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Original Research Article

Comparative Evaluation of Video Laryngoscope with Direct Laryngoscope in Patient Undergoing Tracheal Intubation for Elective Surgical Procedure: A Prospective, Randomized Study

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Conflict of interest: Nil

Abstract:

Background and Aim: Video laryngoscope (VL) is currently introduced Intubating device with high resolution CMOS camera. The primary aim of this study was to compare the efficiency of video laryngoscope with direct laryngoscope regarding their usefulness for tracheal intubation for elective surgical procedure. We compare suitability of video laryngoscope with direct laryngoscope in terms of glottic exposure time, tube insertion time, total duration of intubation, Number of attempts, Cormack and Lehane grading, optimization Maneuvers, Complications and hemodynamic changes.

Materials and Methods: After taking written informed consent, patients between age of 18-60 years of both gender and ASA grade I and II scheduled to undergo elective general surgery were included. Patients with oral pathology, needing rapid sequence intubation and not willing were excluded. The patients were randomly assigned into Group V (video laryngoscope) and Group-M (Macintosh laryngoscope) using sealed envelope method. Glottic exposure time, tube insertion time, total duration of intubation, Number of attempts, Cormack and Lehane grading and optimization Maneuvers were recorded at the time of intubation. Haemodynamic and complications were recorded perioperatively.

Results: Attempts of intubation, optimization maneuvers and complications were comparable amongst both the groups. Glottic exposure time and total duration of intubation time was more and quality of glottic visualization was better with video laryngoscope than with Macintosh Laryngoscope. Hemodynamic parameters were better in group V than in group M.

Conclusion: Video laryngoscope takes short time to achieve successful intubation, offer hemodynamic stability and better quality of glottic view than Macintosh during intubation. Video laryngoscope less frequently need assist maneuvers, so facilitates intubation with less complication. Both devices are useful for routine intubation in adult patients.

Keywords: Macintosh Laryngoscope, Tracheal Intubation, Video Laryngoscope.

Introduction

Airway management is primary responsibility of an anesthesiologist to secure, preserve and protect it during induction, maintenance and recovery from anaesthesia. Most anaesthesia related complications occur at the time of induction of anaesthesia. [1]

Commonly used laryngoscope required for tracheal intubation is the one described by Macintosh in 1943, which is the gold standard for this purpose too. Laryngoscopy done this way is called direct laryngoscopy, as there is direct visualization of glottis through our eyes. This direct laryngoscopy uses a line of sight provided by Macintosh laryngoscope, which requires a direct view of larynx. [2,3] However, there are many requirements for proper visualization of glottis using direct laryngoscopy like patient to be positioned in morning sniffing position to align the oral, pharyngeal and laryngeal axis in a single line.

Moreover, putting the laryngoscope blade in valleculae and lifting the epiglottis to visualise the glottis serves as noxious stimulation and results in pressor response. [4,5]

In last few years, with the development of new technologies, video assisted airway management devices known as Video laryngoscope have been developed and are said to overcome these shortcoming of direct laryngoscopy to a great extent. Undoubtedly this is one of the major advances in practical anaesthesia in recent years. [6]

The era of video laryngoscopy started when levitan attached a video camera to a head ring in 1996. After that so many video laryngoscopes developed. Video laryngoscope is relatively a recent development and is becoming highly popular.

Most video laryngoscope have Macintosh type of blade and handle, complementary metal oxide semiconductor (CMOS) micro video chip camera and a light emitting device (LED) embedded into the end of the blade and an external monitor\screen which is usually liquid crystal display. They provide indirect view of glottis as the images of laryngoscopic view by lens from distal end of blade is transmitted to screen using a video technology which is either attached to the handle or there can be video transmission to a separate wide screen. This is called indirect laryngoscopy which allows operator to visualize the virtual image of patient's vocal cords without obtaining direct line of sight. [7,8]

There are numerous technical benefits of video laryngoscope. Direct laryngoscopy gives line of sight which requires morning sniffing position. Distance between vocal cords and the laryngoscopists eye is also significant and direct laryngoscopy reduces this angle of view to 15 degree. In video laryngoscope, sniffing position is not a must as lens in distal tip of blade provides wider angle of view, increased field of vision and capacity to see around the corner and magnified view with better resolution of the larynx and other structures that are beyond the reach of Macintosh blade. [9] The anatomy of blade is such that making alignment of oral, pharyngeal and laryngeal axis is less mandatory. As well as line of sight view is also not required. This improved view of larynx is seen with minimal neck manipulation and there is less chances of noxious stimulus and trauma. It provides anaesthesia operator to maintain an effective distance from the patient during intubation, useful in patients with infectious diseases. There are generally higher success rate with video laryngoscopes especially in difficult situations. [10] Usually video laryngoscopes are available with two types of blades, channeled and non channeled. In channeled video laryngoscopes, it is easy to guide endotracheal tube in glottis without any stylet whereas non- channeled video laryngoscopes require stylet. [5,6]

So, we undertook this study to evaluate and compare the efficacy of Macintosh laryngoscope and video laryngoscope for tracheal intubation in adult patients.

Material and Methods

After Institutional Review Board (IRB) approval and informed written consent from the patient, this randomized controlled clinical study will be carried out in patients in the Department of Anaesthesiology, Government Medical College, Bhavnagar, and Gujarat, India for the duration of 1 year.

The sample size was calculated to detect 10% difference in success rate in insertion between two devices with type 1 error of 0.05 and power of study 90%, requiring 25 patients per group, we will take 30 patients to accommodate drop out if any. History of the presenting complains, past history, operative history and drug history will be taken. General examination of the patient was be done and vital parameters i.e. pulse, blood pressure, spo2 were assessed. Essential Investigations which will be required are complete CBC, RBS, SE, RFT, LFT and ECG. Patient will be advised to fast for 6 hrs prior to surgery.

Patients were included or excluded according to the following criteria's:

Inclusion Criteria

- Age 18-60 years.
- Weight 40-70 kg.
- Mouth opening 3 fingers width & above.
- Thyromental distance of at least 6.5 cm.
- American society of Anaesthesia grades I & II.

Exclusion Criteria

- Patients with oral pathology.
- Patients with neck flexion deformity.
- Patients needing rapid sequence intubation.
- Patient not willing for participation.

Written informed consent was taken in the local language. Patient will be randomized using computer generated random number sequence methods in two groups.

- Group D -intubation was done with use of direct laryngoscope.
- Group V –intubation was done with use of Video laryngoscope.

After shifting the patient to the pre-operative care room, 18 G intravenous catheter is inserted in non-dominant hand by anaesthesia resident. Patients were shifted to operation theatre. Standard monitoring was applied which includes Noninvasive blood pressure (NIBP), Electro cardiographic monitoring (Heart Rate), Pulse oximeter (SPO2). Patients were premedicated with Inj. Metoclopramide 0.15 mg/kg, Inj glycopyrrolate 0.04mg/kg, Inj midazolam 0.02mg/kg, Inj. fentanyl 1 mcg/kg IV. Patients were preoxygenated with 100% oxygen for three minutes.

Anaesthesia was induced with Inj propofol 2mg/kg IV slowly till loss of eyelash reflex, then inj. Succinyl choline 2mg/kg IV will be given and we will wait till jaw relaxation, absence of movements and apnea. Patients will be put on ventilator with IPPV (Intermittent positive pressure ventilation) mode of ventilation. Intubation will be done according to the group assigned to the patients.

The size of Endotracheal tube will be decided according to the gender (8 to 9 in males, 7 or 7.5 in females). Glottic exposure time (T1) will be counted from introduction of laryngoscope from teeth till visualization of glottis. Quality of visualization of glottic aperture will be recorded according to Cormack and Lehane grading.

Grade I: Visualization of entire glottis

Grade II: Visualization of posterior part of the glottis Grade III: visualization of epiglottis only

Grade IV: No glottis visualized

Tube insertion time (T2) will be taken as time from visualization of glottis to insertion of endotracheal tube).

Total duration of intubation = T1 + T2

Correct positioning of endotracheal tube is confirmed by bilaterally equal air entry, bilateral chest expansion, and t wave form in capnography. If any of the above parameters are not met, it will be considered as a failed attempt & endotracheal tube will be removed and inserted again. First attempt will be done by PI under supervision of Co I. If PI will fail in 1st attempt, 2ndattempt will be done by Co I.

Total of three failed insertions including PI's attempt will be permitted before it is consider as a failure. NIBP, Heart rate, Et CO2, SpO2 will be recorded before induction,1minute after intubation and 10 minutes after intubation. Alveolar ventilation will be set to maintain EtCO2 in the range of 36-44 mmhg.

After successful intubation PI were examine for complications, if any like

1. Lip\dental trauma (Bleeding present or not)
2. Oesophageal intubation (Bilateral chest movement and Air entry absent)
3. Airway trauma
4. Vasovegal syncope (severe bradycardia)
5. Laryngospasm

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2019) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were described as means and standard deviations or median and interquartile range based on their distribution. Qualitative variables were presented as count and percentages. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

Table 1: Demographic data

Parameters	Group –D Mean ±SD	Group-V Mean ±SD	P-value
Age (Year)	35.76±14.56	33.36±14.97	>0.05
Sex (M/F)	14:11	13:12	
Height(CM)	158.16±4.35	158.84±5.56	>0.05
Weight(kg)	55.16±5.25	54.48±6.04	>0.05

Patients characteristics in terms of age, gender, weight, height, were compared among both the groups (P>0.05. The age range was 18 to 60 years in both the groups with mean age in Group D was 35.76±14.56 years compared to 33.36 ±14.97 years in Group V. There was no predominance of any gender in any group as male/female ratio was 14/12 Group D and 13/12 in Group V. The mean weight of the patient in Group D was 55.16 ±5.25 kg compared to 54.48 ± 6.04 kg in Group V. The mean height of patient in Group D was 158.16 ± 4.35 cm and in Group V was 158.48 ±6.04 cm.

Table 2: Time of Intubation

Parameters	Group-D (Mean ±SD)	Group-V (Mean ±SD)	P-value
Glottic exposure time(sec)T1	12.48±2.98	8.56±2.27	<0.05
Tube Insertion time(sec)T2	10 .96±2.40	11.28±2.28	>0.05
Total duration of intubation(sec)T	23.44±4.73	19.84±4.08	<0.05

Glottic exposure time (T1) in Group D was 12.48 ±2.98 sec and in Group V it was 8.56 ±2.27 sec. The difference between glottic exposure time in two groups was statistically significant (P<0.05)

Tube insertion time (T2) was10.96 ± 2.40 sec in Group D compared to 11.28 ± 2.28 sec in Group V. The difference in two groups was statistically not significant (P>0.05). Total duration of intubation (T) in Group D was 23.44 ± 4.73 sec and in Group V it was 19.84 ±4.08 sec. The difference between two groups was statistically significant (P<0.05)

Attempts of intubation with direct laryngoscope and video laryngoscope were comparable as 24/25 (96%) intubation in Group V were done in first attempt while 1/25 (4%) required second attempts. Where in Group D 23/25 (92%) required first attempt of intubation while rest 2/25 (8%) intubation in second attempt (P > 0.05). Grade 1 view was seen in 15\25 (60%) patients in group D and 21\25 (84%) in group V. Grade 2 view was seen in 10\25 (40%) patients in group D and 4\25 (16%) in group V. Grade 3 and Grade 4 were not seen in any patients with any device. The difference between Cormack and Lehane grading was statistically significant (P<0.05) in both the groups. Optimization Maneuver were used while intubation for proper insertion of device and view of glottis. In Group D 16/25 (64%) intubation did not require any optimization maneuver while 9/25 (56%) required optimization maneuvers. In group v 20/25 (80%) intubations did not required any optimization maneuver while 5/25 (20%) required. The difference was statistically not significant (P > 0.05).

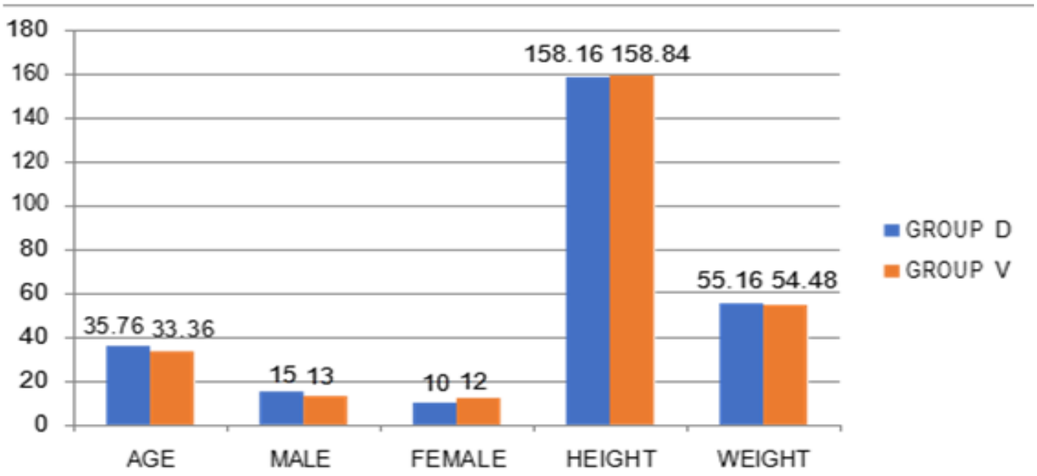

Figure 1:

The Figure 1 shows mean pulse rate at baseline, before induction, after laryngoscopy and 10 minutes after intubation.

In Group V baseline pulse was 88.8 ± 13.08 bpm, after laryngoscopy it became 102.4 ± 13.10 bpm and came nearby baseline at 10 minutes after intubation 92.24 ± 12.07 bpm. Whereas in Group D patients baseline pulse was 95.2 ± 9.95 bpm, After laryngoscopy it became 111.04 ± 8.96 bpm and came nearby baseline at 10 minutes after intubation 96 ±8.34 bpm.

Mean pulse rate was significant lower in group V mainly after laryngoscopy compared to group M (P value < 0.05)

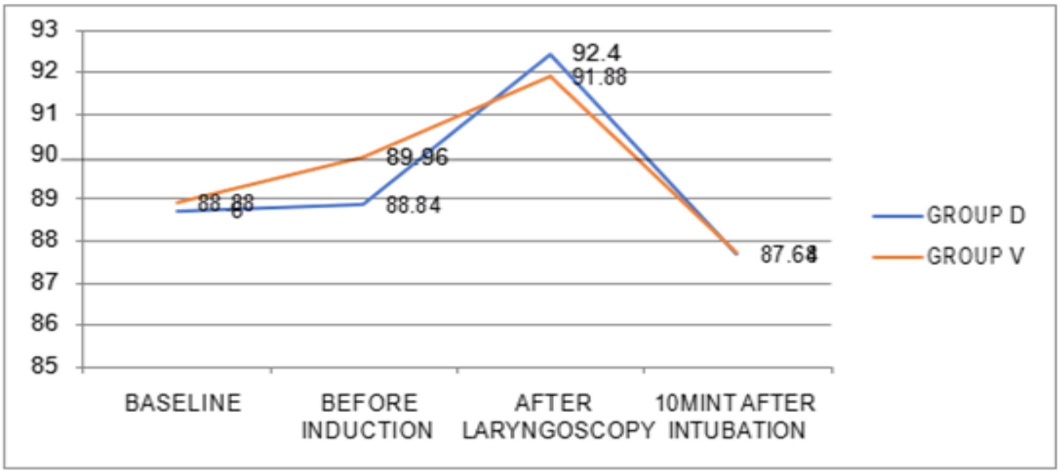

Figure 2:

The Figure 2 shows mean arterial pressure at baseline, before induction, after laryngoscopy and 10 mint after intubation. In both groups MAP increase after laryngoscopy and came to nearby baseline 10 min after intubation. Difference between two groups is statistically not significant (P value > 0.05)

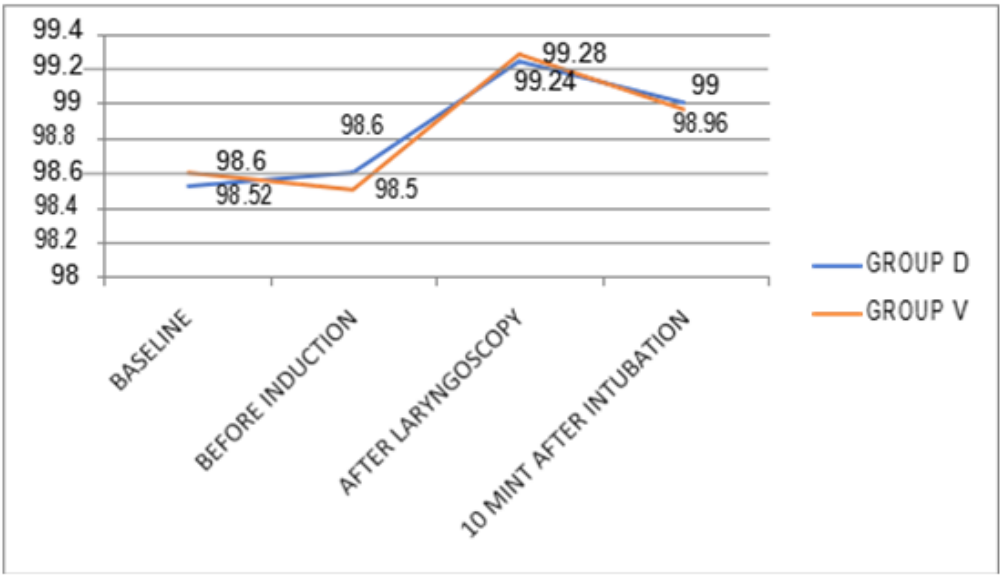

Figure 3:

The Figure 3 shows mean spo2 at baseline, before induction, after laryngoscopy and 10 mint after intubation in group D and group V. The mean oxygen saturation was comparable in both groups (P value > 0.05)

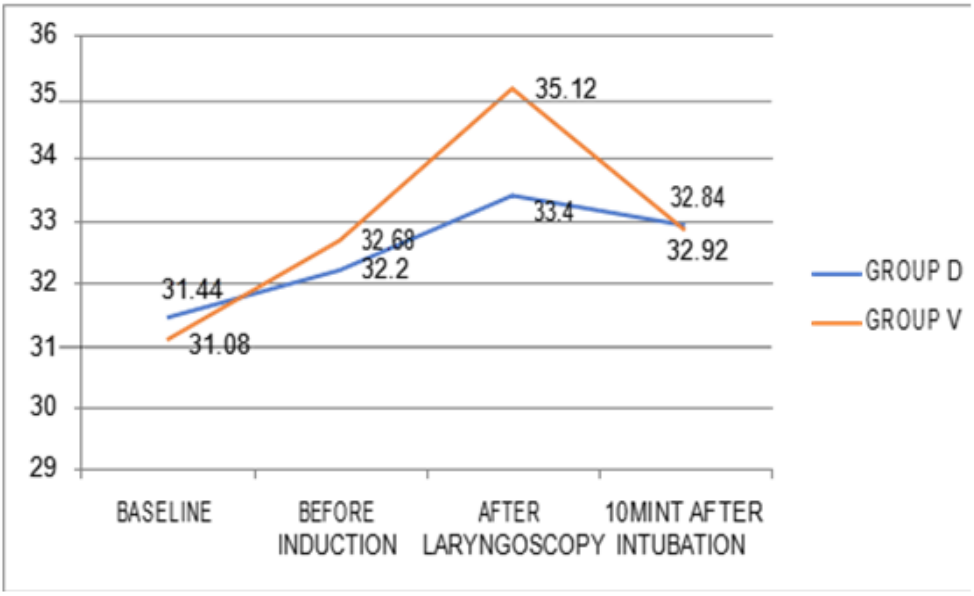

Figure 4:

Figure 4 shows mean ETco2 at baseline, before induction, after laryngoscopy and 10 mints after intubation in Group D and Group V. The mean ETco2 was comparable in both group (P value > 0.05)

Table 3: Complications

Parameters	Group-D Number (%)	Group-V Number (%)	P-value
Lip/dental trauma	3/25 (12%)	1/25 (4%)	>0.05
Esophageal Intubation	0/25	0/25	>0.05
Airway trauma	0/25	0/25	>0.05
Laryngospasm	0/25	0/25	>0.05
Vasovegal syncope	0/25	0/25	>0.05

The table 3 shows that there were only 3 case of Lip/dental trauma in Group D and 1 case of Lip/dental trauma in group V, while no other complications were noted in any patients of either group. No statistically significant complications were observed (P value > 0.05)

Discussion

Laryngoscopy has come a long way since the advent of the first laryngoscope some 120 years ago. Commonly used laryngoscope required for tracheal intubation is the one described by Macintosh in 1943. Though direct laryngoscopy remains the gold standard for this purpose, this needs morning sniffing position just to align the oral, pharyngeal and laryngeal axis in a single line for proper visualization of glottis and results in noxious stimulation like rise in pulse and blood pressure. [11,12]

Video laryngoscope has the advantage that there is no need for morning sniffing position and intubation can be done in a neutral position which can be advantageous in patients with cervical spine injuries. There is no need to apply force in valleculae for the view of glottis and thus the chances of noxious stimulation gets reduced, so does the less chances of Haemodynamic disturbances. It offers indirect (on screen) and superior visualization of glottic structures as the lens of the camera is closer to the glottis opening. An increased viewing angle, from 15 to 80 degrees not only gives better image quality but helps in teaching and research and allows documentation of images for clinical review. [13] So, we undertook this study to evaluate and compare efficacy of Macintosh laryngoscope and video laryngoscope for glottic exposure time, tube insertion time, total duration of intubation, number of attempts of device insertion, quality of visualization in terms of Cormack and Lehane grading, optimization maneuvers and complications in the age group of 18 – 60 years.

The age range was 18 to 60 years in both the groups with mean age in Group D was 35.76±14.56 years compared to 33.36 ±14.97 years in Group V. There was no predominance of any gender in any group as male/female ratio was 14/12 Group D and 13/12 in Group V. Results of our demographic data are in consonance with study done by Qazi Ehsan Ali et al (2015). [1] In our study, glottis exposure time and total duration of intubation were less in group K than in group D and statistically significant .Tube insertion time was less in group D than group K and statistically not significant. Q E Ali et al (2015) [1], reported the time required to intubate patients was significantly shorter when the king vision video laryngoscope with channeled blade was used as compared to the Airtraq (p< 0.05). Alvis BD et al (2016) [2], observed the median time for successful intubation to be 38 sec using the channeled blade with king vision video laryngoscope.

Attempts of intubation with direct laryngoscope and video laryngoscope were comparable as 24/25 (96%) intubation in Group V were done in first attempt while 1/25 (4%) required second attempts. Where in Group D 23/25 (92%) required first attempt of intubation while rest 2/25 (8%) intubation in second attempt (P value > 0.05). Marc Kriege et al (2017) [14] observed 96% first attempt success rates while using the channeled blade of king vision video laryngoscope.

In our study quality of visualization of glottis was assessed by Cormack and Lehane grading and it was found that in group D 15 (60%) out of 25 patients had grade 1 view while remaining 10 (40%) had grade 2 view. In group V 21 (84%) patients had grade 1 view while 4 (16%) patients had grade 2 view. Patrick Schoettker et al (2015) [5] from his study concluded that CL 1 was present in 72 (80%) intubations with the Airtraq- airview (AT) versus 80 (88.9%) with the king vision and a CL 2 was present in 18 (20%) AT intubations versus 10 (11.1) for the KVC group. Cormack Lehane best view during video laryngoscopy before intubation was reported significantly better with the king vision while no significant difference was noted during the intubation process.

In Group D 16/25 (64%) intubation did not require any optimization maneuver while 9/25 (56%) required optimization maneuvers live. In group V 20/25 (80%) intubations did not required any optimization maneuver while 5/25 (20%) required. The difference was statistically not significant (P value > 0.05) Abdullah M Kaki et al (2011) [15] observed higher need for optimization maneuvers with direct Macintosh , than c- mac and Glide scope while no maneuvers were needed for Airtraq

There was not significant rise of mean pulse rate from baseline during video laryngoscopy. Hence, it can be said that video laryngoscopy did not serve as noxious stimuli during intubation, which is usually seen with direct laryngoscopy by Macintosh laryngoscope. This advantage of video laryngoscopy makes them preferred choice of device for intubation in patients of hypertension, IHD, and patients of intracranial pathology, where stress response during laryngoscopy has deleterious effect. Qazi Ehsan Ali et al (2016) [1] observed similar intergroup variations in heart rate between king vision and lighwand group. In both group Mean arterial pressure increase after laryngoscopy and came to nearby baseline 10 min after intubation. Difference between two groups are statistically not significant (P>0.05). During video laryngoscopy tracheal intubation doesn't require morning sniffing position and forceful direct elevation of epiglottis as required during Macintosh direct laryngoscopy. Thus no stress response is seen with video laryngoscope. So, video laryngoscope is good for use in patients with hypertension, IHD, and intracranial pathology where acute rise in blood pressure can be deleterious. In our study, we did not encounter any episode of desaturation while intubation in both groups. The oxygen saturation was comparable between both the groups at every period. (p value > 0.05). Alvis BD et al (2016) [2] observed negligible changes in oxygen saturation. In our study mean ETco2 was comparable in both group (P >0.05). In our study there were no incidences of any serious complications like esophageal intubation, airway trauma, laryngospasm, vasovegal syncope. In group D there were three incidences of lip\dental trauma and in group V only one incidence occurs. Q E Ali et al (2015) [1] did not encounter oesophageal intubation using both king vision and airtaq video laryngoscopes but airway trauma occurred in 1 patient of king vision group. Akihisa Y et al (2014) [8], no incidence of oesophageal intubation occurred with the KVC.

Conclusion

Video laryngoscope takes short time to achieve successful intubation, offer hemodynamic stability and better quality of glottic view than Macintosh during intubation. Video laryngoscope less frequently need assist maneuvers, so facilitates intubation with less complication. Both devices are useful for routine intubation in adult patients.

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