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Efficiency Comparison of Laryngeal Tube Suctions and Classic Laryngeal Mask Airways through General Anesthesia with Controlled Ventilation

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Abstract

In the recent years, new airway preservation and maintenance equipment are used through general anesthesia, such as Laryngeal tube suction (LTS) and classic laryngeal mask airways (c.LMA). We compared their function in airway preservation and maintenance of patients through general anesthesia using controlled ventilation. This study is based on a randomized clinical trial where 83 patients aged between 16 to 65 were selected in a supine position with class I and II A.S.A. Patients were classified in two categories; LTS (43 patients) and c.LMA (40 patients) groups by 4 block randomization method. Both groups were anesthetized with the same method (general anesthesia). After that, one of the mentioned equipment was placed for each group and their ventilation qualities, placement speeds, peak airway pressures, leak airway pressures, and complications were compared. The estimated ventilation qualities, using two SPO₂ and ETCO₂ indicators, indicated no significant difference between two groups. Leak and peak airway pressure in LTS group was statistically higher than cLMA group in each zero, three, and five minute times. Among the estimated values of complications, sore throat, dysphonia, and observance of blood on the device in LTS group revealed higher values than cLMA group. Conclusively, both the LTS and cLMA devices could be used as safe airway equipment. However, peak and leak airway pressures and complications of LTS group were higher than cLMA group.

Introduction:

The most significant issue regarding traumatized or critically ill patients is a safe airway. This is considered to be one of the most important duties of an anesthesiologist. The Laryngeal tube suction (LTS) and classic laryngeal mask airways (c.LMA) airways can be used for those patients whose anatomical cavity of their mouth, head, and neck create a difficult intubation, or emergency patients (Cook *et al.*, 2003a; Eschertzhuber *et al.*, 2009). LT is an almost new device for controlled ventilation of airways through general anesthesia. In this device, the laryngeal tube is placed blindly, including one airway tube with two cuffs and two orifices at the end of the tube which is located between two cuffs. The laryngeal tube is placed throughout the tongue and its end is connected to

hypopharynx or upper region of the esophagus. Laryngeal tube cuffs have low pressures and ventilation is done through two elliptic orifices (Eschertzhuber *et al.*, 2009; Saraswat *et al.*, 2011; Mathis *et al.*, 2013). Three dark lines marked on the laryngeal tube indicate the amount of tube entry into the mouth. If these lines are aligned with a row of teeth, it means that the tube is entered into the mouth sufficiently (Mathis *et al.*, 2013; Cook *et al.*, 2003b; Cook & Kelly, 2015). The silicon laryngeal tubes are reusable, can be reused up to 50 times after sterilizing in the autoclave. LTS is a new kind of laryngeal tube with extra channels for suction and decompression of the stomach and digestive system (Cook *et al.*, 2003a,b; Cook & Kelly, 2015).

The LMA was introduced into anesthesia field from 1984. It includes two kinds of classic and I-Gel types. LMA is better tolerated than a tracheal tube, induces fewer

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coughs, and is used instead of a tracheal tube in emergency cases. The classic type has a rubber mask which is placed into hypopharynx after being blown off (such as cuffs in a tracheal tube) and closes pharynx and its surroundings. I-Gel type is made of a thermoplastic elastomer which needs not to be blown off. Its shape is adjusted by body temperature and closes pharynx and its surroundings without any damage. LMA length is selected based on the patient's weight (Eschertzhuber *et al.*, 2009; Saraswat *et al.*, 2011; Cook & Kelly, 2015; Sierpina *et al.*, 2012; 10. Russo *et al.*, 2012). However, till date LT has not been studied well (Mathis *et al.*, 2013; Sierpina *et al.*, 2012; Russo *et al.*, 2012). Nevertheless, those studies which analyzed LT had always resulted contradictory. No serious attempt in this regard has been taken in Iran. Thus we compared LMA and LT regarding their significant properties, such as ease and speed of placement and ventilation quality in both peak and leak pressures. While approved efficiency of LT, it can be used as a new and alternative intubation device along with LMA in the surgery room and emergency ward (Cook *et al.*, 2003a; Sierpina *et al.*, 2012; Genzwuerker *et al.*, 2002).

Methodology:

This study was carried out as a randomized clinical trial on those patients which were aged between 16 to 65 yrs old and referred to Zahedan hospitals for elective surgery. Selection were done in the supine position with class I and II A.S.A. For Statistical analysis of the data, SPSS software version-16 was used. In order to analyze each variable, which are indicated in Table of variables, suitable tests were used *viz.*, Independent t-test was used for comparison of average leak and peak pressures, SpO₂, age, and ET CO₂ in two LTS and cLMA groups. Pearson chi-square was used for comparison of a sore throat, dysphonia, and observance of blood on the device frequencies between two LTS and cLMA groups.

Results:

The average age of patients in LTS group was 39.2±11.8, and in cLMA group it was 36.4±12.6. including 49 females and 35 males (total 83 patients) were distributed into two intervention groups. Among them, 4 patients (1 patient in LTS and 3 patients in cLMA group) were removed from the trial due to the wrong placement of the device. ET CO₂ and SpO₂ were two variables which were estimated for efficiency comparison. In the present study, mean SpO₂ in LTS group was 99.3% and in cLMA group was 99.8%. Moreover, mean ET CO₂ in LTS group was 39.2 and in cLMA group; 38.5. These values revealed no statistically significant difference (p value > 0.05) (Tables-1 & 2).

Table-1: Comparison of SpO₂ values in two groups using t-test

SpO ₂	number	mean	T	Df	Sig.
LTS	40	99.3			
cLMA	39	99.8	-1.24	77	0.21

Table-2: Comparison of ET CO₂ values in two groups using t-test

SpO ₂	number	mean	T	Df	Sig.
LTS	40	39.2			
cLMA	39	38.5	1.83	77	0.07

Leak pressure in each group is analyzed and compared in three zero, three, and five minute times. In the LTS group, mean leak pressures are 33.2, 33.8, and 34.1, and in the cLMA group were 18.4, 19.8, and 20.2, respectively. All the three means were significantly higher in the LTS group than the cLMA group (p-value > 0.001) (Table-3).

Table-3: Comparison of leak values in three zero, 3, and 5 minute times in both groups using t-test

Mean	Leak 0	Leak 3	Leak 5
LTS	33.2	33.8	34.1
cLMA	18.4	19.8	20.2
p-value	0.0001	0.0001	0.0001

Peak pressure in each group is analyzed and compared in three zero, three, and five minute times. In the LTS group, mean peak pressures were 20.1, 21.2, and 22.3, and in the cLMA group were 15.0, 15.4, and 15.9, respectively. All the three means are significantly higher in the LTS group than the cLMA group (p value < 0.001) (Table-4).

Table-4: Comparison of peak values in three zero, 3, and 5 minute times in both groups using t-test

Mean	Leak 0	Leak 3	Leak 5
LTS	20.1	21.2	22.3
cLMA	15.0	15.4	15.9
p-value	0.0001	0.0001	0.0001

Three parameters were selected for evaluation of LTS and cLMA complications; sore throat, dysphonia, and observance of blood on the device. In LTS group, among total 40 patients, 18 patients experienced sore throat in the first 24 hours, and in cLMA group, among total 39 patients, only 7 patients experienced sore throat which is considered to be a significant difference.

Dysphonia was found in 3 LTS patients, however, no such complication was observed in cLMA group which is considered to be no significant difference.

The third evaluated complication was observance of blood on the device. In LTS group, 4 patients experienced this complication, however, in cLMA group, none of the patients experienced it. It should be noted that this complication is significantly higher in LTS group in comparison with cLMA group (Table-5).

Moreover, the placement time for LT group was 19.5 s and for LMA group was 18.2 s, which is not statistically significant.

Among total 43 patients, LTS placement was done successfully on 40 of them, and only 3 patients were forced to use cuffed tracheal tube as an airway. Furthermore, cLMA was placed successfully on 39 patients, and unsuccessfully on 1 patient. Unsuccessful cases were removed from the trials. Success frequency of both groups

statistically indicated no difference (Table-6).

Table-5: Frequency comparison of after surgery sore throat in both groups

Parameter		LTS		cLMA		Total		p-value
		#	%	#	%	#	%	
Sore Throat	Yes	18	45	7	17.95	25	31.65	<0.01
	No	22	55	32	82.05	54	68.3	
Dysphonia	Yes	3	7.5	0	0	3	3.8	≥0.08
	No	37	92.5	39	100	76	92.2	
Blood on Device	Yes	4	10	0	0	4	5.06	<0.043
	No	36	90	39	100	75	94.94	

Table-6: Comparison of successful placement in both groups

Output		LTS		cLMA		Total		p-value
		#	%	#	%	#	%	
Successful		40	93.02	39	97.5	79	95.18	≥0.34
Unsuccessful		3	6.98	1	2.5	4	4.82	

Discussion:

In this study, cLMA and LTS efficiencies were compared with respect to their ease and speed of placement, ventilation quality; peak and leak pressures. Till date, different kinds of studies were carried out in this field which reported different results as well. Cook et al. (2003a) conducted a study to compare the LMA and LT and reported that leak pressure in LT group was 28 cm/H₂O, and in LMA group was 21 cm/H₂O. Ventilation quality in 25 patients out of 36 ones was good, and in one patient was followed by complications and had no failure (in LMA group). However, this variable in LT group was good in 23 patients, but followed by complications in 11 patients, and was failed in 2 patients. Results showed a significant difference between the two groups. No significant difference was observed between two groups regarding their after surgery complications and incidences. In another study, Cook et al. (2003b) concluded that LT group has 2 failures, while LMA group has no failure. Here no significant difference was observed in their plateau pressure. Genzwuerker et al. (2002) conducted a study on placement and fiberoptic view. In their study, placement time in LT group was 18.8 s, and in LMA group was 10.4 s. Fiberoptic view of both groups proved to be efficient. Amini et al. (2010) conducted a study on reusable and disposable LTs and reported that placement success in disposable LT group is 90%, and in reusable LT group is 98%. Placement time in disposable LT group is 50.9 s, and in reusable LT group is 47 s. Conclusively, both groups have high clinical efficiency and easy placement. In our study, as well, placement time of LTS is 19.5 s, and placement time of cLMA is 18.2 s. These results are consistent with the previously mentioned results. Placement time of LTS is always higher though statistically, we did not get support. In the present study, peak airway pressures of LTS in all three pressure times was 5-6 cm/H₂O higher than cLMA; these results are also consistent with Cook et al. (2003b).

Regarding ventilation quality, mean SpO₂ was higher in cLMA than LTS, and mean ET CO₂ was higher in LTS than cLMA. In sum, all the patients were provided with high quality and efficient ventilations.

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