

# A Randomised Control Study Comparing Hemodynamic Response to Laryngoscopy & Endotracheal Intubation with Macintosh Direct Laryngoscope & C-Mac Video Laryngoscope In Adult Patients

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## Abstract

**Background:** Aim: The aim of the present study is to assess and compare the efficacy of Macintosh laryngoscope with C-MAC video laryngoscope in attenuating the hemodynamic stress responses to laryngoscopy and endotracheal intubation. **Subjects and Methods:** A total of 60 patients of ASA grade I or II who were admitted in the hospital for general anaesthesia were included in the study. The total number of patients was randomly divided into two groups containing 30 patients each. In one of the group the endotracheal intubation was performed using the Macintosh laryngoscope while in the other group the endotracheal intubation was performed using the C-MAC video laryngoscope. After successful completion of the intubation process the various hemodynamic parameters were constantly recorded at regular time interval for any sign of hemodynamic response among the patients post intubation. **Results:** Hemodynamic parameters such as systolic, diastolic and mean arterial pressures and mean heart rate were found to be significantly higher among the Macintosh laryngoscope group in comparison to the C-MAC group. However, no significant difference was observed in the percentage of oxygen saturation among the two groups. The time taken for glottis view and total time taken for intubation was found to be significantly higher among the patients intubated with Macintosh laryngoscope in comparison to C-MAC laryngoscope. The increase in the total time taken for intubation was significantly found to increase the hemodynamic response among the patients signifying the increased risk of hemodynamic complications among patients intubated with Macintosh laryngoscope. Cormack-Lehane grading was found to be higher among the patients intubated with the Macintosh laryngoscope which might have resulted in the increased intubation time among the patients intubated with Macintosh laryngoscope. The percentage of successful intubation at the first attempt was also found to be higher in the C-MAC laryngoscope group in comparison to the Macintosh group. The percentage of glottis opening (POGO) was found to increase significantly with C-MAC video laryngoscope in comparison to the Macintosh laryngoscope. **Conclusion:** The study concluded that video guided C-MAC laryngoscope was a better alternative to conventional Macintosh laryngoscope with decreased hemodynamic response and increased successful intubation among the patients.

**Keywords:** hemodynamic response, endotracheal intubation, C-MAC laryngoscope, percentage of glottis opening, Macintosh laryngoscope.

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Received: August 2019

Accepted: August 2019

## Introduction

Laryngoscopy and endotracheal intubation has been well recognized as a gold standard in airway management and considered as important components of general anaesthesia.<sup>[1]</sup> In a standard endotracheal intubation procedure, a flexible endotracheal tube is passed into the trachea under direct vision.<sup>[2]</sup> Different types of rigid laryngoscopes with or without flexible optic light source are routinely used to facilitate the passage of endotracheal tube into the trachea.<sup>[3]</sup> Macintosh laryngoscope which consists of handle and blade with a light source for direct laryngoscopy has been used since long as it is portable and inexpensive.<sup>[4]</sup> However, in patients with head and neck trauma or suspected instability of the cervical spine, the endotracheal intubation

can be challenging for inexperienced persons.<sup>[5]</sup>

To overcome this in recent years video laryngoscopy has been introduced and increasingly used to facilitate endotracheal intubation.<sup>[6,7]</sup>

C-Mac video laryngoscope is a type of video laryngoscope which consists of a standard Macintosh blade with a small camera and a light source at the end of the blade that connects to a video display. The present study was conducted to assess hemodynamic responses such as heart rate, systolic, diastolic and mean arterial pressures in patients during endotracheal intubation using the conventional laryngoscope (Macintosh laryngoscope) and the C-MAC video laryngoscope, to assess the success rate of the first attempt intubation using Macintosh laryngoscope and C-MAC laryngoscope and to assess the visibility of the larynx.

## Subjects and Methods

Ethical approval for this study was obtained from the Institutional Ethics committee of Narayana Medical College & Hospital, Nellore, A.P. A total of 60 patients of ASA grade I or II who were admitted in the hospital for general anaesthesia were included in the study. The total number of patients was randomly divided into two groups containing 30 patients each. The study sample consisted of individuals of either sex and between the age group of 20-70 years. The study period was from January 2017 to July 2018 in Narayana Medical College & Hospital. Informed and written consent was obtained from all the patients.

The inclusion and the exclusion criteria for the selection of study population were as follows: patients with ASA grade I and II, aged between 20-70 of either sex, patients undergoing elective surgical procedures under general anaesthesia and patients with Mallampatti grade of I and II were included. Pregnant patients, patients with hepatic failure, renal failure and cardiac conduction abnormalities, patients with history of asthma or chronic obstructive pulmonary disease, obese patients with a BMI of more than 30, patients with less than 18 years and more than 70 years of age, patients with ASA grade of III and IV and with a difficult airway and patients with Mallampatti grade of III and IV were excluded.

Pre-anaesthetic evaluation was performed on the previous evening before surgery. On the day of surgery, in the operation theatre intravenous line was started and pulseoxymeter, noninvasive blood pressure cuff and ECG monitors were connected to record the baseline hemodynamic parameters such as the systolic, diastolic, and mean arterial pressures, mean heart rate as well as the percentage of oxygen saturation among the patients prior to intubation. All patients were preoxygenated with 100% oxygen and were premedicated with Inj.Glycopyrrolate 10 mcg/kg, Inj.Midazolam 0.05-0.1 mg/kg, Inj.Fentanyl 1-2 mcg/kg. After preoxygenation, induction was done using Inj.Thiopentone 3-5 mg/kg and Inj.Vecuronium 0.1 mg/kg was given intravenously and intubation done after 3 min. After intubation, anesthesia was maintained with Isoflurane 0.4-1.2 vol%, Air 1.5 L/min, and O<sub>2</sub> 1.5 L/min. An 8.0 mm tube was used for males and a 7.0 mm tube used for females during the endotracheal intubation. All intubations were performed by a single anesthesiologist who has more than 2 years experience with the C-MAC. Parameters such as the Cormack-Lehane score, the time for glottis view, total intubation time, number of intubation attempts and percentage of glottis view were recorded for analysis of the data pertaining to the safety and efficacy of the laryngoscopes. After successful completion of the intubation systolic blood pressure(SBP), diastolic blood pressure(DBP), mean arterial pressures(MAP) in mmHg, mean heart rate(HR) in beats per minute(bpm) and percentage of oxygen saturation(SpO<sub>2</sub>) were monitored at 0,1,3 and 5 min post laryngoscopy and post intubation time intervals respectively.

### Statistical analysis

All the demographic, pre-operative vitals and post-operative assessments were expressed either as mean along with the standard deviation in case of continuous variables or as

number along with percentage in case of categorical variables. The statistical differences between various pre-operative and post-operative variables were calculated either with t-test or chi square test depending on the variable. The correlations among the various continuous and categorical variables were calculated using Pearson's correlation coefficient and Spearman's correlation coefficient respectively. A p value of less than 0.05 was statistically considered to be significant while a p value of less than 0.01 was considered to be highly significant. All the statistical analyses were performed using IBM SPSS Statistics 24 software.

## Results

The study comprised of 60 individuals in whom 30 were intubated using Macintosh laryngoscope while the remaining 30 with C-MAC video laryngoscope.

The demographic data in terms of age, weight, and height was similar in both the groups. The percentage of male and female patients in the study was 53.3 % and 46.7 % respectively.

The percentage of subjects with the grade I and grade II mallampati score intubated with Macintosh laryngoscope were 66.7% and 33.3% respectively while the with C-MAC video laryngoscope they were 63.3% and 36.7% respectively.

**Table 1: Demographic data and pre-operative observations of the patients.**

Pre-Operative vitals		Mean ± SD/ Number (%)		P value
Gender	Male	32 (53.3)		
	Female	28 (46.7)		
Age	Male	44.22 ± 12.28		0.36b
	Female	47.25 ± 13.47		
Height (cm)	Male	174.25 ± 6.6		<0.01**b
	Female	164.89 ± 5.4		
Weight (Kg)	Male	65.4 ± 7.67		<0.01**b
	Female	55.68 ± 6		
Body mass index (BMI)	Male	21.49 ± 1.6		<0.01**b
	Female	20.43 ± 1.29		
Type of laryngoscope	Macintosh	30 (50)		
	C-MAC	30 (50)		
ASA Grade	I	Male	25 (41.7)	0.08a
		Female	16 (26.7)	
	II	Male	7 (11.6)	
		Female	12 (20)	
Mallampati score	Macintosh	I	20 (66.7)	0.78a
		II	10 (33.3)	
	C-MAC	I	19 (63.3)	
		II	11 (36.7)	

a-Chi-square test; b- t-test; \*\*p<0.01

**Table 2: Pre and post-operative mean heart rate (HR) of the patients under study.**

Time interval	Type of laryngoscope	Mean ± SD/ Number (%)	P value
Baseline	Macintosh	80 ± 5.9	0.12a
	C-MAC	78 ± 4.4	
0 min	Macintosh	87 ± 5.89	<0.01**a
	C-MAC	83 ± 4.65	
1 min	Macintosh	87 ± 6.25	<0.01**a
	C-MAC	82 ± 4.76	
3 min	Macintosh	84 ± 5	<0.01**a
	C-MAC	81 ± 5.3	
5 min	Macintosh	83 ± 5.2	<0.01**a
	C-MAC	79 ± 5	

Percentage of individuals with the grade I Cormack-Lehane score was higher in the C-MAC laryngoscope group (46.7%) than that of the Macintosh laryngoscope (20%). The percentage of individuals with grade II and III among the Macintosh laryngoscopy group (36.7% and 33.3% respectively) was higher than that of the C-MAC video laryngoscopy group (33.3% and 20% respectively).

**Table 3: Pre and post-operative mean arterial pressure (MAP) of the patients under study.**

Time interval	Type of laryngoscope	Mean ± SD/ Number (%)	P value
Baseline	Macintosh	98 ± 9	0.24a
	C-MAC	95 ± 6	
0 min	Macintosh	102 ± 10.10	<0.05*a
	C-MAC	97 ± 6.35	
1 min	Macintosh	103 ± 9.26	<0.01**a
	C-MAC	98 ± 6.39	
3 min	Macintosh	104 ± 9.09	<0.01**a
	C-MAC	99 ± 6.05	
5 min	Macintosh	105 ± 8.9	<0.01**a
	C-MAC	98 ± 6.59	

• t-test; \*p<0.05, \*\*p<0.01

**Table 4: Pre and post-operative mean oxygen saturation (SpO2) of the patients under study.**

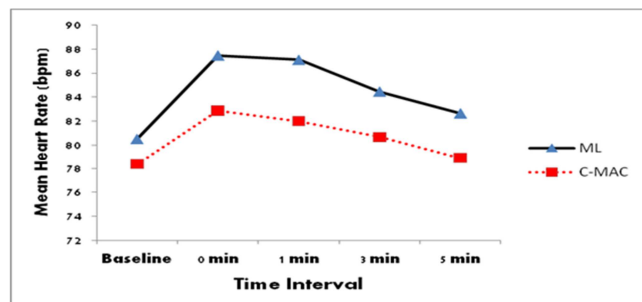
Time interval	Type of laryngoscope	Mean ± SD/ Number (%)	P value
Baseline	Macintosh	97.4 ± 0.81	1a
	C-MAC	97.4 ± 0.67	
0 min	Macintosh	96.7 ± 0.62	0.85a
	C-MAC	96.8 ± 0.76	
1 min	Macintosh	96.9 ± 0.78	0.21a
	C-MAC	97.2 ± 0.64	
3 min	Macintosh	97.2 ± 0.63	0.69a
	C-MAC	97.3 ± 0.66	
5 min	Macintosh	97.3 ± 0.75	0.86a
	C-MAC	97.3 ± 0.67	

a- t-test

C-MAC video laryngoscope had the highest percentage of individuals (80%) with a successful intubation at the first attempt in comparison to Macintosh (60%).

There was no statistically significant difference in the baseline values of all the study parameters among the two groups.

It was observed that in both the groups the mean heart rate increased during the 0 min of intubation which gradually decreased with time. This level of increase at 0,1,3 and 5 min interval was higher in Macintosh group when compared to C-MAC video laryngoscope group [Figure 1] which is statistically significant(p<0.01).



**Figure 1: Comparing the mean heart rate among individuals at different time intervals during and post intubation performed with Macintosh laryngoscope and C-MAC video laryngoscope**

The mean DBP, SBP and MAP among patients during and post intubation increased gradually in both the groups.

**Table 5: Table showing the meantime taken for glottis view and intubation time among individuals intubated with Macintosh and C-MAC video laryngoscope.**

	Type of laryngoscope	Mean ± SD	P value
Time for glottis view (s)	Macintosh	12.23 ± 3.77	<0.01**a
	C-MAC	5.9 ± 1.15	
Time to intubate (s)	Macintosh	15.87 ± 3.43	0.09a
	C-MAC	14.53 ± 2.48	
Total intubation time (s)	Macintosh	29.9 ± 6.18	<0.01**a
	C-MAC	22.33 ± 3.85	

• t-test  
• \*\* p<0.01  
• SD- Standard deviation

**Table 5: Table comparing laryngeal pressure and POGO score among patients intubated with Macintosh and C-MAC video laryngoscope.**

	Type of laryngoscope	Number (%) / Mean ± SD	p value
Laryngeal pressure	Macintosh	19 (63.3)	
	C-MAC	5 (16.7)	
POGO Score	Macintosh	61.33 ± 20.8	<0.01**a
	C-MAC	80.67 ± 15.9	

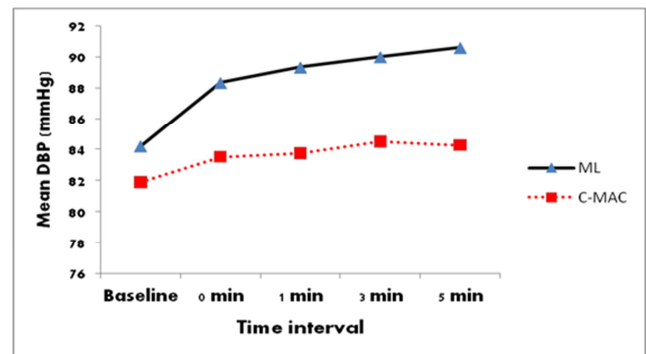
• t-test; \*\*p<0.01

However, in C-MAC group the mean DBP [Figure 2] and SBP [Figure 3] was more or less of the same levels during the 3 min and 5 min post intubation period. There was a significant difference in the mean DBP and SBP during the 0 min, 1 min, 3 min and 5 min post intubation time period among the Macintosh and the C-MAC video laryngoscopic group.

**Table 6: Correlation between the total time taken for intubation and the mean of SBP, DBP, MAP, SpO2 and HR among patients.**

Factors	Pearsonr	95 % CI	P value
Systolic blood pressure (SBP)	0.50	0.28 to 0.67	<0.01**
Diastolic blood pressure (DBP)	0.47	0.24 to 0.64	<0.01**
Mean arterial pressure (MAP)	0.54	0.33 to 0.70	<0.01**
Oxygen saturation (SpO2)	0.08	-0.17 to 0.33	0.50
Heart rate (HR)	0.44	0.22 to 0.63	<0.01**

• \*\* p<0.01  
• r- Coefficient of correlation  
• CI- Confidence interval



**Figure 2: Comparing the mean diastolic blood pressure among individuals at different time intervals during and post intubation performed with Macintosh laryngoscope and C-MAC video laryngoscope**

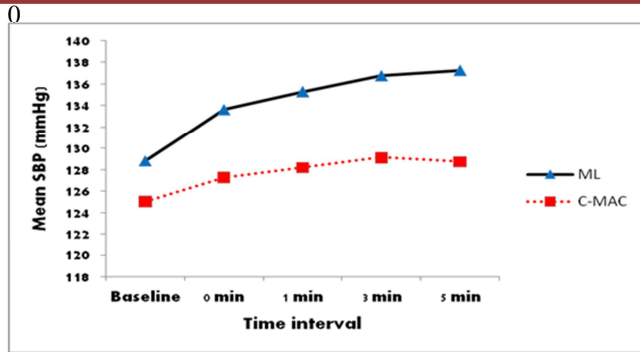


Figure 3: Comparing the mean systolic blood pressure among individuals at different time intervals during and post intubation performed with Macintosh laryngoscope and C-MAC video laryngoscope

In C-MAC group the mean MAP during the 5 min post intubation period was lower than the levels during the 3 min period [Figure 4]. There was a significant difference in the mean MAP during the 0, 1, 3 and 5 min post intubation time period among the Macintosh and the C-MAC video laryngoscopic group.

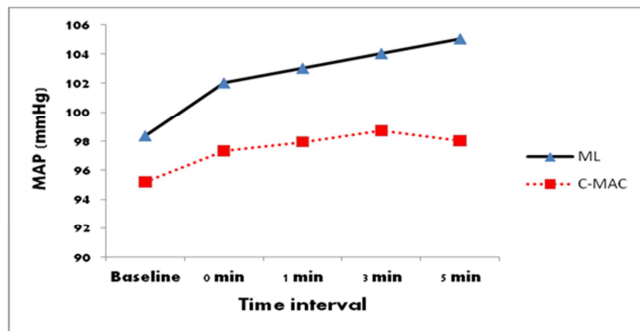


Figure 4: Comparing the mean arterial pressure among individuals at different time intervals during and post intubation performed with Macintosh laryngoscope and C-MAC video laryngoscope

In both the groups the mean SpO<sub>2</sub> dropped during the 0 min intubation period which gradually increased with time. The level of SpO<sub>2</sub> decrease among the Macintosh group during the 0 min interval was found to be higher than that of the C-MAC group [Figure 5]. However, no significant difference was observed for the 0, 1, 3, and 5 min post intubation time period among both the groups.

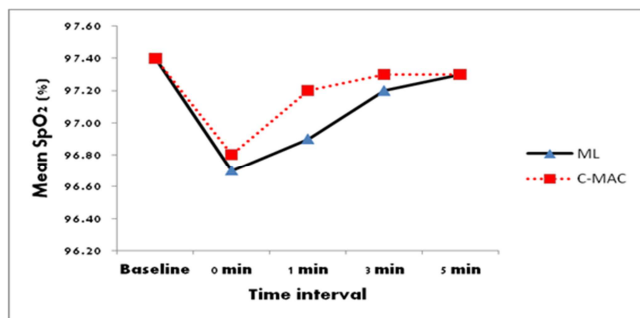


Figure 5: Comparing the mean SpO<sub>2</sub> percentage among individuals at different time intervals during and post intubation performed with Macintosh laryngoscope and C-MAC video laryngoscope

The mean time taken for glottis observation was found to be significantly ( $p < 0.01$ ) higher among the individuals intubated with Macintosh laryngoscope (12.23 s) in comparison to those intubated with the C-MAC video laryngoscope (5.9 s) [Figure 6].

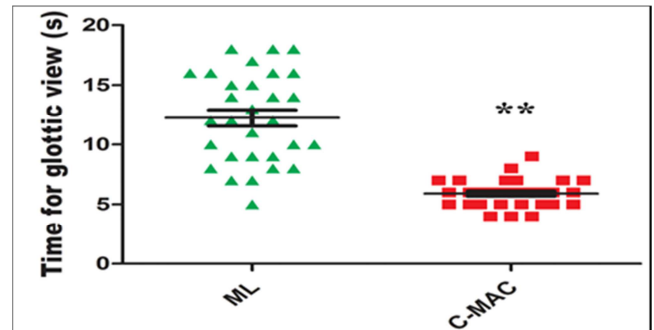


Figure 6: Comparison of the time taken for glottis view during intubation performed using Macintosh laryngoscope and C-MAC video laryngoscope. \*\* denotes  $p < 0.01$

No significant difference was observed for the time taken for intubation among those intubated with Macintosh (15.87s) and C-MAC laryngoscope (14.53 s) (Figure 7).

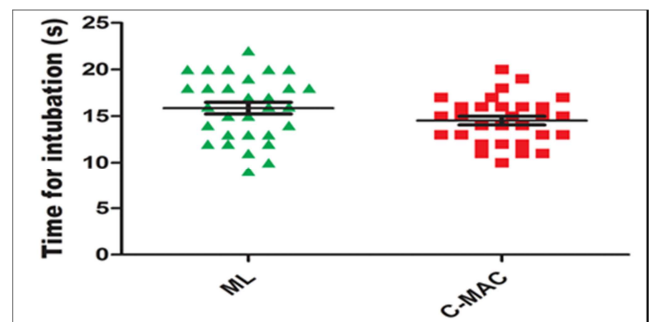


Figure 7: Comparison of the time taken to intubate using Macintosh laryngoscope and C-MAC video laryngoscope.

The total intubation time was found to be significantly ( $p < 0.01$ ) higher among the individuals intubated with Macintosh laryngoscope (29.9 s) in comparison to those intubated with the C-MAC video laryngoscope (22.33s) [Figure 8].

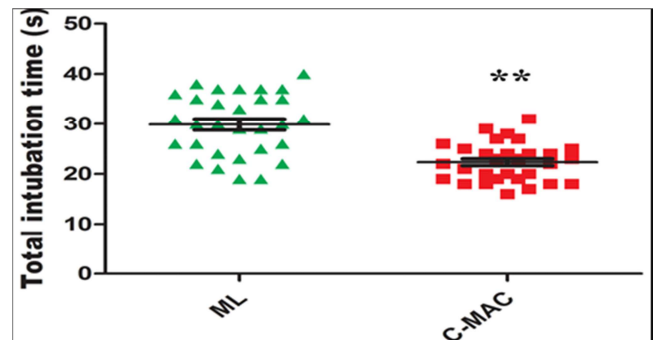
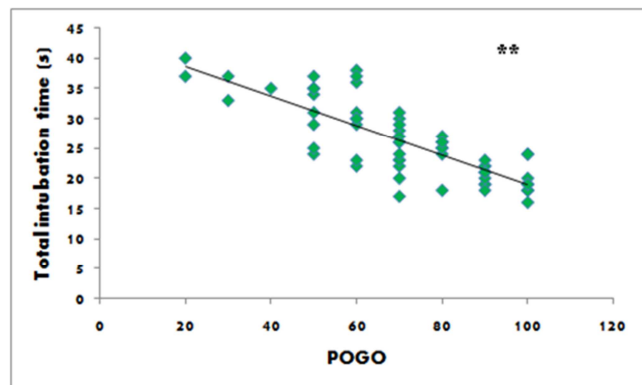


Figure 8: Comparison of the total intubation time using Macintosh laryngoscope and C-MAC video laryngoscope. \*\* denotes  $p < 0.01$

Pearson correlation indicated that with a decrease in the POGO percentage, the total time taken for intubation

increased which is statistically significant at  $p < 0.01$  [Figure 9]. The mean POGO score among individuals intubated with the Macintosh laryngoscope (61.33%) was found to be significantly lower than those intubated with the C-MAC laryngoscope (80.67%).



**Figure 9: Chart showing the correlation scatter graph between the percentage of glottis opening (POGO) and the total intubation time among patients. \*\* denotes  $p < 0.01$**

A significant positive Pearson correlation was observed between total intubation time and mean SBP (0.50), DBP (0.47), MAP (0.54) and HR (0.44) levels. This indicates that the increase in the total intubation time leads to the increase in SBP, DBP, MAP and HR levels.

## Discussion

This randomized controlled study was designed to compare the hemodynamic responses such as heart rate, systolic, diastolic and mean arterial pressures in patients during endotracheal intubation using Macintosh laryngoscope and C-MAC video laryngoscope. The study also compared the visibility of the larynx and success rate at the first attempt of intubation among patients using the Macintosh and the C-MAC video laryngoscope.

From the study it has been observed that the hemodynamic response was significantly reduced among the patients that were intubated using the C-MAC video laryngoscope in comparison to Macintosh laryngoscope. In both the groups it was observed that the mean heart rate, systolic, diastolic and mean arterial pressures increased just after the completion of the intubation. However, among patients intubated with C-MAC video laryngoscope, the mean arterial pressure increased up to the 3 min time interval post intubation followed by a fall in the mean arterial pressure.

The observed increased levels in the hemodynamic parameters among both groups can be explained as the result of the sudden response of the sympathetic system to the laryngoscopic procedure and to the post intubation effect of the laryngeal pressure exerted during laryngoscopy, irritation caused due to the entrance of the tube through the trachea, expansion of the cuff, and pressure exerted on the ring cartilage.

Our study was consistent with the one conducted by Mogahed et al., in which they have reported that the hemodynamic response post laryngoscopy was significantly well maintained in C-MAC group in comparison to those

intubated with Macintosh laryngoscope<sup>[7]</sup>

However, our study was inconsistent with Sarkilar et al., and Chandra Shekaraiah et al. where the hemodynamic response among the patients intubated with Macintosh and C-MAC video laryngoscope were found to be more or less similar.<sup>[11,12]</sup>

Report presented by Sarkar et al. however justified our result mean heart rate and blood pressure among the patients of the direct laryngoscope group was found to be more than 2 fold higher in comparison to those intubated with video laryngoscope.<sup>[13]</sup>

In this study no significant difference in the level of the percentage of oxygen saturation (SpO<sub>2</sub>) was observed among the patients intubated with Macintosh and C-MAC video laryngoscope. Similar results were also reported previously by Mogahed et al., Noppens et al., Sarkar et al., where no difference was observed in the level of SpO<sub>2</sub> among those intubated with Macintosh and C-MAC video laryngoscope.<sup>[7,13,14]</sup> However, in a study by Goksu et al., it was reported that the number of patients with oxygen saturation level below 90% was greater among the patient's group intubated with Macintosh laryngoscope in comparison to those intubated with C-MAC video laryngoscope which was inconsistent with our study.<sup>[15]</sup>

During intubation major contributors of increased sympathetic response includes the force exerted during laryngoscopy, the time duration of complete intubation as well as the number of intubation attempts for successful intubation.<sup>[16]</sup>

While comparing the laryngoscopic view using the Cormack-Lehane score it was observed that the individuals intubated with the C-MAC video laryngoscope displayed a better visibility of the glottis in comparison to those intubated with the Macintosh laryngoscope.

Our study was consistent with previous studies by Van et al., and Kaplan et al., and Shimada et al., where it was also reported that compared with direct visualization video assisted visualization provided better and improved laryngoscopic view.<sup>[17,18,19]</sup>

However, in a study by Vassiliadis et al., it was reported that the C-MAC video laryngoscope did not provide any enhanced view of the larynx during intubation in comparison to the conventional Macintosh laryngoscope which contradicts our findings.<sup>[21]</sup>

The number of patients with successful intubation at the first attempt was found to be higher among the C-MAC video laryngoscopy group in comparison to that of the Macintosh group.

These findings were found to be consistent with the one reported by Aziz et al., where the percentage of patients with the successful intubation at the first attempt was found to be 93% with video laryngoscope while it is 84% among direct laryngoscope which is significant.<sup>[20]</sup> Similar findings were reported in studies by Sulser et al.,<sup>[22]</sup> Sakles et al.,<sup>[23]</sup> and Rida et al., {FouadRida, 2017 #61} Noppens et al.,<sup>[14]</sup>

However, in a study by Driver et al., no difference was observed neither in the incidence of first-pass success attempts nor the duration of the intubation time among the patients intubated with either C-MAC video laryngoscope or Macintosh laryngoscope which is contradictory to the results that was obtained in the study.<sup>[24]</sup> According to Lee JH et al.,

the increased number of attempts during tracheal intubation was found to be associated with increased risk of desaturations and tracheal intubation associated events (TIAEs) Our study was inconsistent with that of the Cattano et al., where no significant difference in the total intubation time was observed among the C-MAC and the Macintosh laryngoscope group.<sup>[25,26]</sup> In studies by Shin et al., Kinicaslan et al., similar observations were obtained where the C-MAC was found to be associated with an improved laryngeal view as well as with a higher success rate of intubation compared to the Macintosh blade.<sup>[27,28]</sup>

The percentage of glottis view among the patients intubated using the C-MAC video laryngoscope was found to be 80.67% whereas with conventional Macintosh laryngoscope it was found to be 61.33%. The total intubation time taken was found to decrease significantly as POGO score of the patient increases.

Similar result was also observed by Kılıçaslan et al., Noppens et al., where a significantly improved POGO score was observed among patients intubated with the C-MAC video laryngoscope in comparison to that of the Macintosh laryngoscope.<sup>[28]</sup> The mean POGO score of the patients intubated with Macintosh laryngoscope was found to be 42% while the mean POGO score of those intubated with C-MAC video laryngoscope was found to be 76%.<sup>[14,29]</sup> Eismann et al., observed that hyper-angulated blade geometries of the C-MAC video laryngoscope provided a better view as well as viewing angle in comparison to that of the standard blade geometry of the Macintosh-type laryngoscope.<sup>[30]</sup>

Pournajafian et al. reported that although the intubation time was reported to be higher among the patients intubated with video laryngoscope did not result in the increase of the hemodynamic responses.<sup>[31]</sup> In a study by İnangil et al., it was reported that there was no difference in the time taken for intubation among the patients performed with video laryngoscope or conventional laryngoscope nor there was any difference in the hemodynamic responses among the patients of the two groups.<sup>[32]</sup> Direct laryngoscopy involves stretching the oropharyngeal tissues in an attempt to straighten the angle between the mouth and the glottic opening, and this stretch can cause pain and trigger a stress response. Both laryngoscopy and intubation separately result in sympathetic stimulation, but the catecholamine rise with intubation exceeds that with laryngoscopy alone. These findings may reflect the fact that video laryngoscopes provides a view of the glottis without the need to align the oral, pharyngeal, and tracheal axes, reducing cervical movement thereby reducing the potential for hemodynamic stimulation.

In a C-MAC video laryngoscope the operator despite remaining in the usual intubation position can also easily change the view from the oropharynx in the display monitor, which allows for simultaneous observation of the patient and the video display. The C-MAC video laryngoscope technique can be used for multiple viewing by more than one person, demonstration purpose to the students, supervision as well as teaching purpose. The C-MAC video laryngoscope may also

allow for video-taping the entire intubation procedure for subsequent review or documentation of the intubation process.

## Conclusion

The study reported that various hemodynamic parameters such as systolic, diastolic and mean arterial pressures and mean heart rate were found to be significantly higher among the Macintosh laryngoscope group in comparison to the C-MAC group. However, no significant difference was observed in the percentage of oxygen saturation among the two groups.

The time taken for glottis view and total time taken for intubation was found to be significantly higher among the patients intubated with Macintosh laryngoscope in comparison to C-MAC laryngoscope. The increase in the total time taken for intubation was significantly found to increase the hemodynamic response among the patients signifying the increased risk of hemodynamic complications among patients intubated with Macintosh laryngoscope. Cormack-Lehane grading was found to be higher among the patients intubated with the Macintosh laryngoscope which might have resulted in the increased intubation time among the patients intubated with Macintosh laryngoscope. The percentage of successful intubation at the first attempt was also found to be higher in the C-MAC laryngoscope group in comparison to the Macintosh group. The percentage of glottis opening (POGO) was found to increase significantly with C-MAC video laryngoscope in comparison to the Macintosh laryngoscope. The study concluded that video guided C-MAC laryngoscope was a better alternative to conventional Macintosh laryngoscope with decreased hemodynamic response and increased successful intubation among the patients.

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**How to cite this article:** Kumar VA, Raj BP, Rajesh VSP, Chandradhar AM. A Randomised Control Study Comparing Hemodynamic Response to Laryngoscopy & Endotracheal Intubation with Macintosh Direct Laryngoscope & C-Mac Video Laryngoscope In Adult Patients. Acad. Anesthesiol. Int. 2019;4(2):142-148.

DOI: [dx.doi.org/10.21276/aan.2019.4.2.33](https://doi.org/10.21276/aan.2019.4.2.33)

**Source of Support:** Nil, **Conflict of Interest:** None declared.