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Comparison between Classic Laryngeal Mask and Cobra Perilaryngeal Airway during Mechanical Ventilation

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ABSTRACT

Background: *Selection of an optimal method for the safe preoperative airway management is the base of a successful general anaesthesia. To achieve this goal various methods and devices are used including endotracheal tube and laryngeal mask airway, each has its own advantages and disadvantages. In this study, we compared a new supraglottic instrument (cobra perilaryngeal airway) with laryngeal mask airway (LMA), considering each one's abilities specially their role in preventing intraocular pressure rise during insertion.*

Materials and Methods: *In a prospective randomized clinical trial 200 ASA class I, II patients with no history of glaucoma, cardiovascular or respiratory diseases and susceptibility to difficult intubation were randomly divided into two similar groups (100 subjects each). None of them (age range 6-70 yrs) received premedication after preoxygenation and induction with sodium thiopental, fentanyl and atracurium. The patient was ventilated manually then one of the devices was inserted. After assurance of the correct position, its cuff was filled with air. In this study various factors including intraocular pressure (IOP), systolic blood pressure (SBP), SPO_2, end tidal CO_2 ($ETCO_2$), heart rate, peak airway pressure and end expiratory tidal volume were recorded exactly before the induction (time 1), after the induction (time 2), 5 minutes after the induction (time 3), 15 minutes after the induction (time 4), and 5 minutes after releasing the device (time 5). Cuff pressure was measured immediately after insertion and at the end of operation. Quality of insertion (1: simple 2: relatively simple 3: difficult 4: unsuccessful), their complications (bleeding, no bleeding) and sore throat 2 and 24 hours after the operation were detected by interview. Fitness of LMA or Cobra PLA on airway for prevention of air leakage were recorded as well. Qualitative data with chi-square and quantitative data with t-test and SPSS software (version 11) were analyzed.*

Results: *There was no clinical significant difference between the two groups regarding age, sex, ASA class, weight, duration of surgery, SPO_2, heart rate and blood pressure. Cobra PLA offered advantages in regard to easy insertion ($p=0.005$), sore throat ($p<0.0001$) and bleeding ($p<0.0001$). Mean rise of intraocular pressure and mean increase of systolic blood pressure (at the time 3) was higher in LMA ($p=0.02$). Regarding $ETCO_2$ ($p=0.0001$), peak airway pressure ($p<0.0001$), ability to fitness on airway ($p=0.01$) and cuff pressure ($p<0.0001$) cobra significantly offered advantages over LMA.*

Conclusion: *Cobra PLA is a useful device for airway management in general anaesthesia during mechanical ventilation with minimal post-up complication and simplicity of usage offering high potential ventilation. More studies are required in regard to use of Cobra tube in different ages.* ***(Tanaffos 2006; 5(2): 13-19)***

Key words: *Cobra perilaryngeal airway, Laryngeal mask, General anesthesia, Airway management, Mechanical ventilation*

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INTRODUCTION

Today, a large number of surgical operations are conducted under general anesthesia. Selecting an optimal airway management technique is the base of a successful safe anesthesia. To reach this goal, one of the three below mentioned techniques has to be used: facial mask, endotracheal tube or supralaryngeal airway.

Among these three, endotracheal tube is the safest device in establishing an adequate airway (1,2). But due to some of its disadvantages including inevitable hemodynamic changes during laryngoscopy and risk of life threatening unsuccessful insertion of the tube, and increasing intraocular and brain pressure, these days laryngeal mask airway (LMA) is commonly used as a new device (3, 4) and various studies have confirmed its safety and effectiveness (5, 6). Cobra perilaryngeal airway (Cobra PLA) is a newly released supraglottic device. There are limited studies in regard to cobra, comparing this device with LMA in spontaneous and mechanical ventilation (7, 8, 9). To date, there have been no published study regarding measuring the IOP comparing these two devices. Considering the importance of steady-state intraocular pressure and avoiding its rise in some surgical operations especially in ophthalmic and brain surgeries (1-3), this study was conducted with the concept that LMA and cobra PLA also different in pattern are similar to each other. The major goal of this prospective randomized clinical trial study was to compare cobra PLA and LMA classic in terms of IOP changes, safety, insertion difficulty, ventilation, hemodynamic responses and intra-operative and post-up complications.

MATERIALS AND METHODS

This was a prospective controlled randomized clinical trial which was performed in Labbafinejad Medical Center after getting the consent from research council and ethic committee of Shaheed Beheshti University of medical sciences in 2004-2005.

Considering the similar sequential articles a total number of 200 patients who were candidates for ophthalmic surgery with the criterion of surgery duration less than 90 minutes in the age range of 6-70 yrs and ASA class I, II physical status were randomly divided into two groups of cobra PLA and LMA each including 100 subjects and entered the study after signing a written consent.

The exclusion criteria were history of pulmonary or cardiovascular diseases, duration of surgery more than 90 minutes, history of any kind of preoperative sore throat, presence of any specific underlying disease interfering with normal physiology of the body, limitation in neck movement, history or risk of difficult airway(Mallampati classification III, IV) in emergency patients with full stomach, gastroesophageal reflux, history of glaucoma or previous interfering ophthalmologic diseases and over 100 kg weight.

Devices were inserted (after being checked, reassuring to be sound) by two anesthesiologists who had experienced inserting more than 200 cases of classic LMA and 50 cases of cobra PLA.

The patients received no premedication and anesthesia was inducted after 3 minutes breathing with 100% oxygen along with 5 mg/kg sodium thiopental, 2 μgr/kg fentanyl and 0.5 mg/kg atracurium. After 5 minutes ventilation by facial mask with 0.5% halothane, losing palpebral reflex and jaw relaxation and no response to (train-of-four) TOF, airway device (cobra or LMA) soaked with lubricant gel was inserted due to the type of understudy group.

After insertion, and assurance about the correct position the pilot balloon cuff pressure in LMA up to

45 mm Hg (60 cmH20) and cobra cuff up to 60 mmHg (80 cmH20) were regulated based on the anatomical equations and the cuff pressure was (repeatedly) checked by manometer. The correct position of the device was checked by simultaneous movement of the thorax during ventilation, listening with stethoscope and assurance about the lung ventilation and absence of any leak or sound from the mouth (by placing the stethoscope on the neck) and then the tube was fixed. Insertion difficulty was categorized and recorded as below:

1) Very simple insertion: immediately in the first try without any resistance.
2) Relatively simple insertion: in the first try by spending some more time, slight resistance.
3) Difficult insertion: possible in the second try.
4) Unsuccessful insertion: possible in the third try or impossible.

All over the larynx was sealed by the airway device to avoid any type of air leak by patients ventilation against outlet valve pressure of 20 cmH_2O. To reach this goal, the expiratory valve was closed on the constant stream of gas (3 litres per minute) and entering the air into the stomach was detected with listening to the stethoscope placed on the epigaster at the time of measuring oropharyngeal leak pressure.

Anesthesia was continued by 0.5-0.7% halothane, 50% oxygen, 50% N_2O, fentanyl and atracurium if required.

Monitoring of patients included nerve stimulator, pulse rate, ECG, end tidal CO_2, non-invasive blood pressure, oximetry and heart rate. At the end of operation, cuff pressure was measured before discontinuing N_2O.

After discontinuing the gases, return of ventilation and reverse of muscle relaxation (neostigmine 0.07 mg/kg, atropine 0.02 mg/kg) and returning the protective reflexes back to the normal position, cuff was slowly drained and airway device was released. Bleeding was recorded. Presence of sore throat was measured 2 and 24 hours postoperatively by questioning and examining by a constant physician and was categorized as below according to the patient's diagnosis:

0. No sore throat
1. Mild: sensation of slight dryness and soreness in the throat by the patient
2. Moderate: sensation of sore throat by the patient without throat congestion.
3. Severe: sensation of severe sore throat by the patient and diagnosis of throat congestion by the physician.

Age, weight, sex, type of operation, duration of operation, alterations in intraocular pressure obtained by constant Tonopen XL device, systolic blood pressure alterations detected by constant non invasive barometer, changes of heart rate, SPO_2 changes, maximum airway pressure, end-tidal CO_2 (capnography), end expiratory tidal volume (EETV) measured by the same anesthesiologist with monitor or same anesthetic device were recorded at five different times.

T1: Before the induction, T2: immediately after the induction, T3: 5 minutes after the insertion of device, T4: 15 minutes after the insertion of device (if the operation had not been finished), T5: 5 minutes after releasing the device.

After gathering the data, qualitative variables were analyzed by chi-square test while quantitative variables were analyzed using t-test or SPSS (Ver-11) software and p-value≤0.05 was considered as significant.

RESULTS

According to the obtained results, there was no significant difference between the two groups regarding age, sex, weight, Mallampati score and duration of operation (Table 1).

Table 1. Demographic and surgical data

Group	LMA (n=100)	Cobra PLA (n=100)	P value
Age	54.2±15.53	53.9±16.2	0.43
Weight	58.61±18.872	60.02±21.519	0.623
Duration of operation (min)	67.17±12.1	62.5±13.4	0.7

Also, there was no significant difference between the two groups regarding SPO_2, heart rate and blood pressure.

Cobra PLA offered advantages in regard to easy insertion (p=0.005), sore throat (p<0.0001) and bleeding (p<0.0001). Mean rise of intraocular pressure and mean increase of systolic blood pressure (at the time 3) was higher in LMA (p=0.02). Regarding $ETCO_2$ (p=0.0001), peak airway pressure (p<0.0001), ability to fitness on airway (p=0.01) and cuff pressure (p<0.0001) cobra significantly offered advantages over LMA.

Results regarding the rate of air-leak, insertion difficulty, mean intraocular pressure, mean systolic blood pressure, mean heart rate, mean SPO_2, mean end tidal $ETCO_2$, mean maximum airway pressure, mean end expiratory tidal volume (EETV), comparison of mean increased cuff pressure 5 minutes before releasing the device, complications such as bleeding and postoperative sore throat are demonstrated in tables 2 to 13 respectively.

Table 2. The comparison of the rate of air leakage between the two groups

Group	Absence of air leak	Presence of air leak	Total
LMA	80	20	100
Cobra	98	2	100

P=0.0001

Table 3. The comparison of insertion difficulty between the two groups

Group	1	2	3	Total
LMA	60	30	10	100
Cobra	70	30	0	100

P=0.005

Table 4. The comparison of mean intraocular pressure between the two groups at times t_1-t_5

Group		No.	Mean	Standard deviation	Std.Error Mean	P
Iop 1	LMA	100	14.39	2.23	0.240	0.63
	cobra	100	15.41	2.239	0.224	
Iop 2	LMA	100	12.72	1.922	0.192	0.43
	Cobra	100	12.82	1.822	0.182	
Iop 3	LMA	100	14.77	1.953	0.195	0.002
	Cobra	100	13.96	1.639	0.164	
Iop 5	LMA	100	14.08	2.173	0.217	0.000
	Cobra	100	15.38	2.278	0.228	

Table 5. The comparison of Mean systolic blood pressure between the two groups at times t_1-t_5

Group		No.	Mean	Standard deviation	Std.Error Mean	Pvalue
SBP 1	LMA	100	121.30	11.561	1.156	0.669
	cobra		120.27	21.041	2.104	
SBP 2	LMA	100	102.25	8.177	0.818	0.437
	cobra		103.25	9.883	0.988	
SBP 3	LMA	100	112.40	8.718	0.872	0.011
	cobra		108.85	10.798	1.080	
SBP 4	LMA	100	113.02	9.397	0.940	0.409
	cobra		111.60	14.370	1.437	
SBP 5	LMA	100	124.30	8.409	0.841	0.610
	cobra		125.00	10.801	1.080	

Systolic Blood Pressure (SBP)

Table 6. The comparison of mean heart rate between the two groups at times t_1-t_5

Group		No.	Mean	Standard deviation	Std.Error Mean	Pvalue
HR 1	LMA	100	79.94	13.870	1.387	0.437
	cobra		81.57	15.654	1.565	
HR 2	LMA	100	81.18	13.950	1.395	0.0762
	cobra		81.82	15.847	1.585	
HR 3	LMA	100	87.62	14.251	1.425	0.533
	cobra		93.64	95.377	9.538	
HR 4	LMA	100	88.90	14.082	1.408	0.046
	cobra		84.65	15.783	1.578	
HR 5	LMA	100	82.07	12.178	1.218	0.507
	cobra		83.42	16.230	1.623	

Table 7. The comparison of mean arterial oxygen saturation rate at times t_1- t_5

Group		No.	Mean	Standard deviation	Std.Error Mean
SPO_2-1	LMA	100	92.10	1.403	0.140
	Cobra	100	92.78	1.133	0.113
SPO_2-2	LMA	100	98.00	0.000	0.000
	Cobra	100	99.00	0.000	0.000
SPO_2-3	LMA	100	98.00	0.000	0.000
	Cobra	100	99.00	0.000	0.000
SPO_2-4	LMA	100	98.00	0.000	0.000
	Cobra	100	99.00	0.000	0.000
SPO_2-5	LMA	100	98.00	0.000	0.000
	Cobra	100	99.00	0.000	0.000

Table 8. The comparison of mean end tidal Co_2 at time t_2-t_4

Group		No.	Mean	Standard deviation	Std.Error Mean	P value
$ETCO_2$-2	LMA	100	36.17	3.117	0.312	<0.0001
	cobra	100	34.07	1.924	0.192	
$ETCO_2$-3	LMA	100	36.58	2.749	0.275	<0.0001
	cobra	100	34.00	1.449	0.145	
$ETco_2$-4	LMA	100	36.82	2.683	0.268	<0.0001
	cobra	100	34.80	1.639	0.164	

End Tidal CO_2= $ETCO_2$

Table 9. The comparison of mean peak airway pressure at times t_3-t_4

Group		No.	Mean	Standard deviation	Std.Error Mean	P value
PAP*-3	LMA	100	16.40	1.310	0.131	< 0.0001
	Cobra	100	12.76	1.621	0.162	
PAP-4	LMA	100	17.51	1.474	0.147	<0.0001
	Cobra	100	13.31	1.756	0.176	

PAP= Peak Airway Pressure

Table 10. The comparison of mean end expiratory tidal volume (EETV) at times t_3-t_4

Group		No.	Mean	Standard deviation	Std.Error Mean	P value
EETV-3	LMA	100	559.70	187.156	18.716	0.514
	Cobra	100	578.35	214.835	21.483	
EETV-4	LMA	100	556.55	193.272	19.237	0.572
	Cobra	100	572.95	215.485	21.549	

Table 11. The comparison of mean increase of cuff pressure 5 minutes before releasing the airway device.

Group	No.	Mean	Standard deviation	Std.Error Mean
Cuff P LMA	100	70.22	7.396	0.740
Cuff P Cobra	100	74.00	5.903	0.590

P<0.0001

Table 12. The comparison of bleeding following releasing the airway device.

Group	No bleeding	Bleeding	Total
LMA	60	40	100
Cobra	90	10	100

Table 13. The comparison of rate of sore throat after the procedure.

Group	0	1	2	3	Total
LMA	40	35	15	10	100
Cobra	65	25	10	0	100

P<0.0001

There was no significant difference between the two groups in regard to IOP at the beginning and 5 minutes after induction. But IOP was less in Cobra PLA group 5 minutes after insertion and 5 minutes after releasing the device. Cobra PLA offered advantages over LMA with respect to insertion difficulty, ability to fitness on airway and less complication.

DISCUSSION

This study demonstrated that both cobra PLA and classic LMA are useful for the management of airway with controlled ventilation in general anesthesia and SPO_2 did not reach less than 95% in any cases but cobra PLA significantly offered advantages over LMA classic in regard to insertion difficulty, larynx sealability, intraocular pressure alterations, end tidal CO_2 ($ETCO_2$) alteration,

maximum airway pressure and mean increased cuff pressure.

Also, with respect to post-up complications, cobra PLA caused less sore throat and trauma (bloody secretions) as compared to LMA (significant difference).

Considering the cobra as a newly released device, there are limited comparative studies in this regard and there is not any published study regarding the intraocular pressure rise in Cobra PLA. Also, there was no study with as much sample size, variables and times of evaluations as ours and hemodynamic changes have not been completely measured and analyzed. In Gaitini L et al. study, LMA, Cobra PLA and PAXpress pharyngeal airway were compared with each other and Cobra PLA offered advantages over the two other pharyngeal airway devices in regard to sealability (7,8).

In a study conducted by Dr. Akca et al., Cobra PLA and LMA were compared with each other regarding their usefulness in positive-pressure ventilation and their complications and demonstrated that the two devices are similar in terms of insertion and oropharyngeal irritation but cobra PLA had a better sealability as compared to LMA. Obviously, a better sealability controls ventilation more adequately by minimizing the gases entering the stomach (7). This finding was in accord with our study result. Since there is a higher chance of steady-state hemodynamics, depth of anesthesia and IOP in mechanical ventilation, this device has a higher feasibility to be used in ophthalmic surgeries.

The latest study in this regard was conducted by Gaitini et al. in 2006 comparing LMA and cobra in general anesthesia and spontaneous ventilation. In cobra, insertion was harder and SPO_2 had a lower rate which was clinically insignificant. No significant difference was found in regard to end expiratory tidal volume (EETV), end tidal CO_2 ($ETCO_2$), number of ventilations and sore throat post operatively (9).

According to the authors, limitations of this study were the small number of study populations and insufficient proficiency in regard to cobra PLA insertion. Also, due to the spontaneous ventilation, a steady depth of anesthesia and hemodynamic was not feasible. In our study the population under study was larger and ventilation was controlled. Hypercapnia was not seen and depth of anesthesia and ventilation volume were not considered as the confounding factors. Also, there were more variables and times of evaluation in our study.

IOP is of the important factors in anesthesia in ophtalmic surgeries. Its increase should be avoided and we have to keep it in a steady-state or decrease it. Laryngoscopy is an effective factor in inevitable increase of IOP. (10-12). A large number of studies have been conducted in regard to IOP changes comparing LMA and endotracheal tube in children and adults (4-7). In all cases LMA offered advantages regarding IOP (1-3). But, to date, there has been no published study regarding IOP in use of cobra PLA and LMA.

In our study, IOP was significantly lower in cobra PLA group 5 minutes after insertion ($P<0.002$) and 5 minutes after releasing the device ($P<0.000$). The reason seems to be the easy insertion of the device and its special design causing less irritation.

Cobra PLA is recommended for airway management in short or medium duration ophthalmic surgeries due to its easy insertion, higher sealability and consequent greater chance for mechanical ventilation, more stable depth of anesthesia and decreasing IOP.

REFERENCES

1. Watcha MF, White PF, Tychsen L, Stevens JL. Comparative effects of laryngeal mask airway and endotracheal tube insertion on intraocular pressure in children. ***Anesth Analg*** 1992; 75 (3): 355- 60.

2. Akhtar TM, McMurray P, Kerr WJ, Kenny GN. A comparison of laryngeal mask airway with tracheal tube for intra-ocular ophthalmic surgery. ***Anaesthesia*** 1992; 47 (8): 668- 71.
3. Bukhari SA, Naqash I, Zargar J. Pressor responses and intraocular pressure changes following insertion of laryngeal mask airway: Comparison with tracheal tube insertion. ***Indian J Anaesth*** 2003; 47(6): 473-5.
4. Keller C, Brimacombe JR, Keller K, Morris R. Comparison of four methods for assessing airway sealing pressure with the laryngeal mask airway in adult patients. ***Br J Anaesth*** 1999; 82 (2): 286- 7.
5. Brimacombe J. Analysis of 1500 laryngeal mask uses by one anaesthetist in adults undergoing routine anaesthesia. ***Anaesthesia*** 1996; 51 (1): 76- 80.
6. Verghese C, Brimacombe JR. Survey of laryngeal mask airway usage in 11,910 patients: safety and efficacy for conventional and nonconventional usage. ***Anesth Analg*** 1996; 82 (1): 129- 33.
7. Akca O, Wadhwa A, Sengupta P, Durrani J, Hanni K, Wenke M, et al. The new perilaryngeal airway (CobraPLA) is as efficient as the laryngeal mask airway (LMA) but provides better airway sealing pressures. ***Anesth Analg*** 2004; 99 (1): 272- 8.
8. Gaitini LA, Somri. Comparison of the laryngeal mask airway unique ^{TM}, pharyngeal airway and press ^{TM} and perilaryngeal airway cobra ^{TM} in parlay adult patients. ***Anesthesiology*** 2003; 99: Alu 95.
9. Gaitini L, Yanovski B, Somri M, Vaida S, Riad T, Alfery D. A comparison between the PLA Cobra and the Laryngeal Mask Airway Unique during spontaneous ventilation: a randomized prospective study. ***Anesth Analg*** 2006; 102 (2): 631- 6.
10. Forbes AM, Dally FG. Acute hypertension during induction of anaesthesia and endotracheal intubation in normotensive man. ***Br J Anaesth*** 1970; 42 (7): 618- 24.
11. Wilson IG, Fell D, Robinson SL, Smith G. Cardiovascular responses to insertion of the laryngeal mask. ***Anaesthesia*** 1992; 47 (4): 300- 2.
12. Mellado PF, Thunedborg LP, Swiatek F, Kristensen MS. Anaesthesiological airway management in Denmark: assessment, equipment and documentation. ***Acta Anaesthesiol Scand*** 2004; 48 (3): 350- 4.