Original Article

Comparison of hemodynamic responses to laryngoscopy and intubation with Truview PCD™, McGrath® and Macintosh laryngoscope in patients undergoing coronary artery bypass grafting: A randomized prospective study

Deepak K. Tempe, Kapil Chaudhary[1], Anitha Diwakar[2], Vishnu Datt[2], Sanjula Virmani[2], Akhlesh S. Tomar[2], Anoop Mohandas[2], Vishwanath Bharav Mohire[2]

Department of Anaesthesiology and Intensive Care, Maulana Azad Medical College and Associated Lok Nayak Hospital, GB Pant and GNEC Hospitals, [1]Department of Anaesthesiology and Intensive Care, Lady Hardinge Medical College and Associated Hospitals, [2]Department of Anaesthesiology and Intensive Care, GB Pant Hospital and Associated Maulana Azad Medical College, New Delhi, India

ABSTRACT

Context: We hypothesized that reduced oropharyngolaryngeal stimulation with video laryngoscopes would attenuate hemodynamic response to laryngoscopy and intubation. **Aim:** Comparison of hemodynamic response to laryngoscopy and intubation with video laryngoscopes and Macintosh (MC) laryngoscope. **Setting and Design:** Superspecialty tertiary care public hospital; prospective, randomized control study. **Methods:** Sixty adult patients undergoing elective coronary artery bypass grafting (CABG) were randomly allocated to three groups of 20 each: MC, McGrath (MG), and Truview (TV). Hemodynamic parameters were serially recorded before and after intubation. Laryngoscopic grade, laryngoscopy, and tracheal intubation time, ST segment changes, and intra-/post-operative complications were also recorded and compared between groups. **Statistical Analysis:** SPSS version 17 was used, and appropriate tests applied. $P < 0.05$ was considered significant. **Results:** Heart rate and diastolic arterial pressure increased at 0 and 1 min of intubation in all the three groups ($P < 0.05$) while mean arterial pressure increased at 0 min in the MG and TV groups and at 1 min in all three groups ($P < 0.05$). A significant increase in systolic arterial pressure was only observed in TV group at 1 min ($P < 0.05$). These hemodynamic parameters returned to baseline by 3 min of intubation in all the groups. The intergroup comparisons of all hemodynamic parameters were not significant at any time of observation. Highest intubation difficulty score was observed with MC (2.16 ± 1.86) as compared with MG (0.55 ± 0.88) and TV (0.42 ± 0.83) groups ($P = 0.003$ and $P = 0.001$, respectively). However, duration of laryngoscopy and intubation was significantly less in MC (36.68 ± 16.15 s) as compared with MG (75.25 ± 30.94 s) and TV (60.47 ± 27.45 s) groups ($P = 0.000$ and 0.003, respectively). **Conclusions:** Video laryngoscopes did not demonstrate any advantage in terms of hemodynamic response in patients with normal airway undergoing CABG.

Key words: Anesthetic techniques - laryngoscopy; Cardiovascular system - responses; Equipment - video laryngoscope; Intubation - tracheal tube

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INTRODUCTION

Adverse responses in the cardiovascular, respiratory, and other physiological systems can be provoked due to the noxious stimuli

Address for correspondence: Prof. Deepak K. Tempe, Maulana Azad Medical College and Associated LNH, GB Pant and GNEC Hospitals, MAMC Complex, New Delhi, India. E-mail: tempedeepak@hotmail.com

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produced by laryngoscopy and intubation.[1] Tachycardia and hypertension associated with laryngoscopy and tracheal intubation, when significant, can result in myocardial ischemia and is undesirable, especially in patients with coronary artery disease (CAD).[1] Avoidance of these is the basic goal of anesthesia in these patients.[2] Hence, the need to attenuate hemodynamic responses to laryngoscopy and intubation is important in patients undergoing coronary revascularization.[3]

Hemodynamic responses to tracheal intubation are the resultant effects of oropharyngeal stimulation produced by laryngoscopy, and laryngotracheal stimulation secondary to tube insertion.[4] The magnitude of hemodynamic response increases with the force and duration of laryngoscopy (DOL)[1] and can also be influenced by prolonged intubation time.[4] Tracheal intubation approaches that minimize oropharyngolaryngeal stimulation might attenuate this stress response. Video laryngoscopes do not require alignment of the oral, pharyngeal, and laryngeal axes for visualization of the glottis and tracheal intubation and cause minimal oropharyngolaryngeal stimulation and may hence potentially attenuate the pressor response.

Several video laryngoscopes have recently been developed. The McGrath® (MG) Series 5 and Truview (TV) PCD™ video laryngoscopes have not been tested previously for hemodynamic responses to laryngoscopy and intubation in patients undergoing coronary artery bypass grafting (CABG). TV EVO_2 and MG® video laryngoscopes have consistently resulted in superior laryngeal view (modified Cormack-Lehane grading [m-CL]),[5-8] reduced the need for optimization maneuvers[6] and reduced intubation difficulty scores (IDS)[6] as compared with Macintosh (MC) blade in non-CABG patients. TV PCD™ (Truphatek International Ltd., Netanya, Israel) video laryngoscope has an LCD display monitor which is not mounted on the laryngoscope, gives better vision to both the intubator and other staff present, is easy to handle and is less cumbersome with regards to image magnification and focusing as compared to TV EVO_2. We hypothesized that the use of TV PCD™ and MG® Series 5 would attenuate the hemodynamic responses to laryngoscopy and tracheal intubation as compared with the MC laryngoscope. The aim of the present study was to assess the hemodynamic response to laryngoscopy and intubation with MC laryngoscope and the video laryngoscopes (primary outcome) and also to assess the laryngoscopic view, laryngoscopic and intubation times, IDS and complications if any (secondary outcomes).

MATERIALS AND METHODS

After obtaining written informed consent, sixty adult patients aged 40–70 years of either sex who underwent elective CABG from October 2012 to August 2013 were included in the study. Approval from the Institutional Ethics Committee [Ref: F.I/IEC/MAMC/(32) 4/2012/No. 250] was obtained. The study was registered with the Clinical Trial Registry of India [Ref: CTRI/2013/04/003554]. Patients were randomly allocated using computer generated random numbers to MC, MG® or TV PCD™ (TV) groups of 20 patients each. Sequentially, numbered sealed, opaque envelopes were used for allocation concealment.

Patients with renal, hepatic or neurological diseases, bleeding diathesis, Mallampati score of III–IV, anticipated difficult intubation or history of difficult intubation, and limited nuchal range of motion were excluded. Patients with gastroesophageal reflux disease delayed gastric emptying, serious respiratory disease, kyphoscoliosis, left ventricular ejection fraction <35%, and American Society of Anaesthesiologists grade IV were also excluded from the study.

During the preoperative examination, age, sex, body weight, dental condition, and Mallampati score were recorded. Intramuscular morphine sulfate (0.2 mg/kg) and promethazine (0.5 mg/kg) were administrated approximately 1 h before surgery as premedication. A wide bore intravenous (IV) cannula, an invasive arterial line and a thermodilution Swan-Ganz catheter were inserted under local anesthesia prior to induction of general anesthesia (GA).

GA was induced with IV injection of midazolam 0.02–0.05 mg/kg, fentanyl 5–10 μg/kg and thiopentone 1 mg/kg. Pancuronium 0.1 mg/kg was used as the muscle relaxant. After 3 min of bag-mask ventilation, an endotracheal tube (ET) was placed orally using direct laryngoscopy by a no. 3 or no. 4 MC blade or an MG® or a TV PCD™ video laryngoscope. All intubations were performed by senior experienced anesthetists who had experience of at least 50 intubations using video laryngoscope in mannikin and at least 20 in patients. Invasive arterial pressure, pulmonary arterial pressures, 5-lead electrocardiogram with ST analysis, pulse oximetry, and end-tidal capnography were performed in all patients.

In group MC; the tracheal intubation was performed using the standard MC laryngoscope. In group TV; TV

PCD™ video laryngoscope was used. It was functionally pretested with all components mounted to the hilt of laryngoscope including oxygen line delivering oxygen at a rate of 6 L/min, and an LCD monitor attached via a cable to the ocular piece. For better control of the ET tube tip, a preformed stylet was used in this group. In Group MG; an MG® video laryngoscope was used. The video laryngoscope was functionally pretested with all the components and integral color liquid crystal display mounted on the top of the laryngoscope handle. Stylet was used for intubation as per manufacturer's recommendation.

Hemodynamic changes, laryngoscopic view, the number of attempts, the time required for laryngoscopy and tracheal intubation, ST segment changes, and intra-/post-operative complications were recorded. Heart rate (HR), systolic arterial pressure (SAP), diastolic arterial pressure (DAP) and mean arterial pressure (MAP) arterial pressures as well as mean pulmonary arterial pressure (MPAP), and diastolic pulmonary arterial pressure (DPAP) along with peripheral oxygen saturation (SpO_2), were recorded before and after induction, immediately after intubation (0 min), and at 1, 2, 3, 4, 5 and 10 min postintubation. Cardiac output (CO), systemic vascular resistance index (SVRI), and pulmonary vascular resistance indexes (PVRI) were recorded before and after induction, and at 1, 5 and 10 min postintubation. End-tidal carbon dioxide ($EtCO_2$) was recorded immediately after induction, immediately after intubation, and at 1, 2, 3, 4 and 5 min postintubation. Measurements obtained after induction of anesthesia when the hemodynamics were stable (postinduction) were considered as baseline measurements in the study.

DOL was defined as the time from oral placement of the laryngoscope blade to obtaining the best glottis view. For the evaluation of glottis view during laryngoscopy, modified Cormack and Lehane Scoring System (m-CL) and percentage of the glottis opening (POGO) score were used. Duration of intubation (DOI) was defined as the time interval between oral placement of the ET to the attainment of tracing of 3 $EtCO_2$ waveforms after intubation and initiation of mechanical ventilation. An attempt was defined as the time from introduction of laryngoscope into the oral cavity until its removal. Three attempts at intubation were allowed for all groups. Failure to intubate was defined as the inability to intubate after three attempts. An alternative technique was used in cases of failure as per the discretion of anesthetist. In the case of multiple attempts, the duration of each attempt was recorded. The duration of laryngoscopy and intubation (DOLI) was defined as the sum of all intubation attempts. The hemodynamic changes after intubation were evaluated after successful intubation.

After the study period, the anesthetic agents were used as per the patient requirement. A number of unsuccessful attempts of intubation, complications encountered during intubation (bleeding, lacerations, dental injury, etc.,), and optimal laryngeal external manipulation (OLEM) during intubation were recorded. IDS was assessed as the sum of the following seven variables: N1 - number of intubation attempts >1; N2 - the number of operators >1; N3 - the number of alternative intubation techniques used; N4 - glottic exposure (Cormack and Lehane grade − 1); N5 - lifting force required during laryngoscopy (0, normal; 1, increased); N6 - necessity for external laryngeal pressure (0, not applied; 1, applied); N7 - position of the vocal cords at intubation (0, abduction/not visualized; 1, adduction).[9] Glyceryl trinitrate (NTG) at a dose of 1 μg/kg IV was instituted whenever the SBP increased by ≥20% of baseline or was persistently ≥160 mmHg for a minute. Patients were evaluated at 24 h after intubation for any throat pain or a sore throat.

Statistical analysis

A sample size of 20 patients was taken based on power analysis from a previous article[10] revealing a sample size of 20 patients per group to be adequate to achieve a power of 80% and an α error of 0.05 for detection of 20 beats/min or 20 mmHg differences in paired hemodynamic data.

Data were expressed as a mean ± standard deviation. Chi-square test was used for categorical data. To compare the data between the three groups ANOVA test was used and for two groups unpaired *t*-test was used. When data did not follow a normal distribution, nonparametric Kruskal–Wallis test was used for three groups and nonparametric Wilcoxon–Mann–Whitney test was used for two groups. For within the group comparison, paired *t*-test was used. When data did not follow a normal distribution, nonparametric Wilcoxon signed rank test was used. The level of statistical significance was taken as $P \leq 0.05$. SPSS version 17.0 (SPSS, Chicago, IL, USA) was used for statistical analysis.

RESULTS

One patient each in the MC and TV groups was excluded from statistical analysis as they required more than

three attempts of intubation and were considered as failure to intubate [Figure 1]. The patient demographics and clinical data are summarized in Table 1. About 70% patients in each group were receiving beta blockers preoperatively.

The hemodynamic data are summarized in Tables 2 and 3. The baseline hemodynamic parameters were comparable in the three groups. HR and DAP increased at 0 min in all the three groups. The increase in HR gradually returned to baseline by 3 min in the MC and MG groups and by 2 min in the TV group. MAP increased at 0 min in the MG and TV groups and at 1 min in MC group. The MAP and DAP returned to baseline values by 2 min in groups MC and MG and by 3 min in group TV. Nonsignificant decrease in MAP and DAP was observed thereafter in MC and MG groups, apart from a significant decrease in MAP at 10 min in group MC. In the TV group, significant decreases in MAP were observed at 5 and 10 min, and in DAP at 10 min. The SAP also increased postintubation, but it was not statistically significant in the MC and MG groups. In the TV group, an increase in SAP was significant at 1 min. The SAP started decreasing from 2 min which was statistically significant from 3 min in the group MC and from 4 min onward in MG and TV groups. MPAP decreased from 4 min onward in groups MC and MG and by 10 min in group TV. DPAP increased at 0 min in the MG and TV groups and returned to baseline within minutes significant decrease in DPAP from baseline was observed from 3 to 5 min onward in group MC, MG, and TV, respectively.

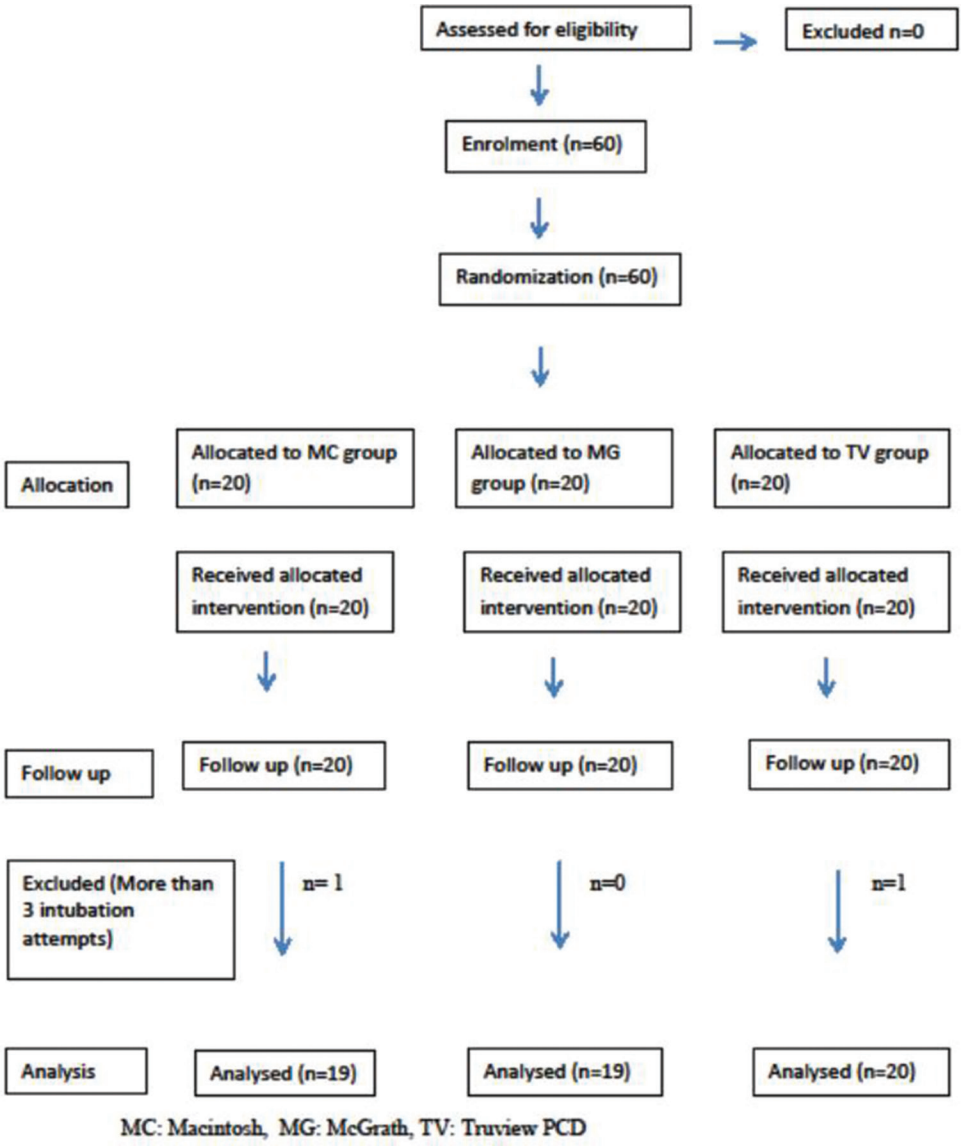

Figure 1: Consort flowchart

Table 1: Patient clinical data

Data	Group TV (*n*=19) (%)	Group MG (*n*=20) (%)	Group MC (*n*=19) (%)
Sex (male/female)	19/0	16/4	16/3
Age (years)	52.47±7.64	54.90±9.68	51.11±8.62
Height (cm)	166.68±9.07	167.5±7.08	168.16±4.16
Weight (kg)	63.00±10.24	64.65±9.32	62.68±10.67
BMI (kg/m^2)	22.25±4.13	23.10±3.54	22.62±2.65
BSA	1.68±0.15	1.72±0.13	1.71±0.12
EF	48.42±9.86	48.50±8.59	53.89±7.38
Left main involvement	1 (5.3)	4 (20)	3 (15.8)
Number of vessels	3 (2-3 [2-3])	3 (2-3 [2-3])	3 (2-3 [2-3])
Hypertension	2	6	5
Diabetes	4	5	2
Mallampati score (I/II)	4/15	5/15	3/16
Abnormal dentition	10 (52.6)	10 (50)	6 (31.6)

Values are mean±SD or number or number (percentage) or median (IQR (range)). BMI: Body mass index, BSA: Body surface area, EF: Ejection fraction, SD: Standard deviation, TV: Truview, MG: McGrath, MC: Macintosh, IQR: Interquartile range

There was no significant change in CO at one min postintubation in any of the three groups. A significant decrease in CO was observed at 5 and 10 min in all the three groups. There was no change in SVRI and PVRI in the MC and MG groups. However, the SVRI was significantly increased at 1, 5, and 10 min in TV group. A significant increase in PVRI was observed at 1 min in TV group which returned to baseline at 5 min. The hemodynamic variations at all study times were comparable between the 3 groups. In addition, the ST segment changes were not significant and comparable in all the groups.

The intubation and laryngoscopic data are summarized in Table 4. Intubations were possible in all patients using the three laryngoscopes, although one patient in the TV and one in the MC group required more than three attempts of intubation. MG group was significantly

Table 2: Hemodynamic variability data

	Baseline	0 min	1 min	2 min	3 min	4 min	5 min	10 min
HR (beats/min)								
TV	76.89±17.02	84.95±14.58*	84.84±15.68*	81.47±16.17	78.89±16.39	76.74±16.59	75.26±15.54	71.26±11.84*
MG	76.84±16.91	86.75±18.22*	86.35±17.01*	82.05±15.39*	80.15±15.09	77.75±14.29	75.90±13.87	72.90±13.43
MC	74.16±11.04	82.00±12.34*	84.21±13.40*	80.32±12.77*	77.26±11.86	76.32±9.52	75.58±8.82	72.79±8.60
P	0.819	0.624	0.906	0.934	0.826	0.946	0.989	0.886
SAP (mmHg)								
TV	129.05±29.87	136.11±27.35	138.84±28.61*	130.16±28.39	124.05±26.38	116.21±26.81*	110.68±23.34*	99.00±15.86*
MG	135.30±37.43	142.05±33.84	145.15±30.36	132.95±25.39	127.60±25.64	119.45±23.21*	113.00±22.04*	108.60±26.36*
MC	127.37±31.88	126.39±38.09	130.26±31.51	120.42±29.76	112.05±21.86*	106.05±20.47*	101.84±17.12*	98.63±11.18*
P	0.735	0.354	0.312	0.348	0.133	0.194	0.229	0.187
DAP (mmHg)								
TV	64.26±10.82	77.74±12.96*	72.94±12.97*	68.63±12.25*	65.63±12.07	62.63±11.05	60.47±10.55	58.05±9.96*
MG	66.25±16.67	78.80±15.66*	76.95±11.74*	70.60±11.37	67.45±10.93	64.05±11.40	61.95±12.33	62.25±13.74
MC	61.61±13.19	71.22±23.75*	71.26±18.12*	65.95±16.11	61.68±12.47	59.58±11.64	58.79±10.08	57.74±7.97
P	0.590	0.383	0.459	0.556	0.308	0.462	0.673	0.356
MAP (mmHg)								
TV	83.84±15.18	97.47±18.38*	96.26±20.36*	90.79±18.78*	86.53±18.33	81.58±17.36	77.89±15.41*	72.21±12.52*
MG	86.58±21.83	101.84±23.36*	101.50±16.55*	92.65±15.87	87.55±15.43	82.25±14.73	78.35±15.22	78.05±17.94
MC	81.89±19.26	89.33±30.26	92.68±22.84*	85.21±21.12	79.11±16.12	75.47±14.71	73.63±12.00	71.84±8.00*
P	0.752	0.295	0.390	0.441	0.238	0.342	0.534	0.281
MPAP (mmHg)								
TV	15.32±3.09	17.47±4.99	16.68±6.16	16.37±6.81	15.21±6.05	14.37±4.51	13.63±4.37	12.16±2.69*
MG	15.45±4.27	18.35±6.60	17.10±5.86	14.90±5.27	14.90±4.66	13.90±4.02*	13.05±3.84*	12.40±3.45*
MC	15.42±5.10	18.79±10.74	18.47±12.95	16.84±11.61	14.79±8.77	13.79±7.16*	13.26±6.49*	12.37±4.44*
P	0.995	0.870	0.810	0.748	0.980	0.940	0.935	0.975
DPAP (mmHg)								
TV	9.84±2.65	12.47±4.12*	11.26±5.48	10.79±5.63	10.05±4.75	9.63±4.90	8.32±3.23*	8.37±2.00*
MG	10.50±3.76	13.45±5.58*	11.05±5.11	9.80±4.56	9.45±3.99	9.00±3.50*	8.75±3.05*	8.10±2.84*
MC	11.32±4.51	13.79±9.28	12.21±10.43	10.95±8.72	9.68±7.28*	9.00±5.92*	8.68±5.43*	8.26±4.09*
P	0.505	0.847	0.733	0.704	0.563	0.612	0.752	0.692

Values are mean±SD. *P<0.05 within the group. HR: Heart rate, SAP: Systolic arterial pressure, DAP: Diastolic arterial pressure, MAP: Mean arterial pressure, MPAP: Mean pulmonary arterial pressure, DPAP: Diastolic pulmonary arterial pressure, SD: Standard deviation, TV: Truview, MG: McGrath, MC: Macintosh

Table 3: Changes in cardiac output and derived parameters

	Baseline	1 min	5 min	10 min
CO				
TV	4.90±1.19	5.11±1.48	4.07±1.26*	3.69±0.92*
MG	5.40±1.35	5.59±1.59	4.21±0.72*	4.04±0.57*
MC	5.09±1.65	5.04±1.47	4.37±1.22*	3.90±0.97*
P	0.164	0.359	0.625	0.398
SVRI				
TV	2161.47±565.60	2432.53±464.04*	2554.74±569.94*	2484.32±550.00*
MG	2174.80±957.78	2368.80±663.92	2472.00±566.44	2532.70±696.70
MC	2134.68±603.62	2253.89±628.50	2265.05±491.87	2383.53±592.83
P	0.953	0.441	0.432	0.898
PVRI				
TV	184.26±74.53	221.32±64.47*	223.53±105.66	192.26±67.69
MG	215.35±100.39	222.00±81.93	224.05±70.66	203.30±66.86
MC	248.16±111.72	261.42±202.50	210.21±85.59	204.00±103.57
P	0.161	0.949	0.706	0.934

Values are mean±SD. *P<0.05 within the group. CO: Cardiac output, SVRI: Systemic vascular resistance index, PVRI: Pulmonary vascular resistance index, SD: Standard deviation, TV: Truview, MG: McGrath, MC: Macintosh

Table 4: Intubation and laryngoscopy data

Data	TV (*n*=19)	MG (*n*=20)	MC (*n*=19)	*P*
Successful attempt for intubation (1/2/3)	19/0/0*	14/6/0*	17/1/1	0.020
UA (0/1/2)	19/0/0*	14/6/0*	17/1/1	0.022
IDS	0.42±0.83‡	0.55±0.88†	2.16±1.86†,‡	0.001
m-CL (1/2a/3)	17/2/0‡	18/1/1†	9/6/4†,‡	0.031
POGO	100 (100-100 [50-100])‡	100 (100-100 [0-100])†	80 (55-100 [0-100])†,‡	0.002

Values are number of patients or mean±SD or median (IQR (range)). *P<0.05 between MG and TV, †P<0.05 between MC and MG, ‡P<0.05 between TV and MC. UA: Unsuccessful attempts, IDS: Intubation difficulty score, m-CL: Modified Cormack Lehanne score, POGO: Percentage of glottis opening, SD: Standard deviation, MG: McGrath, MC: Macintosh, IQR: Interquartile range, TV: Truview

inferior to MC group with respect to successful intubation at 1st laryngoscopy attempt (P = 0.009). Number of unsuccessful attempts at intubation were six in the MG group as compared with none in the TV group (P = 0.009) [Figure 2a]. Six patients each in MC and MG groups and one in TV group required OLEM (P = 0.091). Highest IDS was observed with MC (2.16 ± 1.86) as compared with MG (0.55 ± 0.88) and TV (0.42 ± 0.83) groups (P = 0.003 and P = 0.001, respectively) [Figure 2b]. Moreover, high m-CL grades were observed with MC as compared with MG and TV groups (P = 0.015 and P = 0.015, respectively). POGO (median [IQR (range)]) was significantly low in the MC group (80 [55–100 (0–100)]) compared with MG (100 [100–100 (0–100)]) and TV (100 [100–100 (50–100)]) groups (P = 0.005 and 0.005, respectively). DOL was significantly less in MC (12.16 ± 6.89 s) as compared with MG (26.10 ± 16.47 s) and TV (18.37 ± 11.77 s) groups (P = 0.001 and 0.016, respectively). Also, DOI was significantly less in MC (24.53 ± 10.94 s) as compared with MG (52.30 ± 28.10 s) and TV (42.11 ± 23.80 s) groups (P = 0.000 and 0.005, respectively). As a result, DOLI was significantly less in MC (36.68 ± 16.15 s) as compared with MG (75.25 ± 30.94 s) and TV (60.47 ± 27.45 s) groups (P = 0.000 and 0.003, respectively) [Figure 2c]. SpO_2 remained above 95% at all times in all the groups. $EtCO_2$ data were comparable at all times in the three groups.

One patient each in MC and MG and two patients in TV group needed NTG (P = 0.748). The total NTG used and interventional SAP were also comparable in the 3 groups. Sore throat was observed in 4 patients in MC and 3 each in groups MG and TV (P = 0.818). Other complications such as injury to lips, teeth, and oropharyngeal structures were not observed in any of the patients.

DISCUSSION

The present study observed that the hemodynamic response to laryngoscopy and intubation with video laryngoscopes and conventional MC laryngoscope was almost similar. An increase in HR, systemic

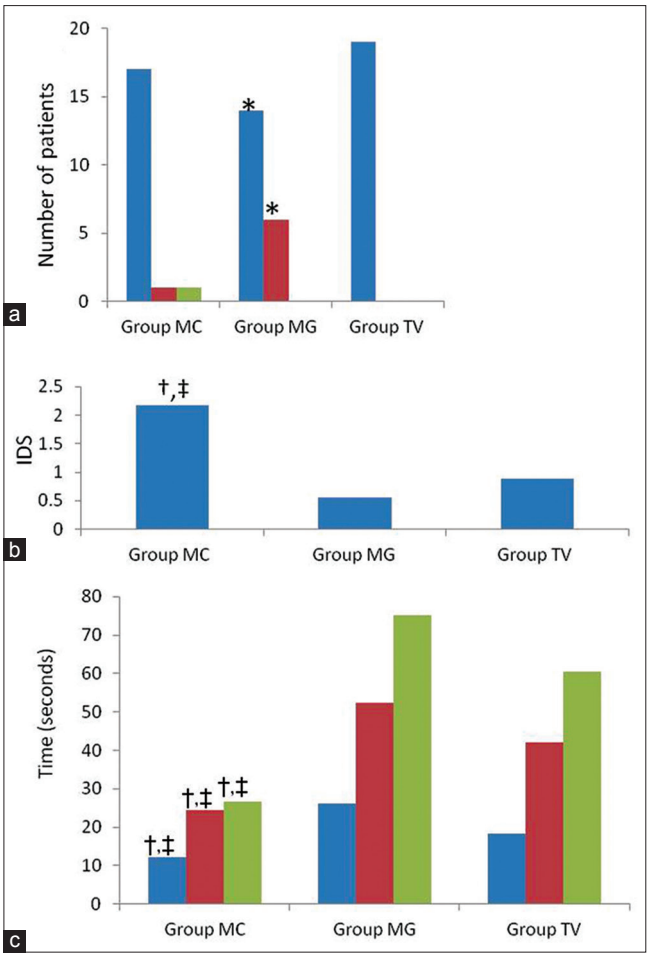

Figure 2: Intubation and laryngoscopy parameters. *n* = 19 for Macintosh and Truview PCD groups, *n* = 20 for McGrath group. (a) Unsuccessful attempts at intubation: No unsuccessful attempt (■); one unsuccessful attempt (■); two unsuccessful attempts (■). (b) Intubation difficulty score; (c) intubation and laryngoscopy duration: Duration of laryngoscopy (■), duration of intubation (■), and duration of laryngoscopy and intubation (■). Values are represented as number or mean. **P* < 0.05 between McGrath and Truview, †*P* < 0.05 between Macintosh and McGrath, ‡*P* < 0.05 between Truview and Macintosh

and pulmonary pressures were observed following intubation and this returned to baseline by 2–3 min, and continued to decrease until 10 min of observation. The trend was similar in all the groups.

There is a paucity of literature assessing the use of video laryngoscopes for attenuation of hemodynamic response in patients with CAD.[3,11] Only Pentax Airway Scope (Pentax Corporation, Tokyo, Japan) and (Saturn Biomedical System Inc., Burnbaby, Canada) GlideScope® video laryngoscopes have been evaluated and compared with conventional MC laryngoscope for attenuation of the hemodynamic response to laryngoscopy in patients with CAD.[3,11] TV PCD™ and MG® Series 5 video laryngoscopes have not been evaluated for attenuation of hemodynamic responses to laryngoscopy and intubation in patients with CAD. Furthermore, the evaluation of ST segment analysis, CO, pulmonary pressures changes with respect to laryngoscopy and intubation have not been performed with any video laryngoscope before.

The initial increase in HR and SAP observed after intubation in the present study can be considered mild and clinically insignificant. The changes returned to baseline by 3 min in most patients. The preoperative beta-blocker therapy may have accounted for these results. No patient showed any ST segment changes. There was no change in the CO despite an increase in the HR at 1 min. This may be explained by the fact that the stroke volume (SV) decreased in these patients. The decreased SV also accounted for the decrease in CO observed at 5 and 10 min. These hemodynamic changes are suggestive of anesthetic effect taking over, once the intubation response stabilized.

The present study observed that although the glottis visualization (POGO and m-CL) and IDS were worse with MC, yet the DOLI was better with MC. The first attempt success for laryngoscopy and intubation with MC was comparable with the TV and MG groups. Few studies have found the DOI with TV to be comparable with MC,[12,13] and easier intubation with MG[8] when compared to MC. However, majority of studies, like the present one have found an increased duration with TV[5,14,15] and MG[16,17] video laryngoscopes. The results of the present study are consistent with a recent review which observed that good laryngeal view may not always translate into easy intubation.[18]

Difficulty in navigating the ET tube to the glottis despite adequate visualization was encountered in most patients in MG and TV groups which have accounted for the increased DOI. The prolongation of DOI with these video laryngoscopes may account for the failure to demonstrate any hemodynamic benefit with the video laryngoscopes in the present study which is in consistence with the previous studies.[3,11] However, DOI and DOL were secondary outcomes and there exists a possibility of β error while interpretation.

Prolonged intubation time with video laryngoscopes in the present study could be due to multiple reasons. The video laryngoscope blade occupies larger oral space than MC blade. The authors observed that the tongue, which is not usually pushed to the left while using video laryngoscopes in contrast to MC, further, decreased

the space available to insert the ET into the oral cavity which required manoeuvering. Fogging of the MG lens due to expired gases inhibiting clear visualization of glottis was another contributory factor. Although the problem of fogging of the lens has not been reported in literature with MG, it was commonly observed in the present study. The authors overcame this by placing the tip of a suction catheter in pharynx with oxygen flow at 6 L/min. Enormous experience with MC may be another reason for quicker intubation as compared with video laryngoscopes where the glottic image is intubated, which requires hand – eye coordination.

Our study had some limitations. It was not possible to blind the intubating anesthetist for the laryngoscope being used. In addition, intubation was performed by three different anesthetists. Although all intubations were performed by senior experienced anesthetists who had an experience of at least 50 intubations using video laryngoscope in mannikin and at least 20 in patients, interpersonal variations cannot be ruled out. The hemodynamic response was not attenuated with video laryngoscopes in the present study with patients having normal airways, and the results cannot be extrapolated to patients with difficult airways. The depth of anesthesia was not monitored in the present study and intubation was not standardized at a specific monitored anesthetic depth. However, the anesthetic induction technique was similar in all patients.

CONCLUSION

Video laryngoscopes MG and TV do not offer any advantage in attenuation of hemodynamic response in patients with normal airways undergoing CABG. They improve the laryngoscopic views but prolong the time to intubation.

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Conflicts of interest
There are no conflicts of interest.

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