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Original Article

Endotracheal intubation using video laryngoscopy causes less cardiovascular response and less airway morbidity compared to classic direct laryngoscopy during surgery.

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Abstract:

Introduction: *Endotracheal intubation using video laryngoscopy causes less cardiovascular response and less airway morbidity compared to classic direct laryngoscopy, in cardiac surgery. A comparison of the cardiovascular responses to endotracheal intubation using both indirect video laryngoscopy and direct laryngoscopy within the same patient has not yet been described.*

Materials and methods: *This comparative randomized controlled clinical trial on 110 patients undergoing elective CABG. Data were expressed as mean ± SD and statistically analyzed using analysis of variance (ANOVA) and paired "t"-test over time and software SPSS-19.00.*

Results: *Total intubation time was significantly higher in Video laryngoscopy group than direct laryngoscopy group (Table 2). The mean effective airway time were 6.15±4.92 in Video laryngoscopy group and 11.32(±9.11) in direct laryngoscopy group which was statistically significant (Table 3). The relative increase of the Rate Pressure Product (RPP) at intubation was significantly smaller (i.e. 27%, P < 0.001) using video laryngoscopy compared to the classic direct laryngoscopy. Cardiovascular responses were blunted by an additional 10. 2% (P = 0.029), when the patient was on beta blockade (Table 4).*

Conclusion: *Study observed that less hemodynamic responses during endotracheal intubation using indirect video laryngoscopy compared to classic direct laryngoscopy. Even if the patient is on beta-blocker therapy, diminished cardiovascular responses at intubation were recorded after indirect laryngoscopy compared to direct laryngoscopy.*

Key words: *Cardiovascular responses, video laryngoscopy, classic laryngoscopy.*

Introduction:

Endotracheal intubation using video laryngoscopy causes less cardiovascular response and less airway morbidity compared to classic direct laryngoscopy, in cardiac surgery[1]. Direct laryngoscopy has been the standard technique for tracheal intubation for almost a century. However, the last two decades have seen the development of myriad alternative intubating devices.[2] Video laryngoscopy is the most significant development in airway management in this century.[3]

Cardiovascular responses to endotracheal intubation have been well documented for direct laryngoscopy and are caused by the noxious stimuli to the oropharyngeal structures (laryngoscopy) and the larynx and trachea (exerted by the tracheal tube insertion).[4] The improved glottic view provided by indirect video laryngoscopy reduces the need for excessive force on the laryngoscope.[5] A comparison of the cardiovascular responses to endotracheal intubation using both indirect video laryngoscopy and direct laryngoscopy within the same patient has not yet been described.

Materials and methods:

This comparative randomized controlled trial was conducted in the department of cardiothoracic vascular anaesthesia and critical care of Evercare Hospital, Dhaka on 110 patients undergoing elective CABG. Study period was (July-December), 2020. The study was approved by the institutional review board, and informed consent was obtained from all subjects.

Randomization was done by computer generated random number concealed in sealed envelope. Patients were excluded if risk factors for gastric aspiration, difficult intubation, or both (Mallampatti class III or IV; thyromental distance <6 cm; and inter-incisor distance <3.5 cm) were present. Patients with left main coronary artery disease, poor left ventricular (LV)

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function, conduction abnormality and those on a permanent pacemaker were excluded too. All data were collected by an independent unblinded observer. Patients were randomized into two groups: tracheal intubation done with the Kingvision Video laryngoscopy (group A) and Macintosh Direct laryngoscopy (group B). All the patients received standard premedication of clonazepam (1mg) orally on the previous night and midazolam (7.5mg) on the morning of surgery. All antihypertensive and antianginal medications were continued till the morning of surgery except angiotensin-converting enzyme inhibitors and angiotensin-receptor blockers.

Electrocardiogram and pulse oximeter were used for monitoring the patients during induction of anaesthesia in addition to direct intra-arterial pressure monitoring placed under local anesthesia with the patient breathing O_2 with face mask. Baseline parameters, namely, heart rate , systolic, diastolic and mean blood pressure (SBP, DBP and MBP, respectively), and arterial oxygen saturation (SPO_2) were recorded. Electrocardiographic (ECG) monitoring for myocardial ischaemia and arrhythmia was instituted during the study period using automated system with Solar, Marquett monitoring system. Myocardial ischaemia was defined as ST-segment depression or elevation exceeding 1 mm, 60 ms after the J point.

After pre-oxygenation, anaesthesia was induced with titrated doses of fentanyl (5–10 µg/kg) and midazolam (0.1–0.2 mg/kg) till loss of consciousness, and pancuronium bromide (0.1 µg/kg) was used for neuromuscular blockade in standard dosage. Patients were ventilated manually with isoflurane (1% end-tidal) in oxygen using facemask and laryngoscopy was done at the end of 3 min. In group A patients, trachea was intubated orally with an 7.5-mm ID polyvinyl chloride tracheal tube (for males) or a 7.0-mm ID tube (for females) was attached to the groove of the video laryngoscope blade and the tip of the tracheal tube was positioned just beyond the charge-coupled device (CCD) camera by anesthesiologist. No local anaesthetic (lignocaine) was utilized either as laryngotracheal spray or by intravenous route. The time (in seconds) to intubation was calculated from the time of picking up of the laryngoscopy to the time the blade was removed from the mouth after successful intubation, using a stop-watch. In group B patients, direct laryngoscopy (Macintosh) was used in the following manner.

Data were expressed as mean ± SD and statistically analyzed using analysis of variance (ANOVA) and paired "*t*"-test over time and software SPSS-19.00. P value < .05 is considered statistically significant

Results:

Table 1 shows demographic characteristics of the study patients (n=110.The mean age was found 52.25±6.53 in Video laryngoscopy group and 51.13±6.31 in direct laryngoscopy group. Male were predominate in both group which was 70.9% in group A and 67.3% in group B. ASA physical status 45(81.8%) were in Video laryngoscopy group and 46(83.6%) in Direct laryngoscopy group.

Table 2 shows comparison between mouth opening, thyro mental distance, Mallampatti class and total intubation time (n=110). Comparisons of mouth opening, thyro mental distance, Mallampatti class were not significant between Video laryngoscopy group and direct laryngoscopy group. Total intubation time was significantly higher in Video laryngoscopy group than direct laryngoscopy group. Comparisons of mouth opening, thyro mental distance, Mallampatti class were not significant between Video laryngoscopy group and direct laryngoscopy group. Total intubation time was significantly higher in Video laryngoscopy group than direct laryngoscopy group.

Table 3 shows comparison between effective airway time (n=110). The mean effective airway time were 6.15±4.92 in Video laryngoscopy group and 11.32(±9.11) in direct laryngoscopy group which was statistically significant. .

Table 4 shows systolic blood pressure times heart rate which is mean rate pressure product (RPP) values for the different measurement occasions (n=110). The relative increase of the RPP at intubation was significantly smaller (i.e. 27%, P < 0.001) using video laryngoscopy compared to the classic direct laryngoscopy. Cardiovascular responses were blunted by an additional 10. 2% (P = 0.029), when the patient was on beta blockade.

Table 1

Parameters	Group A (n=55) Mean ± SD		Group B (n=55) Mean ± SD		P value
Age (years)	52.25	±6.53	51.13	±6.31	0.473
Sex					
Male	39	70.9	37	67.3	0.679
Female	16	29.1	18	32.7	
Body mass index (kg/m^2)	24.53	±3.21	23.98	±2.87	0.345
ASA physical status					
I	0	0.0	0	0.0	
II	45	81.8	46	83.6	
III	9	16.4	7	12.7	0.742
IV	1	1.8	2	3.6	

Table 2

Parameters	Group A (n=55) Mean ±SD	Group B (n=55) Mean ±SD	P value
Mouth opening (cm)	5.06 ±0.47	5.03±0.36	0.707
Thyromental distance (cm)	7.10±0.31	7.03±0.27	0.209
Mallampati class	1.15±0.28	1.13±0.31	0.723
Intubation time (seconds)	27.62±2.89	23.56±3.77	0.001

Table 3

Parameters	Group A (n=55) Mean±SD	Group B (n=55) Mean±SD	p-value
Airway time (Seconds)	6.15±4.92	11.32±9.11	0.001

Table 4

Parameters	No beta CL Mean ±SD	Beta CL Mean±SD	No beta VLS Mean±SD	Beta VLS Mean±SD
Baseline	7734±1721	6751±1753	7857±1841	7193±1891
Intubation	11109±3387	8467±2898	8846±2563	7795±2186
Intubation+ 1 minute	9945±2756	7943±2345	8912±2874	7801±2558
Intubation+ 3 minute	8307±1953	7342±2142	7897±2250	6922±2201

CL-classic laryngoscope; VLS- video laryngoscope

Figure 1 shows relative change in Rate Pressure Product (RPP) from baseline. Following intubation a peak in RPP is seen with direct and indirect video laryngoscopy, with a diminished peak at intubation when using the video laryngoscope (VLS) compared to direct (classic) laryngoscopy (CL) for both patients with (Beta) and without beta blockade (No Beta).

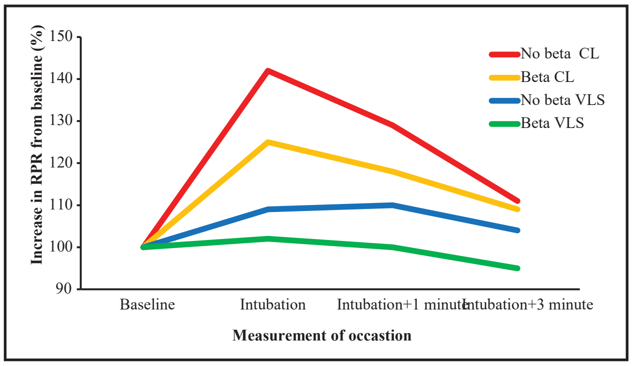

Figure 1

Discussion:

In this study we observed that the mean age was found 52.25±6.53 in Video laryngoscopy group and 51.13±6.31 in direct laryngoscopy group. Male were predominate in both group which was 70.9% in group A and 67.3% in group B. American society of anesthesiologists (ASA) physical status 45(81.8%) were in Video laryngoscopy group and 46(83.6%) in Direct laryngoscopy group. Upadhyaya and Pathak[6] reported that the mean age was found 29.62±7.62 years in group V (Video laryngoscope) and 30.80±7.55 years in group D (Direct laryngoscope) group. The difference was not statistically significant (p>0.05) between two groups. Maassen et al.[7] reported that the mean age was found to be 66.2±10.2 years. They observed mean BMI to be 27.0±4.0 kg/m^2, ASA physical status II to be 67(84.0%) and ASA physical status III to be 13(16.0%). Upadhyaya and Pathak[6] reported that out of 100 participants, 47 patients were ASA I and three were ASA II in Direct Laryngoscopy group whereas in Video Laryngoscopy group, 49 were ASA I and only one patient was ASA II.

In our study we observed that comparisons of mouth opening, thyromental distance, Mallampatti class were not significant between Video laryngoscopy group and direct laryngoscopy group. Total intubation time was significantly higher in Video laryngoscopy group than direct laryngoscopy group. The mean effective airway time were 6.15±4.92 in Video laryngoscopy group and 11.32(±9.11) in direct laryngoscopy group which was statistically significant. Upadhyaya and Pathak[6] mean mouth opening was 5.08±0.37 cm in group V and 5.02±0.33 cm in group D. Mean thyromental distance was 7.00±0.25 cm in group V and 6.98±0.23 cm in group D. Mean mallampati class was 1.12±0.33 in group V and 1.10±0.30 in group D. The mean intubation time for direct laryngoscopy was 22.80 seconds and for video laryngoscopy was 26.54 seconds which was statistically highly significant (p<0.001). However, mean mouth opening, thyromental distance, mallampati class were not statistically significant (p>0.05) between two groups. Despite significant increase in percentage of visible glottic opening with Glidescope (P < 0.05), Choi et al.[9] did not find any difference in the time required for a successful tracheal intubation when compared with the Macintosh laryngoscope. Similar finding for intubation time was observed in many other studies using King Vision video laryngoscope, Airtraq and Glidescope when all these were compared with Macintosh laryngoscope.[10,11] Unlike these studies, Castillo-Monzón et al.[12] and Dhonneur et al.[13] found shorter intubation time with Airtraq when compared with Macintosh laryngoscope. But, many researchers have observed significantly longer time for intubation using video laryngoscope mostly Glidescope when compared with Macintosh laryngoscope.[14,15] Maassen et al.[7] reported mean thyromental distance was found to be 77.8 ± 8 cm.

In our study it was observed that the mean effective airway time were 6.15±4.92 in Video laryngoscopy group and 11.32(±9.11) in direct laryngoscopy group which was statistically significant. Maassen et al.[7] reported that the effective airway time was significantly longer when using classic laryngoscopy (10.3 ± 13.8 s) compared to video laryngoscopy (6.1 ± 5.9 s, P = 0.002). There was no significant correlation between effective airway time and RPP after correction for laryngoscope type and beta blocker effect.

Our study showed that the relative increase of the RPP at intubation was significantly smaller (i.e. 27%, P < 0.001) using video laryngoscopy compared to the classic direct laryngoscopy. Cardiovascular responses were blunted by an additional 10. 2% (P = 0.029), when the patient was on beta blockade. Maassen et al.[7] reported that based on mean RPP values, maximal values of RPP during observation increased by 48.3% and 189% of their baseline values during indirect video laryngoscopy and direct classic laryngoscopy, respectively. The mean RPP values for the different measurement occasions within the different groups (i.e. classic laryngoscope and LS with and without beta blockade). Upadhyaya and Pathak [6] found relative increase of RPP from baseline values at intubation which was significantly lower using video laryngoscope (i.e. 27%, $P < 0.001$) when compared to the classic direct laryngoscopy.[15]

In our study we observed relative change in RPP from baseline. Following intubation a peak in RPP was seen with direct and indirect video laryngoscopy, with a diminished peak at intubation when using the video larygoscope (VLS) compared to direct (classic) laryngoscopy (CL) for both patients with beta blockade and without beta blockade. Maassen et al. observed that the relative increase of the RPP at intubation was significantly smaller (i.e. 27%, $P < 0.001$) using video laryngoscopy compared to the classic direct laryngoscopy. Cardiovascular responses were blunted by an additional 10.2% ($P = 0.029$), when the patient was on beta blockade. Studies[16,17] that investigated cardiovascular responses to endotracheal intubation, comparing direct laryngoscopy and indirect video laryngoscopy with the use of the Glidescope ®, were not able to show an attenuation of the cardiovascular responses when video laryngoscopy was used. The GlideScope® video laryngoscope offers an excellent view of the glottis, but intubation is not always straightforward. The use of a stylet with a relatively pronounced curve (the best angle is reported to be 90°) [18,19] at the distal end is the most helpful and needed in the majority of the cases in order to advance the tip of the endo tracheal tube (ETT) to the glottic opening.[20] Stylet use goes hand in hand with more manipulations and increases the potential noxious stimulation to the trachea, which can provoke cardiovascular responses.

Conclusion:

Our study observed less hemodynamic responses during endotracheal intubation using indirect video laryngoscopy compared to classic direct laryngoscopy. Even if the patient is on beta-blocker therapy, diminished cardiovascular responses at intubation are recorded after indirect laryngoscopy compared to direct laryngoscopy.

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