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ORIGINAL ARTICLE

Comparative Evaluation of Performance of Videolaryngoscope *vs* Fastrach Intubating Laryngeal Mask Airway

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ABSTRACT

Introduction: This prospective randomized study aimed to compare the effectiveness of the intubating laryngeal mask *airway* (ILMA) with the King Vision Video laryngoscope in aiding endotracheal intubation in Asian patients with normal airway. King Vision Video laryngoscope is a two-piece design. It has a reusable monitor that attaches to disposable blades. The ILMA is a device specifically designed to be an effective ventilatory device and blind intubating guide in patients with normal and abnormal airways.

Materials and methods: After ethics committee approval and obtaining patient's written informed consent, 60 American Society of Anesthesiologists grade I and II adult patients undergoing elective surgery requiring intubation were randomly allocated into either the ILMA group (Group L) or the King Vision Video laryngoscope group (Group V).

- Thorough preanesthetic checkup was done. Patient was premedicated. Induction was done with propofol 2.5 mg/kg and succinylcholine 1.5 mg/kg. In Group L, ILMA was inserted using a single-handed rotational technique. In the King Vision Video laryngoscope group, intubation was done with videolaryngoscope. Placement was confirmed with auscultation and capnography.
- An independent observer recorded the following:
  - Time taken for successful intubation
  - Success or failure of the tracheal intubation
  - Number of attempts needed for successful tracheal intubation
  - Complication associated with tracheal intubation: bleeding or postoperative sore throat
  - Hemodynamic response to intubation

Results and conclusion: King Vision Video laryngoscope is the more effective technique in aiding endotracheal intubation in patients with normal airways.

Keywords: Intubating laryngeal mask airway, Intubation, King Vision video laryngoscope.

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INTRODUCTION

King Vision has been designed with the intention to make a revolutionary series of high-performance portable videolaryngoscopes. The King Vision combines the convenience of a durable, reusable video display with a disposable blade.

The King Vision Video laryngoscope is a two-piece design. It has a reusable monitor that attaches to disposable blades. In some respects, this is a similar approach to the Pentax Airway Scope, which has a reusable monitor and disposable blades. This makes the design simpler to use as one essentially just has to connect the two pieces together by simply sliding them into each other.

The blades are all Macintosh #3 size and compared with a normal Macintosh #3 bladed laryngoscope, the King Vision blades appear wider and shorter. There are blades with a guiding channel and standard blades without. Both only come in #3 size though. The guide channel blade is very similar to the Pentax and Airtraq blade designs.

The display is an organic light-emitting diode design of surprisingly good clarity and resolution. It is turned on with a single power button on the back of the display and turned off by depressing it for 3 seconds. It is certainly a no-frills design, which makes it simple to understand and use. There is no brightness adjustment nor in-built video recording function. There is a mini universal serial bus port for a video out function to either a display or digital recorder. The LED light on the blade tip is very good with excellent intensity and a pale white illumination. The device is powered by standard AAA size batteries × 3 and is rated to last at least 90 minutes or greater.

The intubating laryngeal mask airway (ILMA) is a device specifically designed to be an effective ventilatory device and blind intubating guide in patients with normal and abnormal airways. The principal features of ILMA are an anatomically curved, rigid airway tube with an integral guiding handle, an epiglottic elevating bar replacing the LMA bars, and a guiding ramp to direct the tracheal tube anteriorly as it emerges from the mask aperture.

This prospective randomized study aimed to compare the effectiveness of the ILMA technique with the King Vision Video laryngoscope in aiding endotracheal intubation in Asian patients with normal airways. As airway management is routine in anesthesia practice, the option and availability of a reliable tool to secure the airway other than direct laryngoscopy is important to decrease morbidity in difficult airway situations. This trial comparing the ILMA and the King Vision Video laryngoscope allows an anesthesiologist proficient in both devices to select the most effective device in anticipated and unanticipated difficult airways.

MATERIALS AND METHODS

After Ethics Committee approval and obtaining patients' written informed consent, 60 American Society of Anesthesiologists (ASA) grade I and II adult patients undergoing elective surgery requiring intubation were randomly allocated into either the ILMA group (Group L) or the King Vision Video laryngoscope group (Group V). Exclusion criteria were patients with difficult airways (defined as patients with a history of impossible intubation, mouth opening less than 20 mm, cervical spine fixed in flexion, Mallampati class III or IV, thyromental distance less than 65 mm), ASA grade III, IV, or V, those with respiratory tract pathology or coagulation disorders, or those at risk of regurgitation–aspiration (previous gastrointestinal surgery, known hiatus hernia, esophageal reflux, peptic ulceration, or not fasted). Randomization was performed using sealed opaque envelops.

Thorough preanesthetic checkup was done and informed written consent was taken. Tab Ranitidine 150 mg and alprazolam 0.25 mg were given orally the night before surgery.

Patient was premedicated with Inj. ranitidine 50 mg, Inj. ondansetron 4 mg, Inj. glycopyrrolate 0.2 mg, and Inj. butorphanol 1 mg. Induction was done with propofol 2.5 mg/kg and succinylcholine 1.5 mg/kg. Before induction, preoxygenation was performed in all cases (4 minutes by bag and mask with 100% oxygen). Each patient was routinely monitored during the entire procedure by electrocardiography, peripheral capillary oxygen saturation, partial pressure or maximal concentration of carbon dioxide, and noninvasive blood pressure measurements.

In the ILMA group, ILMA was inserted using a single-handed rotational technique. If resistance was felt during bag ventilation or if the tracheal intubation had failed, following adjusting maneuvers were performed: (1) Performing an up and down maneuver to prevent the epiglottis from downfolding, by swinging the ILMA back outward a few centimeters without deflating the cuff and then repositioning the ILMA; (2) optimizing the airway by steering the ILMA with the handle and moving it in the horizontal plane from one side to the other or raising the mask upward, while squeezing the reservoir bag to obtain the lowest resistance during insufflations and a complete expiration; and (3) removing the ILMA to change its size. Initial size selection for the ILMA was as follows: Size 3 for patients less than 50 kg and size 4 for those greater than 50 kg. However, the anesthesiologist was permitted to change the size during the study (Fig. 1).

The cuff was inflated with air (size 3, 20 mL; size 4, 30 mL) and an anesthesia circuit was connected. The position of the ILMA was adjusted until optimal ventilation was obtained. This position was maintained by holding the handle firmly. The tracheal tube was inserted through the ILMA and advanced to 9 cm beyond the epiglottic elevating bar if no resistance was felt. If resistance was felt through the tracheal tube, the ILMA was readjusted in the patient's mouth before the second attempt of tracheal tube insertion. If tracheal intubation was unsuccessful in second attempt, the following adjusting maneuvers were performed before a further attempt depending on the depth of resistance: 1.5 to 2.0 cm, withdrawal of the ILMA by 5 cm followed by reinsertion; 0 to 1.5 or >4 cm, a smaller size ILMA is used; and 2 to 4 cm, a larger size ILMA is used. In the ILMA group, ventilation using the ILMA was permitted between attempts, if required.

In the King Vision Video laryngoscope group, the anesthesiologist introduced the blade along the middle of the tongue. The glottis opening was observed on the liquid crystal display (LCD) screen by advancing the blade down the posterior pharynx while following the path of advancement on the LCD screen. A 7 mm internal diameter endotracheal tube was introduced in the slit, which is present on the blade of videolaryngoscope, and the patient was intubated. Placement was confirmed with auscultation and capnography. If the anesthesiologist failed to introduce the endotracheal

Fig. 1: Intubation with video laryngoscope and fastrach ILMA

tube through the glottic opening, the following maneuvers were used to aid tracheal intubation: External laryngeal pressure, withdrawal and readjustment of the endotracheal tube, increase the lifting force of intubating device, or slight withdrawal of intubating device.

An independent observer recorded the following:

- Time taken for successful intubation
- Success or failure of the tracheal intubation
- Number of attempts needed for successful tracheal intubation
- Complication associated with tracheal intubation: bleeding or postoperative sore throat
- Hemodynamic response to intubation

The anesthesiologist was allowed three attempts or up to 120 seconds to intubate the trachea successfully. More than three attempts or 120 seconds was regarded as failure of intubation. Failure to secure the airway with either technique resulted in the use of direct laryngoscope to secure the airway. Patients with failed intubation were not included in the analysis of the total intubation time.

STATISTICS

Data were summarized as mean ± standard deviation or as percentages. Statistical analysis was performed by Statistical Package for the Social Sciences version 15. Numerical variables were normally distributed and compared by Student's unpaired "t"-test.

RESULTS

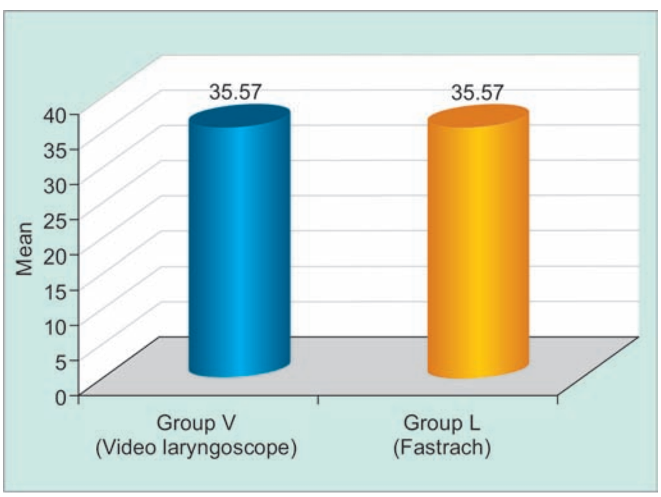
All the patients (n = 60) completed the study.

There was no significant difference in age, weight, height, body mass index (BMI), ASA, Mallampati grade, mouth opening, thyromental distance, and neck circumference in both the groups (Table 1 and Graphs 1 to 5).

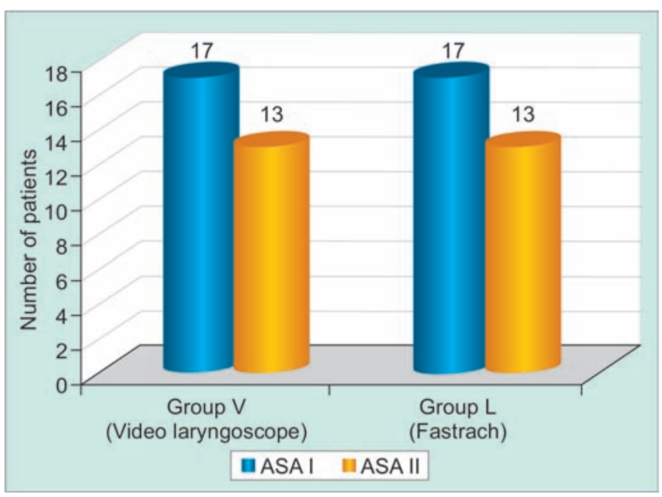
Mean tracheal intubation time (seconds) in Group V was 24.6 ± 2.00 seconds, and it was 37.42 ± 2.46 seconds in Group L (Table 2 and Graphs 6 to 10). There was a highly significant difference in tracheal intubation time (seconds) in both groups. Tracheal intubation was successful in all 30 patients in the first attempt in Group V and 24 patients in first attempt and 4 patients in second attempt in Group L. There was significant difference in successful tracheal

Table 1: Patient and airway profile

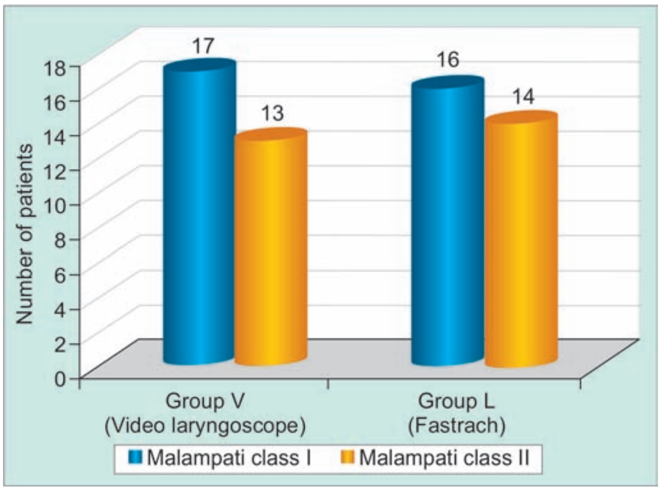
	Group V Videolaryngoscope	*Group L Fastrach*	*t-value*	*p-value*
Age (in years)	35.57 ± 5.30	35.50 ± 5.23	0.0515	0.9591
Weight (in kg)	62.73 ± 4.49	62.63 ± 4.75	0.0838	0.9335
Height (in cm)	156.83 ± 9.33	158.27 ± 3.81	0.7826	0.4370
BMI	25.75 ± 3.88	25.01 ± 1.86	0.942	0.3501
ASA			χ^2-value	p-value
ASA I	17	17	0.000	1.000
ASA II	13	13		
Malampati class				
Malampati class I	17	16	0.0673	0.79525
Malampati class II	13	14		
			t-value	p-value
Mouth opening	5.05 ± 0.23	5.06 ± 0.23	0.1684	0.8669
Thyromental distance	7.42 ± 0.20	7.38 ± 0.16	0.8554	0.3959
Edentulous status	–	–		
Neck circumference	34.35 ± 1.09	34.74 ± 1.16	1.3420	0.1848



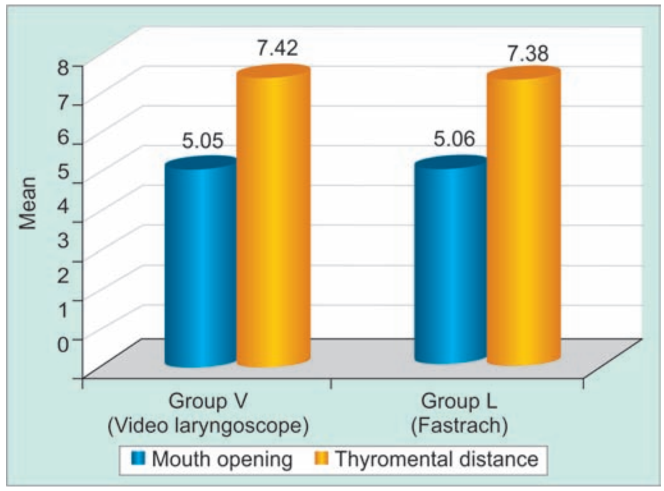
Graph 1: Mean age in Groups V and L



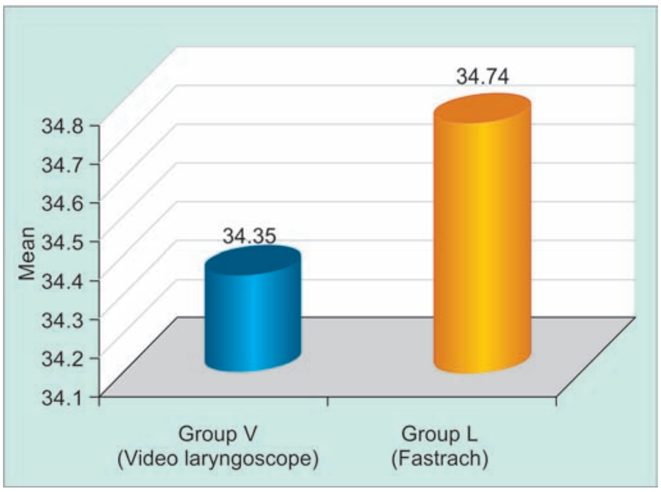
Graph 2: ASA grades in Groups V and L



Graph 3: Mallampati class in Groups V and L



Graph 4: Mouth opening in Groups V and L



Graph 5: Mean neck circumference in Groups V and L

intubation in both groups. There were no failed intubations in any of the patients in Group V and in two patients in Group L. There was no significant difference in systolic blood pressure (SBP) and diastolic BP (DBP) and heart rate at different time intervals in both groups.

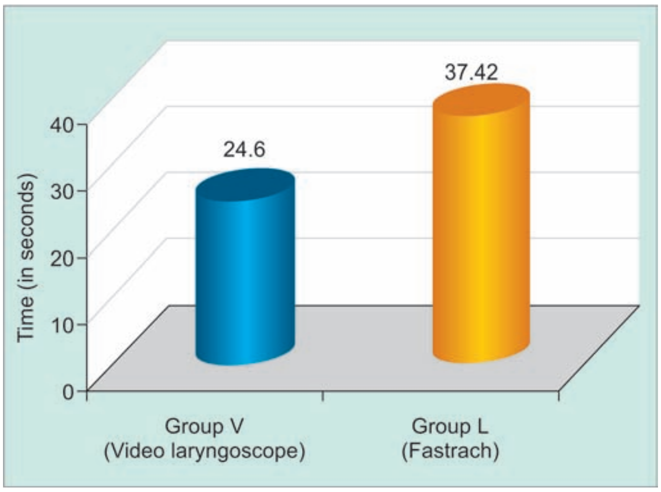
There were no complications in patients in Group V, and three patients had bleeding (orotracheal) and three patients had sore throat in Group L (Table 3).

DISCUSSION

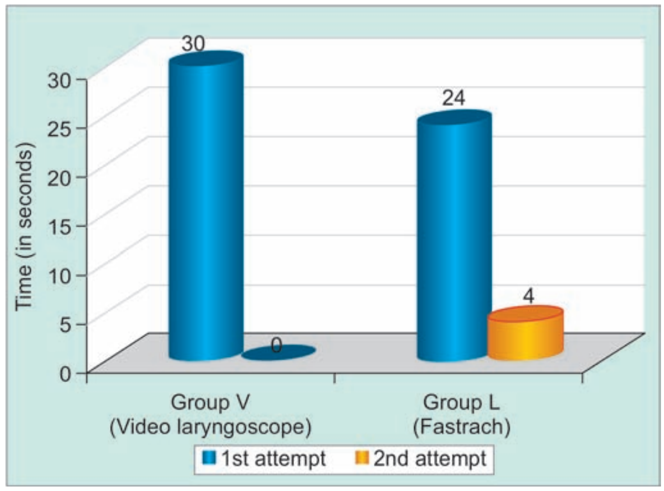
We showed that the videolaryngoscope was easier to insert and significantly shortened the time for successful intubation. The improvement of intubation time of 24.6 ± 2 seconds seen with the King Vision Video

Table 2: Observations

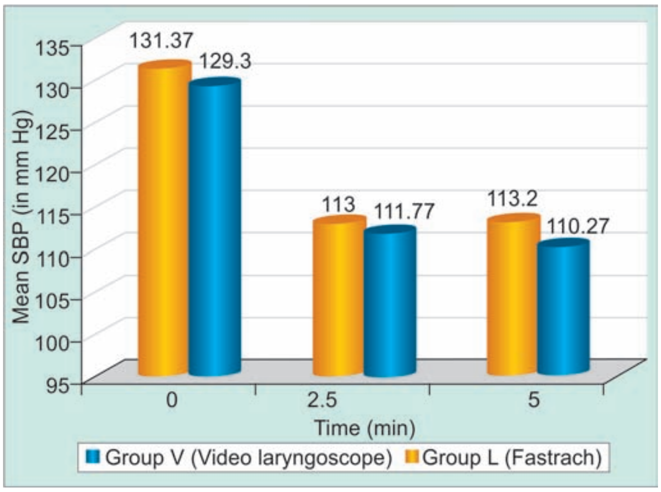
	Group V	*Group L*		
	Videolaryngoscope	*Fastrach*	*t-value*	*p-value*
Tracheal intubation time (sec)	24.6 ± 2.00	37.42 ± 2.46	21.842	<0.0001
Successful tracheal intubation			χ^2-value	p-value
First attempt	30	24	4.6032	0.03191
Second attempt	0	4		
>second attempt	0	0		
Failed intubation	0	2		
Hemodynamic			t-value	p-value
SBP 0 minute	131.37 ± 5.05	129.30 ± 7.19	1.2904	0.2020
SBP 2.5 minutes	113.0 ± 6.57	111.77 ± 7.66	0.6676	0.5070
SBP 5 minutes	113.20 ± 5.67	110.27 ± 6.79	1.8142	0.0748
DBP 0 minute	88.47 ± 6.44	87.10 ± 7.87	0.7379	0.4635
DBP 2.5 minutes	67.63 ± 7.76	66.63 ± 8.33	0.4811	0.6322
DBP 5 minutes	68.10 ± 6.93	66.23 ± 6.05	1.1134	0.2701
HR 0 minute	94.23 ± 6.03	91.80 ± 6.80	1.4644	0.1485
HR 2.5 minutes	72.93 ± 7.24	73.70 ± 8.00	0.3909	0.6973
HR 5 minutes	71.80 ± 11.46	71.70 ± 5.83	0.0426	0.9662



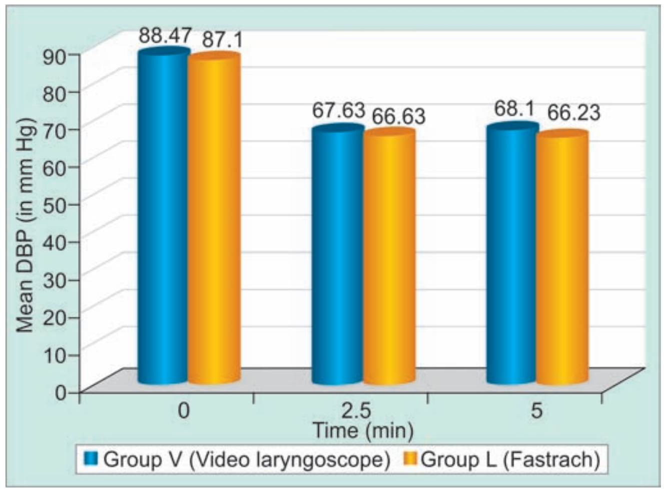
Graph 6: Mean tracheal intubation time in Groups V and L



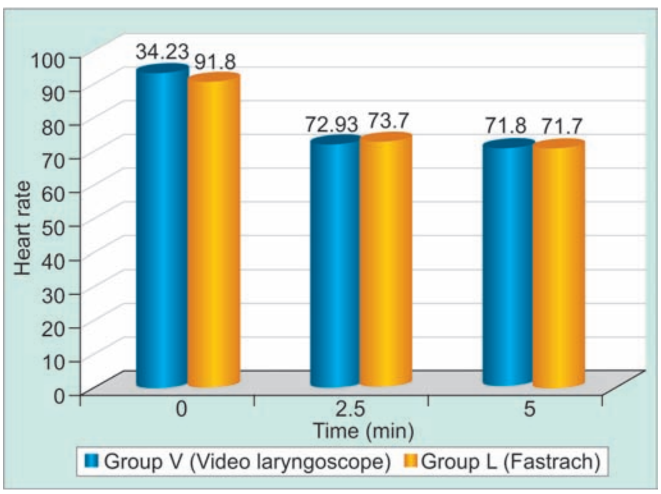
Graph 7: Successful tracheal intubation in Groups V and L



Graph 8: Mean SBP in Groups V and L



Graph 9: Mean DBP in Groups V and L



Graph 10: Mean HR in Groups V and L

laryngoscope may be clinically significant in influencing the choice of airway adjuncts for use in patients with difficult airways, in which the instrument that allows a faster intubating time will decrease the apnoeic period, reducing the risk of hypoxia in difficult intubations.

Table 3: Complication

	Group V	*Group L*
	Videolaryngoscope	*Fastrach*
Bleeding (orotracheal)	0	3
Sore throat	0	3
Dysphonia	0	0
Pain on swallowing	0	0

Mean age in Group V was 35.57 ± 5.30 years and it was 35.57 ± 5.30 years in Group L. There was no significant difference in age in both the groups. Mean weight in Group V was 62.73 ± 4.49 kg and it was 62.63 ± 4.75 kg in Group L. There was no significant difference in weight in both groups. Mean height in Group V was 156.83 ± 9.33 cm and it was 158.27 ± 3.81 cm in Group L. There was no significant difference in height in both groups. Mean BMI in Group V was 25.75 ± 3.88 kg/m^2 and it was 25.01 ± 1.86 kg/m^2 in Group L. There was no significant difference in BMI in both groups. There were 17 patients in ASA I and 13 in ASA II in both groups, and there was no significant difference in ASA in both groups. There were 17 patients in Mallampati class I and 13 in Mallampati class II in Group V and 16 patients in Mallampati class I and 14 in Mallampati class II in Group L, and there was no significant difference in Mallampati class in both groups. Mean mouth opening in Group V was 5.05 ± 0.23 cm and it was 5.06 ± 0.23 cm in Group L. There was no significant difference in mouth opening in both groups. Mean thyromental distance in Group V was 7.42 ± 0.20 cm and it was 7.38 ± 0.16 cm in Group L. There was no significant difference in thyromental distance in both groups. Mean neck circumference in Group V was 34.35 ± 1.09 cm and it was 34.74 ± 1.16 cm in Group L. There was no significant difference in neck circumference in both groups.

Time taken for tracheal intubation was much less in Group V than in Group L. All the patients in Group V were successfully intubated in first attempt, whereas 24 patients were successfully intubated in the first attempt, four patients in second attempt, and in two patients intubation through ILMA was unsuccessful. The mean SBP at 0 minute in Group V was 131.37 ± 5.05 mm Hg, at 2.5 minutes 113.0 ± 6.57 mm Hg, and at 5 minutes 113.20 ± 5.67 mm Hg, and in Group L, it was 129.30 ± 7.19 mm Hg at 0 minute, 111.77 ± 7.66 mm Hg at 2.5 minutes, and 110.27 ± 6.79 mm Hg at 5 minutes. There was no significant difference in SBP at different time intervals in both groups. Mean DBP at 0 minute in Group V was 88.47 ± 6.44 mm Hg, at 2.5 minutes 67.63 ± 7.76 mm Hg, and at 5 minutes 68.10 ± 6.93 mm Hg, and it was 87.10 ± 7.87 mm Hg at 0 minute, 66.63 ± 8.33 mm Hg at 2.5 minutes, and 66.23 ± 6.05 mm Hg at 5 minutes in Group L. There was no significant difference in DBP at different time intervals in both groups. Mean Heart Rate (HR) at 0 minute in Group V was 94.23 ± 6.03 bpm, at 2.5 minutes 72.93 ± 7.24 bpm, and at 5 minutes 71.80 ± 11.46 bpm, and it was 91.80 ± 6.80 bpm at 0 minute, 73.70 ± 8.00 bpm at 2.5 minutes, and 71.70 ± 5.83 bpm at 5 minutes in Group L. There was no significant difference in HR at different time intervals in both groups.

Many studies have been done which corelate to the result of our study. Murphy et al[1] found that the King Vision Video laryngoscope was slightly faster than Macintosh direct laryngoscope in two of four studied airway scenarios, and had a higher success rate in the difficult cadaver airway scenario.

Yun et al[2] demonstrated that Video and optical laryngoscopes can be used successfully by experienced tactical paramedics in a simulated tactical setting. The King Vision and AirTraq resulted in improved Cormack–Lehane glottic views, but similar times to ventilation and first-pass success compared with direct laryngoscopy.

Akihisa et al[3] showed that the King Vision Video laryngoscope facilitated intubation by novice personnel without incidence of esophageal intubation.

We found that the first success rate for blind ILMA-guided intubation was lower that for King Vision guided intubation. The incidence of postoperative complications is higher with ILMA. Being a blind technique, the chances of failed intubation or esophageal intubation will be higher in ILMA group as shown in our study. The high incidence of esophageal intubation in our study suggests that early conformation of successful tracheal intubation via ILMA is mandatory. Other complications like airway trauma and postoperative sore throat for ILMA group were higher. This may be due to high mucosal pressure exerted by cuff of ILMA. On the contrary, the video monitor of the King Vision Video laryngoscope helps the anesthesiologist performing the tracheal intubation and the assistant in providing the right laryngeal manipulation to improve their coordination, causing less trauma. Both the devices are useful adjuncts to intubation for use in difficult airways, without significant difference in hemodynamic stimulation.

One advantage of the ILMA over the King Vision Video laryngoscope is that it can provide effective ventilation between intubation attempts, avoiding hypoxia. Other than allowing ventilation in between attempts, blind intubation through the ILMA offers less advantage over King Vision Video laryngoscope, but it is a feasible option.

Many studies have showed that the intubating laryngeal mask is an effective ventilation device and intubation guide with potential for use in patients who may present difficulty in tracheal intubation.[4-10] Our study has a few limitations. Our study population consisted of only young Asian populations, who did not have difficult airways. Our patients were healthy; hemodynamic responses may be different in patients with cardiovascular disease.

CONCLUSION

King Vision Video laryngoscope is a more effective technique in aiding endotracheal intubation in patients with normal airways. It improved intubation times of tracheal intubation as compared with the ILMA. Blind intubation through the ILMA offers less advantage over King Vision Video laryngoscope for adult patients with normal airways requiring intubation for elective surgery. However, it can provide effective ventilation between intubation attempts and an intubation guide with potential for use in patients who may present difficulty in tracheal intubation. Despite its limitations, the ILMA is a valuable adjunct to the airway management, especially in difficult airway management, when it can provide ventilation in between intubation attempts. However, the longer intubation time and greater risk of esophageal intubation must be taken into consideration.

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