PROSEAL LARYNGEAL MASK AIRWAY VERSUS CLASSIC LARYNGEAL MASK AIRWAY FOR AIRWAY MANAGEMENT IN BURN NECROSIS AND SKIN GRAFTING SURGERY

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Abstract

Objectives: To compare the efficiency of the classic laryngeal mask airway (c-LMA) and the proseal laryngeal mask airway (p-LMA) in patients with indications for burn necrosis and skin grafting surgery. ***Methods:*** A clinical descriptive, randomized comparison study was conducted on 60 patients divided into two groups: p-LMA (30 patients) and c-LMA (30 patients) were anesthetized with p-LMA and c-LMA, respectively. Accessing and comparing the ease of placement, respiratory function, and hemodynamic response, and the degree of airway injury after surgery between two groups. ***Results:*** 100% patients were successfully inserted laryngeal mask airway (LMA) with insertion time of 22.14 seconds and 20.56 seconds, respectively ($p > 0.05$); oropharyngeal leak pressure (OLP) was 28.56 cmH_2O (p-LMA) and 19.66 cmH_2O (c-LMA) ($p < 0.05$); hemodynamic and respiratory function during surgery were maintained in normal range and there was no difference between the two groups ($p > 0.05$), and no airway complications related to insertion technique (sore throat, hoarseness, or blood staining) were found in either group. ***Conclusion:*** Both LMAs are useful for managing airways in burn necrosis and skin grafting procedures. Both kinds of masks are simple to put on, do not significantly alter hemodynamic response or respiratory function, and patients recover safely from LMA placement without any problems.

Keywords: Laryngeal mask airway; Proseal laryngeal mask airway; Classic laryngeal mask airway; Burn necrosis and skin grafting.

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INTRODUCTION

Since introducting into clinical use in 1988, the LMA has quickly gained popularity as a convenient tool for airway management in anesthesia and resuscitation. The advantages of utilizing the LMA are its simplicity of use, quick airway control, and minimal postoperative airway injuries. Nevertheless, because LMAs are supraglottic airway devices, they have drawbacks such as malposition during surgery, the possibility of gastroesophageal regurgitation, or air leakage when using positive pressure ventilation [1]. The two most widely used laryngeal masks today are c-LMA and p-LMA, of which p-LMA is a later generation with a silicon cuff and drainage tube for higher mask sealing pressure and can drain gastric juice. On the other hand, c-LMA is easier to manage when inserting because of its smaller size and simpler structure [1, 2, 3]. Burn necrosis and skin grafting surgery often do not require a long surgical time, not requiring deep muscle relaxation, so airway management perioperative with LMA is a reasonable choice. We conduct this study to: *Compare the efficiency of c-LMA and p-LMA in terms of ease of placement, respiratory function and hemodynamic response, and the degree of airway injury after LMA anesthesia in patients with indications for burn necrosis and skin grafting surgery. This will provide evidence for selecting safe equipment for surgery.*

MATERIALS AND METHODS

1. Subjects

Including active sampling of 60 patients diagnosed with burns and indications for necrosis and skin grafting surgery under LMA anesthesia at the Department of Anesthesia, Le Huu Trac National Burn Hospital, from January 2024 to June 2024.

* *Inclusion criteria*: Patients aged 18 - 60 years old; ASA I - III; agreed to participate in the study.

* *Exclusion criteria*: Patients had one of the following factors: Chronic lung disease, airway injury due to burns, and suspected cases of full stomach; patients diagnosed with difficult intubation, obese (BMI > 30); or cases with complications during surgery requiring a change in anesthesia method.

2. Methods

* *Study design:* A clinical descriptive, randomized comparison study.

* *Study grouping*: Patients participating in the study were randomly divided into 2 groups:

The p-LMA group (30 patients): Anesthesia with p-LMA for airway management;

The c-LMA group (30 patients): Anesthesia with c-LMA for airway management.

* *Anesthesia procedure:* 1 day before surgery, patients had preoperative examinations and received instructions on anesthesia and surgical techniques. A consent form must be signed by each patient or relative who decides to take part in the research.

After entering the surgery room, patients received a peripheral intravenous, standard monitoring with non-invasive blood pressure (NIBP), SpO_2, and $EtCO_2$, and an ECG DII. Oxygen was inhaled at 3 L/minute through a face mask. Anesthesia protocol: Slow intravenous injection of midazolam 0.05 mg/kg, fentanyl 3 mg/kg, and propofol 3 mg/kg. A face mask was applied for ventilation support when the patient lost consciousness and stopped breathing. The LMA (Teleflex Medical, Dublin, Ireland) (size 4 for male and size 3 for female) was inserted when muscles were relaxed and the jaw was down. The LMA cuff was inflated with a pressure of 60 mmHg (checked by pressure manometer); check the correct LMA position using $EtCO_2$ waveform and auscultation. The number of insertion attempts was recorded. A failed attempt was defined as the removal of the device from the mouth. Three attempts were allowed before device use was considered a failure.

The airway sealing pressure or "leak" test was measured using the "audible noise" method that was first described by Keller et al. [4]. We set a continuous 100% oxygen flow of 3 L/min with the circuit connected to the reservoir bag and the adjustable pressure limiting valve closed. Then trachea was continuously auscultated in the anterior neck for the audible leak. OLP (cmH_2O) was defined as the airway pressure plateau at which an audible leak occurs.

Ventilate with VC mode (Vt = 5 - 6 L/kg; f = 12 - 14 cycles/minute) and adjust to ensure $EtCO_2$ in the range of 35 - 40 mmHg. Anesthesia was maintained with propofol via an electric syringe at a rate of 10 - 15 mg/kg/hour. When beginning a skin incision, add 100mcg of fentanyl and then another 100mcg every hour. Give 20mg of nefopam combined with 100mL of 0.9% sodium chloride solution 30 minutes before the procedure ends to reach the maximum analgesic concentration when the patient starts to wake up. Anesthesia was stopped completely while the wound was being bandaged. When the patient was completely conscious, able to raise their limbs, and breathing on their own (SpO_2 = 95 - 100% breathing air), LMA was removed. Postoperative blood staining of the LMA, sore throat, and hoarseness were recorded after surgery.

* *Data collection:*

Patients' general characteristics.

Ease of LMA insertion (the number of attempts and insertion time).

Changes in heart rate, NIBP, end-expiratory CO_2 pressure ($EtCO_2$), oxygen saturation (SpO_2), and $EtCO_2$ at the following times: T_0 (before LMA insertion); T_1 (1 minute after LMA insertion); T_2 (5 minutes after LMA insertion); T_3 (skin incision); T_4 (wound bandage); T_5 (after removing LMA).

OLP, peak airway pressure (P-peak), and adverse effects during the procedure. The percentage of patients who suffer from airway injury postoperative.

* *Statistical calculation*: The Statistical Package for the Social Sciences 22.0 (SPSS 22.0) software was used for statistical calculation. Data were expressed as either mean and standard deviation or numbers and percentages. A p-value less than 0.05 is believed to be statistically significant.

3. Ethics

The protocol of LMA anesthesia for burn surgery used in the study referred to the procedure that received approval from the Director of Le Huu Trac National Burn Hospital, Vietnam Military Medical University, according to the decision No. 324/QD-BVB dated April 1, 2020, on promulgating the Guidelines for Procedures for Medical Examination and Treatment at Le Huu Trac National Burn Hospital. All patients' data was secure throughout the study to protect their anonymity. Le Huu Trac National Burn Hospital granted permission for the use and publication of the research data. The authors declare to have no conflicts of interest.

RESULTS

Table 1. Patient general characteristics.

Variables	p-LMA	c-LMA	p
No. of patients/males/females (n)	30/25/5	30/27/3	
Age (years)	32.68 ± 7.92	36.74 ± 7.42	
Height (cm)	165.67 ± 12.55	167.23 ± 8.27	
Weight (kg)	55.55 ± 9.12	57.80 ± 6.35	> 0.05
BMI	20.40 ± 3.75	20.72 ± 5.33	
Duration of surgical procedure (minute)	47.26 ± 6.76	46.73 ± 9.75	
Duration of anesthesia (minute)	62.65 ± 8.55	60.17 ± 6.45	

There is no significant difference in patient general characteristics between the two groups ($p > 0.05$).

Table 2. Comparison between the p-LMA and c-LMA.

	p-LMA	c-LMA	p
Attempts at insertion (n) 1/2/3	23/7/0	27/3/0	> 0.05
Insertion time (seconds)	22.14 ± 1.55	20.56 ± 2.42	> 0.05
Oropharyngeal leak pressure (cmH_2O)	28.56 ± 4.26	19.66 ± 2.88	< 0.05
LMA malposition perioperative, n (%)	0 (0)	2 (6.66)	> 0.05
LMA needs to be positioned or reinserted, n (%)	0 (0)	2 (6.66)	> 0.05
Hoarseness or sore throat, n (%)	0 (0)	0 (0)	> 0.05
Blood staining at removal, n (%)	2 (6.33)	0 (0)	> 0.05

Oropharyngeal leak pressure in patients of the p-LMA group is higher than that of the c-LMA group (p > 0,05).

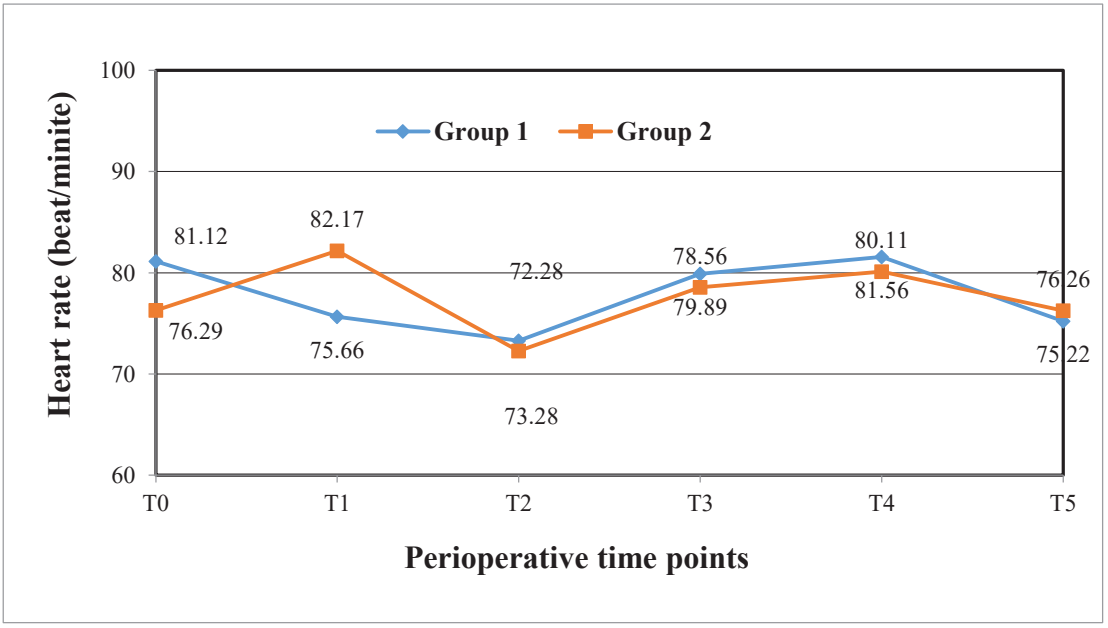

Chart 1. Changes in heart rate during anesthesia.

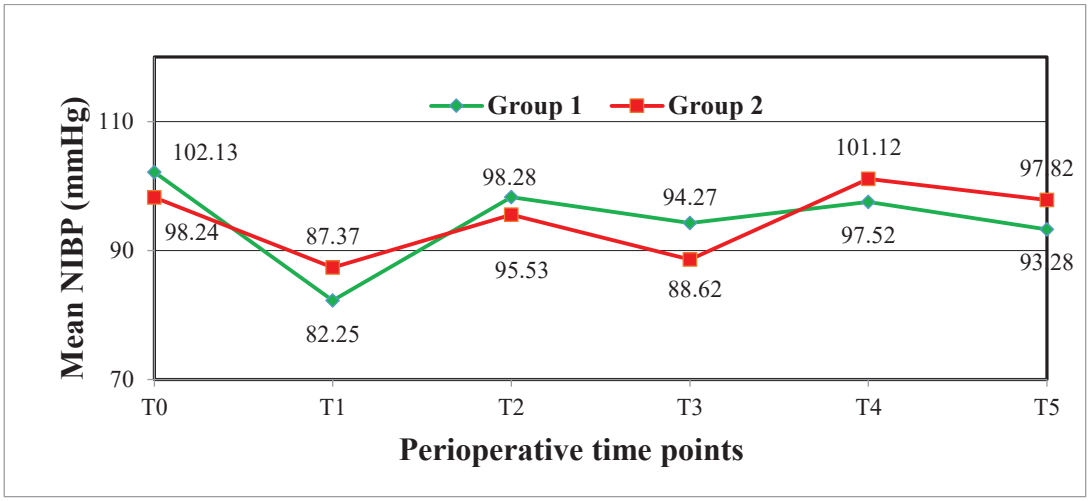

Chart 2. Changes in mean NIBP during anesthesia.

There is no significant difference in hemodynamic changes between the two groups ($p > 0.05$).

Table 3. Changes in SpO_2, $EtCO_2$ and P-peak during anesthesia.

	SpO_2 (%) ($\overline{X} \pm SD$)		$EtCO_2$ (mmHg) ($\overline{X} \pm SD$)		P-peak (cmH2O) ($\overline{X} \pm SD$)	
	p-LMA	c-LMA	p-LMA	c-LMA	p-LMA	c-LMA
T_0	99.87 ± 0.11	99.83 ± 0.15	-	-	-	-
T_1	99.63 ± 0.36	99.05 ± 0.28	38.13 ± 6.34	38.60 ± 5.22	15.26 ± 2.65	13.50 ± 2.60
T_2	99.25 ± 0.54	99.08 ± 0.50	36.13 ± 6.45	37.30 ± 7.98	13.33 ± 4.53	14.28 ± 3.60
T_3	98.97 ± 0.78	98.93 ± 0.97	39.15 ± 7.83	40.10 ± 7.50	15.12 ± 6.51	14.05 ± 4.47
T_4	99.25 ± 0.66	99.42 ± 0.50	40.28 ± 6.34	41.20 ± 5.38	14.62 ± 2.35	13.55 ± 2.40
T_5	99.80 ± 0.26	99.85 ± 0.32	-	-	-	-

There is no significant difference in respiratory parameters between the two groups ($p > 0.05$).

DISCUSSION

Our study results clearly show that using both types of LMA ensures safety and good airway management during anesthesia for patients undergoing burn necrosis and skin grafting. This is reflected in the changes in hemodynamics and respiration of both study groups being within the allowable limits, and there was no significant difference between the two groups ($p > 0.05$) (*Chart 1, Chart 2, Table 3*). In terms of LMA

insertion technique, although p-LMA has a larger structure than c-LMA, the ease of mask placement shown in the number of times and time of successful LMA placement between the two study groups were not different (*Table 2*). This is different from the study by Joseph Brimacombe et al. [5] when comparing the effectiveness of LMA on 384 patients divided into 2 groups using p-LMA and c-LMA. The authors discovered that c-LMA succeeded in 159/192 (83%), whereas p-LMA was successful after just one try in 174/192 (91%). Additionally, p-LMA placement time is longer than c-LMA placement time (22 and 38 seconds, respectively, $p < 0.05$). According to the authors, p-LMA insertion had a lower success rate caused by the mask's larger size and the absence of a backplate, which increased the likelihood that the cuff would fold over at the back of the mouth. The differences with our study may be due to the fact that our operators are experienced anesthesiologists who have performed p-LMA mask insertion on thousands of cases. Furthermore, the reason for this could be that our study had a significantly smaller patient population than the aforementioned study.

The safety of both airway management is also reflected in the results of postoperative adverse effects related to LMA perioperative. According to the study's findings, neither study group experienced any adverse effects like laryngeal laryngospasm or symptoms associated with airway damage, such as hoarseness or sore throat (*Table 2*). This is the main benefit of LMA over other airway control devices or endotracheal tubes. Furthermore, our study's laryngeal mask placement was carried out by experienced anesthesiologists; the patient was sufficiently sedated to eradicate all pharyngeal reflexes, making the procedure simpler and more convenient. According to Pham Quang Minh et al.' study [6], the patients who underwent general anesthesia with endotracheal tube insertion had a 40% and 3.3% higher rate of sore throat and hoarseness symptoms, respectively, than the LMA group, which had a 0% rate ($p < 0.01$). Our findings were in line with those of Belena JM et al. [7], who discovered that patients under LMA anesthesia did not experience hoarseness or sore throat complications.

Our study's most significant finding was that patients in the p-LMA group had higher OLP than those in the c-LMA group (*Table 2*). The results of our study are similar to those of the authors Qamarul Hoda M, Joseph Brimacombe, PP Lu, A Coulson et al. [2, 5, 8, 9]. This is due to the structure

of p-LMA being different from that of c-LMA. According to author Shin et al., a potential risk of LMA use is incomplete airway sealing, which may cause gastric insufflation; inflation of airways at pressures above 20 cmH_2O can induce the opening of the esophageal sphincter [10]. As a supraglottic airway management device, the LMA may move from its intended position, particularly during laparoscopic surgery involving abdominal inflation or when the patient needs to change positions during the procedure. The more OLP there is, the less air leakage there is and the greater the ventilation safety. Furthermore, the LMA is held more securely and is less likely to malposition during surgery when the OLP is higher. Because the patients in our study did not require positional changes during surgery and had short surgical times, this benefit of p-LMA is not immediately apparent.

Our study's limitations included its single-center design and small sample size. Another benefit of p-LMA is that it has a gastric drainage route. However, since this feature was not utilized during anesthesia in our study, there was no way to compare how well these two mask types performed in terms of the aforementioned feature. Therefore, we recommend that multicenter studies with larger sample sizes and in-depth patient selection should use the characteristics of p-LMA to more clearly see the differences between the two study groups.

CONCLUSION

By comparing the effects of p-LMA and c-LMA, we discovered that both LMAs are useful for managing airways in burn necrosis and skin grafting procedures. Both kinds of masks are simple to put on, do not significantly alter hemodynamic response or respiratory function, and patients recover safely from LMA placement without any problems.

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