Section: Anaesthesiology

Original Research Article

COMPARATIVE EVALUATION OF HEMODYNAMIC RESPONSE TO LARYNGOSCOPY AND INTUBATION USING MACINTOSH AND VIDEO LARYNGOSCOPES: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Laryngoscopy and endotracheal intubation have been reported to invoke the activation of sympathetic nervous system causing marked haemodynamic response. Since video laryngoscopes offer a more magnified view of the glottis and easier tube placement compared with direct Macintosh laryngoscope, they might reduce intubation-caused hemodynamic stress. We conducted this study to measure and compare the haemodynamic responses induced by these two devices in adults who underwent elective surgery under general anaesthesia. **Materials and Methods:** One hundred and fifty patients with age ranging from 18 to 60 years, ASA physical status I–II were included in the study. They were randomly allocated into 2 groups of n = 75 each, group M (Macintosh laryngoscope) and group V (Video laryngoscope). Monitoring included heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure, respiration rate and SaO2 at baseline (immediately before intubation) and 1, 3 and 5 minutes following intubation. **Result:** Both groups exhibited gradual decreases in both heart rate and blood pressure following intubation while retaining stable oxygen saturations and respiratory rates. There was no intergroup difference that reached the statistical threshold. Smoother haemodynamic changes and procedural advantages, including better glottic view, shorter duration of intubation, and lessened use of external laryngeal manoeuvres were noted for video laryngoscopy. **Conclusion:** Macintosh and video laryngoscopes had similar haemodynamic stability. Video laryngoscopy provides other clinical benefits, which is a practical choice for the routine and difficult airway stimuli.

INTRODUCTION

One of the most important parts of contemporary anesthesia practice is securing the airway, which is done by tracheal intubation, which provides ventilation and oxygenation during surgical events. Direct laryngoscopy and intubation process, however, is linked to sympathetic stimulation that is accompanied by considerable haemodynamic changes. These are accelerations of heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure that can amplify the myocardial oxygen requirements, and can be dangerous in patients with a depleted cardiovascular reserve. Sudden haemodynamic changes are unwelcome during the perioperative phase even in normal people.[1,2]

One of the most popular tools of endotracheal intubation is the Macintosh laryngoscope, which was invented in the middle of the 20th century due to its simplicity, accessibility, and integrity. The procedure includes the adaption of the axes of the mouth, throat and voice box, and reducing such movements demands significant tissue repositioning and movement of the cervical spine. Such manipulation tends to lead to an increased sympathetic discharge, which adds to the haemodynamic disturbance of intubation. However, more modern equipment like video laryngoscopes have been created to eliminate these.[1,3,4]

Examples include the video laryngoscopes such as C-MAC system where the camera and display monitor gives an indirect view of the glottis. The technology reduces the necessity of matching airway axes, and the necessity of excessive force and movement of

airway structures. Video laryngoscopy is also linked to better glottic views, less airway trauma, and possibly, mitigated haemodynamic reactions. In addition, the improved perspective usually results in the shortened intubation period, the increased ability to maneuver in challenging airway cases, and the reduced necessity of external laryngeal manipulations.[5–7]

There are a number of clinical trials comparing video laryngoscopes with Macintosh devices. Certain reports indicate similar changes in haemodynamics in both procedures, and some reports provide that video laryngoscopy can affect the sympathetic response more easily. Nevertheless, there are numerous publications dealing with high-risk groups or small sample sizes. There is limited evidence on direct comparisons between the haemodynamic effect of Macintosh and video laryngoscopes on routine elective surgical patients.[8–10]

This gap is then filled by the present prospective, randomized comparative study. The main goal was to compare haemodynamic response such as heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, respiratory rates and oxygen saturation during Macintosh and video laryngoscopy and endotracheal tube intubation. The study would offer strong information on haemodynamic stability and the benefits of the procedural procedure with each device by concentrating on adult patients undergoing elective surgeries by the use of general anesthesia. The results may assist clinicians in their decision-making and demonstrate the possibilities of video laryngoscopy in the field of reliable alternatives to the conventional Macintosh laryngoscopy.

MATERIALS AND METHODS

This was a prospective, randomised comparative study carried out at the Department of Anaesthesiology in a hostpital-based teritiary health care centre for duration of two years (September 2019 -August 2021). The aim of the study was to evaluate and compare hemodynamic responses during laryngoscopy and endotracheal intubation when performed with either a video laryngoscope or Macintosh laryngoscope.

Ethical Considerations and Patient Recruitment

The study was approved by the Institutional Ethics Committee and informed written consent obtained from all participants. Patients of either sex between the ages 18 and 60 years with American Society of Anesthesiologists (ASA) physical status I or II, undergoing elective surgery under general anaesthesia were included. Exclusion comprises pregnancy, presence of oral lesions or masses that prevent laryngoscopy, increased risk for aspiration and the need to secure a nasogastric tube or rapid sequence induction.

Sample Size and Randomization

According to the Cavus et al.'s study, a sample of 61 participants per group was needed; we included an estimated attrition and had 75 per group (total=150). Randomization was carried out through computer-generated sequence in sealed envelopes. Group M were intubated using Macintosh laryngoscope and Group V with the video laryngoscope (C-MAC D-Blade).

Procedure and Monitoring: Airway evaluation along with baseline monitoring (ECG, NIBP, SpO_2) was done. Baseline haemodynamics were recorded. Premedications were 0.2 mg IV glycopyrrolate and 1 mg IV midazolam. Anesthesia was induced in the standard manner and intubation was according to group assignment.

Data Collection and Analysis: Haemodynamic parameters HR, SBP, DBP, MAP, RR and SpO_2 were recorded at baseline, during laryngoscopy and intubation time periods and 1 minute following intubation as well as at 3 minutes post-intubation and finally in the same way at 5 minutes post-intubation. The gathered statistics were processed with SPSS v. 22. Continuous parameters and categorical variables were compared using Student's t test and Chi-square analysis, respectively. P-value < 0.05 was considered the criterion for statistical significance.

RESULTS

The study was completed by 150 patients and 75 of the patients were divided in each group (Macintosh laryngoscope, Group M, and Video laryngoscope, Group V). Demographic and clinical baseline parameters were similar in both groups, so further comparisons of haemodynamic response related to the action of the devices and not to the patient differences.

Table 1: Patient demographics

Group	Male (n)	Female (n)	Mean Age (years)	ASA I (n)	ASA II (n)
Macintosh (Group M)	41	34	38	47	28
Video (Group V)	38	37	36	42	33
Total	79	71	40.5	89	61

The Macintosh laryngoscope group (Group M) consisted of 41 males and 34 females with mean age of 38 years. This sample consisted of 47 patients who were grouped into ASA I (healthy, no systemic disease) and 28 patients who were grouped into ASA II (mild systemic disease) [Table 1].

A total of 38 male patients and 37 female patients formed the Video laryngoscope group (Group V) and the mean age was 36 years. This was a sample of 42

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ASA I patients and 33 patients in the ASA II category.

In total 79 males were considered in the study and 71 females, and the average age of the subjects participated was 40.5 years. Most patients (89 patients) were ASA I and 61 patients were ASA II. These are the same demographics within the two groups that ensured that there was an equal balance of the hemodynamic responses between the laryngoscopy and intubation [Table 1].

Heart Rate (HR): Both groups also exhibited a gradual decrease in the mean heart rate during the entire time periods. Mean HR in Group M dropped to 87.9 beats/min at baseline, to 84.3 beats/min at intubation, to 77.4 beats/min by the 5th minute following intubation. Correspondingly, HR decreased in Group V between baseline (89.4 ± 14.6 beats/min) and intubation (85.2 ± 8.1beats/min) and in the fifth minute (76.6 ± 9.3beats/min). No statistically significant differences were found at any of the time points recorded in intergroup comparisons ($p > 0.05$) [Table 2].

Table 2: Comparison of Average heart rate between the two groups

Time Point	Macintosh Laryngoscopy (Mean ± SD)	Video Laryngoscopy (Mean ± SD	P value
Pre induction	87.9 ± 12.6	89.4 ± 14.6	0.495
At induction	84.3 ± 7.8	85.2 ± 8.1	0.486
1 min	80.4 ± 7.4	80.3 ± 7.2	0.956
3 min	79.9 ±10.7	77.3 ± 7.4	0.086
5 min	77.4 ± 12.8	76.6± 9.3	0.662

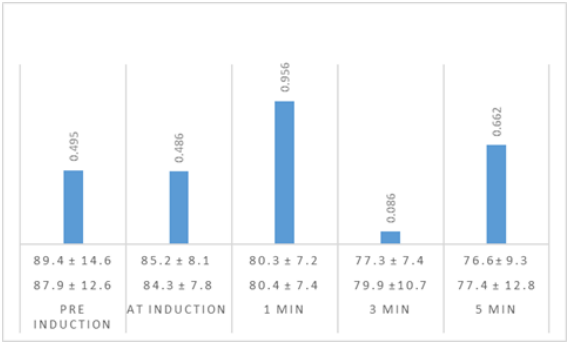

Figure 2 Graph showing the Mean heart rate betwenn

Systolic Blood Pressure (SBP)

There was a progressive decrease in the SBP of both groups after induction and intubation. In group M, the average SBP reduced at the beginning to 125.7 8.9 mmHg then 117.9 8.3 mmHg after intubation, and at the fifth minute, respectively. SBP in Group V decreased baseline to intubation values of 123.8 -7.3 mmHg to 115.8 -10.6 mmHg and subsequently to 111.1 -8.5 mmHg at five minutes, respectively. At none of the intervals were there statistically significant differences between the two groups ($p > 0.05$) [Table 3].

Table 3 Comparision of systolic blood pressure between the Macintosh laryngoscope vs video laryngoscope

Time Point	Macintosh Laryngoscope (Mean ± SD)	Video Laryngoscope (Mean ± SD)	p-value
Pre-induction	125.7 ± 8.9	123.8 ± 7.3	0.148
At intubation	117.9 ± 8.9	115.8 ± 10.6	0.196
1 min	117.9 ± 11.2	119.1 ± 9.8	0.458
3 min	109.4 ± 8.7	109.6 ± 8.4	0.909
5 min	110.5 ± 8.3	111.1 ± 8.5	0.635

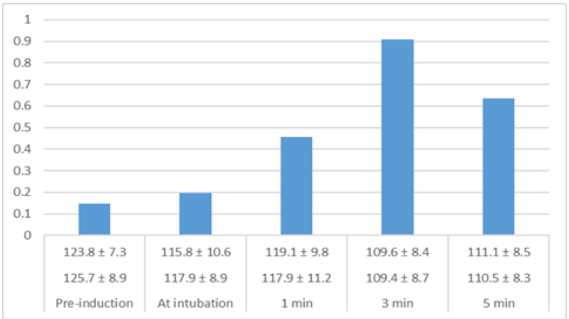

Figure 3: Graph showing systolic blood pressure between Macintosh laryngoscope vs Video Laryngoscope

Diastolic Blood Pressure (DBP).

Table 4 shows the comparison of the diastolic blood pressure of both groups. Group M showed that the baseline was 81.8 ± 7.1 mmHg of DBP, which dropped to 72.6 ± 5.7 mmHg at the time of intubation and increased to 76.4 ± 6.9 mmHg in the fifth minute. Group V recorded a decrease of 79.6 +7.5mmHg to 74.0 +4.4mmHg during intubation and the fifth minute was 74.6 +7.9mmHg. The statistical analysis showed that there was no significant difference between the intergroups at any of the time ($p > 0.05$) [Table 4].

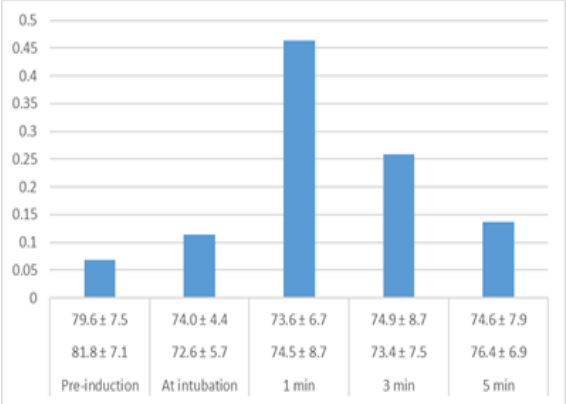

Figure 4: Graph showing Diastolic blood pressure

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Mean Arterial Pressure (MAP)

Group M showed a reduction in 96.4mmHg at baseline to 87.7mmHg at intubation and 87.8mmHg at five minutes of intubation. Group V, MAP levels decreased pre-induction by 94.3 + 6.4 mmHg compared to 87.9 + 4.6 mmHg at intubation, and 86.8 + 6.0 mmHg at the fifth minute. Intergroup differences were not found to be statistically significant at any of measured intervals ($p > 0.05$) [Table 5].

Table 4 Diastolic blood pressure during intubation process

Time Point	Macintosh Laryngoscope (Mean ± SD)	Video Laryngoscope (Mean ± SD)	p-value
Pre-induction	81.8 ± 7.1	79.6 ± 7.5	0.069
At intubation	72.6 ± 5.7	74.0 ± 4.4	0.114
1 min	74.5 ± 8.7	73.6 ± 6.7	0.464
3 min	73.4 ± 7.5	74.9 ± 8.7	0.258
5 min	76.4 ± 6.9	74.6 ± 7.9	0.137

Table 5 Mean Arterial pressure comparison between Macintosh laryngoscope vs video laryngoscope

Time Point	Macintosh Laryngoscope (Mean ± SD)	Video Laryngoscope (Mean ± SD)	p-value
Pre-induction	96.4 ± 7.1	94.3 ± 6.4	0.059
At intubation	87.7 ± 4.3	87.9 ± 4.6	0.799
1 min	89.0 ± 6.6	88.8 ± 4.8	0.836
3 min	85.4 ± 6.0	86.5 ± 5.9	0.274
5 min	87.8 ± 5.6	86.8 ± 6.0	0.299

Respiratory Rate (RR)

The comparison of respiratory rates is presented in [Table 6]. The two groups kept the respiratory rate constant during the study. Group M had a range of mean RR of 16.9 0.7 and 17.2 0.8 breaths/min and Group V with a range of 16.9 0.8 to 17.3 0.8 breaths/min. There was no significant difference between the groups ($p > 0.05$) [Table 6].

Table 6: Respiratory rate comparison between Macintosh laryngoscope vs video laryngoscope

Time Point	Macintosh Laryngoscope (Mean ± SD)	Video Laryngoscope (Mean ± SD)	p-value
Pre-induction	16.9 ± 0.7	16.9 ± 0.8	0.912
At intubation	17.1 ± 0.9	17.0 ± 1.0	0.731
1 min	17.0 ± 0.8	17.0 ± 0.8	0.758
3 min	17.2 ± 1.0	17.3 ± 1.0	0.679
5 min	17.2 ± 0.8	17.3 ± 0.8	0.767

Oxygen Saturation (SpO_2)

Oxygen saturation was quite stable in both groups at every stage of the observation. Group M had SpO 2 of 100.0 ± 0.0% before the induction and 99.6 ± 0.7% at five minutes, whereas Group V had 100.0 ± 0.0% to 99.8 ± 0.5%. There were no noticeable differences in the groups ($p > 0.05$) [Table 7].

Table 7 Oxygen saturation (%) comparison Macintosh laryngoscope vs video laryngoscope

Time Point	Macintosh Laryngoscope (Mean ± SD)	Video Laryngoscope (Mean ± SD)	p-value
Pre-induction	100.0 ± 0.0	100.0 ± 0.0	1
At intubation	99.7 ± 0.5	99.6 ± 0.5	0.608
1 min	99.8 ± 0.4	99.9 ± 0.3	0.484
3 min	99.6 ± 0.7	99.6 ± 0.7	0.639
5 min	99.6 ± 0.7	99.8 ± 0.5	0.254

DISCUSSION

The main objective of the study was to determine the comparison of haemodynamic response of laryngoscopy and intubation with Macintosh and video laryngoscopes when applied to adult patients undergoing elective surgery under general anesthesia.The two devices were tested in terms of heart rate, systolic blood pressure, and diastolic blood pressure, mean arterial pressure, respiratory rate and oxygen saturation.The findings showed that although haemodynamic parameters were similar in their time course of decline in the two groups, no statistically significant differences were observed between them at any specific time point.

The progressive decreases in heart rate and blood pressure that were seen after intubation indicate that both methods ensured stable hemodynamics during anaesthesia.Notably, oxygen saturation levels were held at a steady 100 per cent and there was no clinically significant difference in respiratory rate, once again confirming that the devices were similar when it came to peri-intubation stability.However, the haemodynamic responses of the patients in the video laryngoscope group were a bit smoother, and this finding can be explained by the fact that the

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glottis is indirectly visualized, which minimizes airways manipulations and sympathetic stimulations.This is in agreement with earlier reports.Both Chandrashekhariah et al. and Kanchi et al. found similar haemodynamic effects of video and Macintosh laryngoscopes, even in patients with coronary artery disease.[11,12] On the other hand, Peirovifar et al. found much lower heart rate and blood pressure with video laryngoscopy in hypertensive patients and Parasa et al. found moderately higher increases in haemodynamic parameters with the Glidescope. These discrepancies can indicate the variation in the study design, sample and the kind of video laryngoscope used. In addition to haemodynamic stability, video laryngoscopy had procedural benefits such as improved glottic view, shortened intubation time and less frequent external laryngeal manipulation.[8,13]

The outcomes and complications of the post-operative were not measured and the operator could not be blinded, which might have introduced bias. Overall, the findings support the original objective of the research, which is that it can be concluded that video and Macintosh laryngoscopes elicit similar haemodynamic responses to intubation, but video laryngoscopy can provide more clinical benefits in the procedure than Macintosh laryngoscopy, especially in high-risk or challenging airway control scenarios.

CONCLUSION

It was a prospective randomised trial to assess haemodynamic responses during laryngoscopy and intubation in adult patients undergoing elective surgery under general anesthesia with Macintosh and video laryngoscopes. There were also similarities regarding the stability in variables of heart rate, systolic and diastolic blood pressure, mean arterial pressure, respiratory rate, and oxygen saturation in both devices, and no statistically significant differences were observed at any given time interval. Despite the similarity in haemodynamic patterns, video-laryngoscopy had more smooth responses and had certain procedural benefits, such as, better visualization of the glottis, reduced intubation time, and fewer external laryngeal movements. These characteristics underscore its possible use not in simple airway management, but also in patients with challenging airways or in patients at risk of exaggerated sympathetic reactions. On the whole, video laryngoscopy can be viewed as the safe and effective alternative of the traditional Macintosh laryngoscopy. More multicentric studies that involve increased sample sizes and high-risk groups should be conducted to confirm these results and expand the clinical use of these results.

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