough and straining, bronchospasm, laryngospasm, breathholding, vomiting, oxygen desaturation, and severity of airway hyperreactivity (mild, moderate, severe) with LMA removal were evaluated.

Results: There were no significant differences in bronchospasm, laryngospasm, oxygen desaturation among four subgroups. Significant differences were in cough and straining, breath holding, vomiting, and finally severity of airway hyperreactivity among four subgroups. Depth of anesthesia didn't have any effect on incidence and severity of airway hyperreactivity but in those with propofol, they were lower than those with halothane.

Conclusion: In short time surgery and with use of LMA, anesthesia with propofol is associated with lower incidence and severity of airway hyperreactivity than halothane.

Keywords: propofol, halothane, airway hyperreactivity, Laryngeal Mask Airway (LMA).

Laryngeal mask airway (LMA) is a supraglottic device that is designed to provide and maintain a seal around the laryngeal inlet[1]. LMA removal can be associated with adverse respiratory events such as cough and straining, laryngospasm, bronchospasm, vomiting, and etc. The optimal time for removing LMA is unknown exactly. Brain, designer of the LMA, and manufacturers suggest that LMA should be removed in awaked state, when the patient can maintain his or her airway patent[2, 3, 4, 5]. While in one study, removal of LMA in the deep patients was associated with less adverse respiratory effects[6], in another study there was no difference in the incidence of airway complications whether the LMA was removed in the anesthetized or the awake childs[7]. Different incidences for these problems have been reported in some studies: 10% to 53% in awake and 2.6% to 27% in deep anesthesia[2]. On the other hand, the choice of anesthetic drug during induction of anesthesia may contribute to airway reactivity, witch manifests during emergence anesthesia[8, 9, 10, 11]. In this study we tried to evaluate effect of depth of anesthesia and choice of anesthetic drug on respiratory adverse effects after LMA removal and tried to compare between a volatile (halothane) and an intravenous (propofol) anesthetic drug.

Subjects and Methods

This is a randomized, double blind clinical trial. After getting institutional approval and patients consent, 156 ASA physical status I and II patients, aged 18-65 years who had undergone general anesthesia for a short time elective surgery (less than 60 minutes) in the educational hospitals of medical university of Isfahan were selected for the study.

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Exclusion criteria were: 1) active upper respiratory tract infection in recent 2 weeks before the time of surgery, 2) active lower respiratory tract infection in recent 4 weeks before the time of surgery, 3) airway disease (Asthma, COPD), 4) airway surgery, 5) any contraindication for using LMA 6) pregnancy, 7) change of LMA, 8) administration of any drug that affects the airway during anesthesia.

Patients randomly assigned in halothane and propofol groups, using computerized generated random list. Then in each group, patients assigned randomly in awake or deep anesthesia subgroups. Thus we designed four subgroups: *subgroup 1 (Hal-Aw:* maintenance of anesthesia with halothane and LMA removal in awaked state), *Subgroup 2 (Hal-Deep:* maintenance of anesthesia with halothane and LMA removal in deep anesthesia), *Subgroup 3 (Pro-Aw:* maintenance of anesthesia with propofol and LMA removal in awaked state), and *Subgroup 4 (Pro-Deep:* maintenance of anesthesia with propofol and LMA removal in deep anesthesia). An awake state was defined as the presence of spontaneous eye opening, purposeful movement of the extremities without any physical stimulation, and responding to verbal commands.

All patients were NPO for 8 hours before the operation and didn't get any sedative or effective drug on the airway preoperatively. Routine intraoperative monitoring consisting of electrocardiogram (ECG), noninvasive blood pressure (NIBP) cuff, pulse oximeter and capnograph were used in all the patients. Two minutes before induction of anesthesia, fentanyl, 1.5 μg/kg, and lidocain, 1.5 mg/kg, administered intravenously. After preoxygenation, induction of anesthesia preformed with thiopental, 5 mg/kg. Atracorium, 0.6 mg/kg was used as a muscle relaxant and appropriate LMA was inserted by an anesthesiologist. For maintenance of anesthesia in the halothane group, halothane equal MAC +50% N2O + 50% O2 and in propofol group, propofol, 100 μg/kg/min + 50% N2O + 50% O2 were used. Opioid analgesics were not administered during the surgery. At the end of surgery and after antagonizing of muscle relaxant, in the awaked subgroups (subgroups 1 and 3) oropharynx was suctioned, anesthetic drug and N2O were discontinued and, 100% oxygen administered for patient. When the patient became awake (spontaneous eye opening, purposeful movement of the extremities without any physical stimulation, and responding to verbal commands), LMA was removed. In the deep subgroups (subgroups 2 and 4), at the end of surgery when patient was still receiving anesthetic drug, N2O was discontinued and after inhalation of 100% oxygen for at least 5 minutes, while the patient was still anesthetized, LMA was removed, oral airway was inserted and finally anesthetic drug was discontinued. Then patient was transported to the post anesthesia care unit (PACU) being in lateral position and receiving 100% oxygen via face mask until the patient became completely awaked. In PACU an anesthesiologist who was blind to the type of anesthetic drug and time of LMA removal, recorded study variables. Recording of study variables was initiated from discontinuing of anesthetic drug until 30 minutes later in 5 minutes intervals. Demographic data (age, gender, weight, height) and duration of anesthesia were recorded. Study variables included cough and straining, bronchospasm (wheezing in auscultation of lung), laryngospasm, breath holding, oxygen desaturation (Spo_2<90%), and vomiting. Determination of severity of airway hyper reactivity was based on modified table of scores that was used by Pappas et al (Table 1). Because this study was in adults, we changed some items in original table.

Data analysis

SPSS 11.0 was used for statistical analysis. The data presented as mean (±) standard deviation (SD). Analysis of variance (ANOVA) was used for analysis of demographic data. Study variables were analyzed with chi-square test (fisher exact test) (Table2) and data of severity of hyper reactivity (Table3) was analyzed with Kruskal-Wallis test (and Mann-Whitney). The level of significance was taken as P-value<0.05. Bonferroni correction was performed for multiple testing.

Results

There was no significant difference in demographic data and duration of anesthesia among the four subgroups (P> 0.05).

There was no significant difference in bronchospasm, laryngospasm, and oxygen desaturation among subgroups, too (P>0.05) but significant differences were in cough and straining, breathholding, vomiting, and finally, severity of airway hyperreactivity (P<0.05)

Table 1. Airway Hyperreactivity Score.

Parameter	Score				
	0	1	2	3	4
Cough	None	Occasional	Frequent	Continuous	Laryngospasm (partial/complete)
Breathholding	None	<15 sec	15-30 sec	>30 sec	Positive pressure Ventilation
Oxygen desatursion	None $Spo_2 \geq 95\%$	$93\% \leq Spo_2 < 95\%$	$90\% \leq Spo_2 < 93\%$ >10 Sec	$85\% \leq Spo_2 < 90\%$ >10 sec	$Spo_2 < 85\%$ >10sec

Severity of airway hyperreactivity: Mild = score 1-3, Moderate = score 4-8, Severe = score ≥ 9.

Table 2. Incidence of airway events during and after removal of the laryngeal mask airway.

Airway events	Subgroup 1 Hal-Aw	Subgroup 2 Hal-Deep	Subgroup 3 Pro-Aw	Subgroup 4 Pro-Deep
Cough and Straining	11(28.2%)*	6(15.4%)	5(12.8%)	2(5.1%)
Bronchospasm	2(5.1%)	1(2.6%)	1(2.6%)	0
Laryngospasm	1(2.6%)	0	0	0
Breathholding	6(15.4%)*	2(5.1%)	0	1(2.6%)
Vomiting	3(7.1%)*	0	0	0
Oxygen desaturation	0	0	2(5.1%)	0

Values are represented as n (%)
* Significantly higher compared to Subgroups 2, 3, and 4 ($P<0.05$)

(Table 2). Incidence of cough and straining, breath holding, and vomiting were highest in subgroup 1 (Hal-Aw) and lowest in subgroup 4 (Pro-Deep). Depth of anesthesia at the time of LMA removal didn't correlate with incidence and severity of airway hyper reactivity but anesthesia with propofol was safer than halothane ($P<0.05$) (Table 3). No severe hyper reactivity occurred in the patients.

Discussion

This study shows that the incidence of respiratory adverse events and severity of airway hyperreactivity after LMA removal depends on choice of anesthetic drug. Incidence of severity of airway hiperreactivity is higher in anesthesia with halothane than propofol. There were a few studies that had evaluated both choice of anesthetic drug and depth of anesthesia at LMA removal.

Pappas et al compared between two kinds of volatile anesthetic (isoflurane versus sevoflurane) in children. They concluded that while LMA removal in the anaesthetized as well as in the awaked child after sevoflurane anesthesia appears to be safe, a higher risk for respiratory complications has been described following awake removal after isoflurane anesthesia[3]. New point in Pappas, study was defining the severity of airway hyperreactivity that we used the same criteria with modification for our study too.

Gataure et al concluded that it may be safer to remove the LMA while adult patients are deeply anesthetized[6].

Baird et al reported that incidence of oxygen desaturation in awaked patients was higher than deeply anesthetized patients[12].

Nunez et al recommended that LMA can be safely left placed until the patient has regained consciousness after emergence from the anesthesia[5].

Because of the importance of propofol and LMA in outpatient and short time surgery, we compared propofol with halothane in this study. Our findings correlate with pharmacologic properties of propofol.

Propofol can cause bronchodilation in patients with chronic obstructive pulmonary disease. It can also decrease the incidence of intraoperative wheezing in patients with asthma[13]. Propofol in subhypnotic doses is effective against chemotherapy-induced nausea and vomiting. When administered to induce and maintain

Table 3. Incidence of severity of airway hyperreactivity.

	Subgroup 1 Hal-Aw	Subgroup 2 Hal-Deep	Subgroup 3 Pro-Aw	Subgroup 4 Pro-Deep
Mild	18(46.2%)	13(33.3%)	6(15.4%)	1(2.6%)
Moderate	3(7.7%)	1(2.6%)	2(5.1%)	1(2.6%)
Severe	0	0	0	0
Overall	21(53.9%)*	14(35.9%)*	8(20.5%)	2(5.2%)

Values are represented as n (%)
*Significantly higher compared to Subgroups 3, and 4 (P<0.05)

anesthesia, it is more effective than ondansetron in preventing postoperative nausea and vomiting[14].

On the other hand, studies have showed that propofol suppressed pharyngeal reflexes to a degree that permitted the insertion of the LMA without need to either muscle relaxants or potent inhaled anesthetics. Propofol has been found to depress laryngeal reflexes, facilitating insertion of LMAs[15].

All of these properties demonstrate decrease in incidence of cough and straining, bronchospasm, laryngospasm, vomiting, oxygen desaturation, and severity of airway hyperreactivity with propofol that concluded from our study.

Finally we recommend use of propofol for maintenance of anesthesia in procedures that airway device is LMA.

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