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Original Contribution

A comparison of classic laryngeal mask airway insertion between lightwand- and standard index finger–guided techniques

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Abstract

Study objective: To compare the efficacy of lightwand-guided classic laryngeal mask airway (cLMA) real-time insertion technique with the standard recommended index finger–guided insertion technique.

Design: Prospective, randomized controlled study.

Setting: University-affiliated hospital.

Patients: Three hundred patients undergoing minor gynecological or orthopedic surgeries under general anesthesia using the cLMA as an airway management tool.

Interventions: Patients were randomly divided into either lightwand-guided group or standard group.

Measurements: Fiberoptic bronchoscopy was used to determine the cLMA position after a cLMA was inserted. The first attempt and total success rates of the cLMA insertion, insertion time, distances from the end of cLMA pilot tube to the upper central incisors, views of fiberoptic bronchoscopy, blood staining, tidal volume, airway pressure, end-tidal CO_2, SpO_2, noninvasive hemodynamic parameters, and others were compared.

Main results: The cLMA was all successfully inserted within 3 attempts except for 2 patients in the standard group. The success rates of lightwand-guided insertion technique at first attempt were significantly higher than standard insertion technique; the ideal view rates assessed by fiberoptic bronchoscopy in lightwand-guided group patients were also significantly higher than in standard group patients, but the insertion time of first successful attempt was similar; the blood staining rates on the cLMA in lightwand-guided group patients were significantly less than in standard group patients. The depths of cLMA insertion in standard group patients were significantly deeper than those in lightwand-guided group patients. There was no significant difference in end-tidal CO_2, SpO_2, airway pressure, and hemodynamic variables.

Conclusion: Lightwand-guided cLMA insertion technique can provide a more objective indicator for correct cLMA positioning, higher first attempt success rates, better glottic views, and less damage to oropharyngeal or esophagus tissues than standard index finger–guided cLMA insertion technique.

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1. Introduction

Since the classic laryngeal mask airway (cLMA) was first introduced into clinical practice in 1988, a variety of new extraglottic airway devices with some specific advantages have been developed [1,2]. However, the first generation of cLMA is still widely used in clinical practice, especially in patients undergoing minor surgeries by providing a safe and effective alternative to tracheal intubation [3,4]. The standard recommended cLMA placement technique is performed blindly and requires full insertion of the index finger into the mouth [5,6]. The correct cLMA position is determined by feeling of resistance while the cLMA is pushed down in the pharynx [5,6]. As a result, the first attempt success rate of cLMA insertion varies between 67% and 95% due to the lack of an objective indicator of correct cLMA position, unmatched cLMA sizes, and operator experience [7–11]. In addition, more and more operators are reluctant to insert their index fingers into the patient's mouth [5,12].

The standard rigid lightwand has been successfully used to guide difficult endotracheal intubation depending on the location of light [13,14]. Furthermore, flexible lighted stylets have been used to help adjust the laryngeal mask airway (LMA) position for facilitating intubation through the intubating LMA [15,16]. For these reasons, we conducted this study to evaluate the feasibility of the lightwand-guided real time insertion of the cLMA, which offers significant benefits such as having no need to insert fingers into the patient's mouth.

2. Materials and methods

After obtaining approval from institutional ethics committee and written informed consent from all the subjects participating in the study, 300 patients scheduled for elective gynecological or orthopedic surgeries under general anesthesia in supine position with anticipated duration less than 45 minutes were enrolled. The inclusion criteria for the study were as follows: (*a*) patients of either sex, aged 20 to 65 years, body mass index (BMI) 20 to 25 kg/m^2, and (*b*) American Society of Anesthesiologists (ASA) physical status I and II. The exclusion criteria were as follows: (*a*) patients at risk for regurgitation and aspiration; (*b*) conditions where use of the cLMA would be inappropriate; (*c*) predicted airway difficulty and emergency surgery; and (*d*) patients with reported history of hypersensitivity for 1 or more of the medications and latex, patients having any abnormality of the neck upper respiratory tract, and patients with history of obstructive sleep apnea.

The patients were randomly divided into 2 groups: standard cLMA insertion group (with index finger intraoral manipulation) and lightwand-guided cLMA insertion group using computer-generated random number table with the allocations concealed in a sealed envelope. The sealed envelope was opened before anesthesia induction. Two anesthesiologists who had performed at least 80 insertions with the standard technique and 10 insertions with lightwand-guided technique did all of the cLMA insertions.

For both groups of patients, the cLMA size was chosen based on manufacturer's recommendation (Tuoren Medical, Henan, China). A patient who weighed less than 50 kg had a size 3; 50 to 70 kg, a size 4; and more than 70 kg, a size 5. The cLMA cuff was deflated, and the back surface of cLMA was lubricated by water-soluble gel before insertion.

Routine preanesthetic assessment was performed for all patients, which included Mallampati score and screen for sore throat. Noninvasive blood pressure measurement, pulse oximetry, and electrocardiography, and other routine monitoring parameters were also recorded. Preoxygenation was performed for 3 minutes, and all patients received intravenous midazolam 0.02 mg/kg, fentanyl 2 to 4 μg/kg, propofol 2 to 2.5 mg/kg, and succinylcholine 1.0 mg/kg for induction. After muscle fibrillations stopped, a cLMA was inserted either by standard insertion technique or lightwand-guided insertion technique depending on the randomization table. Anesthesia was maintained with sevoflurane of 0.7 to 1.0 minimum alveolar concentration with intermittent bolus injection of fentanyl 0.05 mg. The end-tidal CO_2 ($ETCO_2$) concentration was maintained within the range of 35 to 40 mm Hg.

The standard insertion technique was performed according to manufacturer's instruction with the index finger fully into the patient's mouth. The lightwand-guided insertion technique was performed as follows: (1) lightwand was preshaped as in Fig. 1a; (2) the preshaped lightwand stylet was first passed down the cLMA tube until the stylet tip reached the distal end of cLMA tube and then locked with the cLMA tube to avoid the stylet passing through the aperture bars of cLMA while keeping the orientation of cLMA (Fig. 1b and c); (3) the anesthesiologist held the distal portion of the stylet in the dominant hand and opened the patient's mouth with the other (Fig. 1d); (4) after the lightwand stylet was turned on and operating room light turned off, the anesthesiologist inserted the cLMA into patient's mouth from the midline and glided it down along the palatopharyngeal curve while adjusting the stylet together with cLMA tube to locate a distinct central point of light at the cricothyroid membrane (Fig. 1e); (5) turned off and pulled off the stylet; (6) inflated the cLMA cuff with 10-mL syringe using less air than the volume recommended by manufacturer for individual size, stabilized the cLMA, and connected it to the breathing circuit of anesthesia machine. The success standard of cLMA insertion was determined by (1) detection of satisfactory bilateral chest movement and breath sound; (2) normal square waveform on capnograph occurred with each squeeze of the breathing bag with SpO_2 greater than 95%; (3) no air leak was detected by audition and palpation when the adjustable pressure-limiting valve was set at 20 cm H_2O pressure as breathing bag was gently squeezed; (4) confirmation of cLMA position by fiberoptic bronchoscopy assessment at cLMA aperture bars through the airway tube. The glottic view was only classified into 2 categories, ideal view (Fig. 1f, full vocal cords with or without posterior epiglottis) and un-ideal view (other