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Original Research Article

Comparison of Ease of Endotracheal Intubation and Hemodynamic Response using Mc Grath Mac Videolaryngoscope and Conventional Macintosh Laryngoscope in Adult Surgical Patients

Surbhi Sahay[1], Surya Prakash[2], Sandhya Evney[3]

[1]Professor, Dept. of Anesthesia, BMHRC, Bhopal, MP, India
[2]Junior Resident, Dept. of Anesthesia, BMHRC, Bhopal, MP, India
[3]Associate Professor, Dept. of Anesthesia, BMHRC, Bhopal, MP, India

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Corresponding author: Dr. Surya Prakash
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Abstract

Introduction: Airway management is an essential component of anaesthetic practice and emergency medicine. The Macintosh laryngoscope has long been the standard for tracheal intubation. However, advancements in technology have introduced video laryngoscopes like the McGrath Mac videolarygoscope designed to provide enhanced glottic visualization and potentially improve intubation outcomes. Despite widespread use in difficult airway scenarios, their effectiveness in routine elective surgeries remains under scrutiny. This study aims to compare the ease of intubation and hemodynamic responses using McGrath Mac video laryngoscope versus the conventional Macintosh laryngoscope in patients with normal airways.

Aims and Objectives: The primary objective was to evaluate the ease of intubation based on time taken for laryngoscopy, time taken for intubation, and the Percentage of Glottic Opening (POGO) score. The secondary objective was to assess hemodynamic stress responses, including heart rate and blood pressure variations during and after intubation.

Materials and Methods: A prospective randomized controlled study was conducted on 100 adult patients (ASA Grade I–III), scheduled for elective surgery under general anaesthesia. Patients were randomly divided into two groups: Group V (McGrath Mac video laryngoscope) and Group M (Macintosh laryngoscope), with 50 patients each. Key parameters measured included time for laryngoscopy, time for intubation, POGO score, number of attempts, and hemodynamic variables (heart rate, systolic and diastolic blood pressure, and SpO_2) at various time points during intubation.

Results: The McGrath Mac video laryngoscope provided significantly superior glottic views with a higher mean POGO score (91.3% vs. 81.4%; $p<0.001$). However, intubation was slower in Group V, with longer laryngoscopy (11.33±2.52 sec vs. 7.47±1.32 sec) and intubation times (20.58±2.18 sec vs. 16.39±1.78 sec), both statistically significant ($p<0.001$). First-attempt success rates were comparable across both groups. Importantly, the McGrath Mac group exhibited a significantly lower hemodynamic stress response, with reduced heart rate and blood pressure changes during and after intubation.

Conclusion: While the McGrath Mac video laryngoscope requires more time for laryngoscopy and intubation, it offers significant advantages in glottic visualization and attenuation of hemodynamic stress responses. These findings support its use as a valuable tool for routine airway management, particularly in patients where cardiovascular stability is a priority.

Keywords: McGrath Mac; Macintosh; Ease of Intubation; POGO score.

Introduction

In the evolving era of airway management, newer video laryngoscopes, ultrasound to identify difficult airway, virtual endoscopy and use of artificial intelligence have greatly improved the success rate of securing the airway. [1] Literature cites McGrath Mac videolaryngoscope (VL)to be potentially successful in challenging laryngoscopy conditions when compared to a standard Macintosh laryngoscope.[2,3] However, its efficacy in tracheal intubation has been demonstrated to be inconsistent [4.5]. Several randomized controlled trials have been conducted to compare the success rate but not many studies have deliberated the practical usefulness such as time for laryngoscopy, time for intubation, POGO score, number of intubation attempts and assessing ease of intubation between

Macintosh laryngoscope and McGrath Mac VL in normal airway for routine elective surgery. Thus, this study was designed to compare the ease of intubation with McGrath Mac VL and conventional Macintosh laryngoscope in adult patients undergoing elective surgery.

Objectives:

1. To compare the ease of intubation using McGrath Mac VL and conventional Macintosh laryngoscope by using time taken for intubation, time taken for laryngoscopy and Percentage of glotttic opening (POGO) scoring.
2. To compare the hemodynamic stress response elicited in McGrath Mac video laryngoscope and conventional Macintosh laryngoscope by heart Rate and blood pressure recorded at pre induction, induction, and intubation and at 1 minute, 3- and 5-minutes post intubation.

Methodology:

This prospective randomized controlled study was conducted over a duration of 18 months after obtaining approval from Institutional Ethics Committee. All patients 18-60 years of age, either gender and ASA grade 1 &2 undergoing elective surgery under general anesthesia were included in the study. Patients were randomized according to odd and even calendar date. Informed written consent was taken from all patients included in the study. On the day prior to surgery, pre anesthetic evaluation including airway assessment was done by using Mallampati grading, thyromental distance and hyomental distance to predict the possibility of difficult laryngoscopy and intubation. Sample size calculated using two-proportion test formula was 100.Patients were then randomly allocated into two groups of 50 patients each as:

Group V- intubated with McGrath Mac VL.

Group M - intubated with Macintosh laryngoscope.

On the day of surgery, patients were kept nil orally for at least 6 hours prior to surgery. Baseline values of heart rate, SpO_2 and blood pressure were recorded using 5 para monitor on arrival of the patients in the pre-operative room and patients were randomized into one of the two groups. Premedication including inj. midazolam 0.05mg/kg and inj. fentanyl 2µg/kg was administered to all patients followed by preoxygenation with 100% oxygen. Induction was done with inj. propofol 2mg/kg and inj. vecuronium 0.08 mg/kg was given. Laryngoscopy and intubation were carried out by a skilled and experienced anaesthesiologists with an experience of tracheal intubation of more than 25 video laryngoscopy using McGrath Mac VL and more than 100 tracheal intubations using conventional Macintosh laryngoscope. Anesthesia was maintained with 50% oxygen in air and 0.5- 1% v/v of isoflurane with closed flow rate of 2l/min. neuromuscular blockade was achieved with intermittent doses of inj. vecuronium. At the end of surgery, residual neuromuscular blockade was reversed with inj. neostigmine 0.05mg/kg and inj. glycopyrrolate 0.01mg/kg. The patient's trachea was extubated after adequate reversal of neuromuscular blockade and return of spontaneous respiration. The data was first entered into Microsoft Excel using a customized form for analysis. Statistical analysis was conducted using trial versions of SPSS, MS Excel and online software to calculate the p-values, mean and Standard Deviation (SD). Pearson Chi-square test was used to determine the relationship between variables. Categorical variables were compared using the chi-square test. Quantitative variables were represented as mean and standard deviation. An independent t-test was used to assess the significance and identify the mean difference between quantitative and qualitative variables. p-value of less than 0.05was considered significant. Time for laryngoscopy was time taken from insertion of laryngoscope through the lips to visualize the glottis. Time for intubation was taken from removal of face mask used for oxygenation till the precise position of endotracheal tube confirmed by first visible EtCo2 in the capnogram.

Grading the view of glottis with POGO score at the time of laryngoscopy.

A complete view of the glottis from the anterior commissure to the inter-arytenoid notch is represented by a POGO score of 100%. When the POGO, score is zero, it indicates that not even the inter-arytenoid notch is visible. If lower one third of vocal cords and arytenoids are visible it is given as 33%. In our study we have incorporated POGO scoring to dynamic real time laryngoscopy.

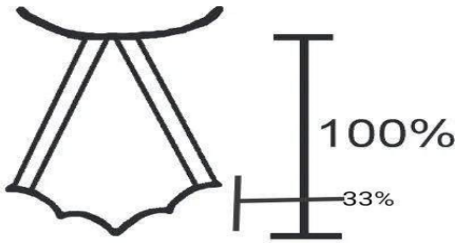

Figure 1:

Results

Table 1: Demographic Data

Parameters	Group V (n =50)	Group M (n =50)	p value
Age (years)	49.18±13.524	47.00±11.595	0.389
Male	42%	50%	0.422
Female	58%	50%	
Mallampati -Grade 1	46%	36%	0.309
Mallampati-Grade 2	54%	64%	
Mean Thyromental distance	8.43±1.0183cm	8.61±0.6932cm	0.304
Mean Hyomental distance	6.366±0.8375cm	6.398±0.6278cm	0.829

The demographic profile of the patients (Table 1) showed no significant differences between the two groups.

Table 2: Ease of Intubation

	Group V		Group M		p value
Time taken for laryngoscopy	11.33±2.52 Seconds		7.47±1.32 seconds		<0.001
Time taken for Intubation	20.58±2.18 Seconds		16.39±1.78 seconds		<0.001
Percentage of glottic opening	91.30±12.07%		81.40±16.96%		<0.001
No of attempts	Attempt 1	Attempt 2	Attempt 1	Attempt 2	0.475
No of patients	49	1	49	1	

The mean time for laryngoscopy was significantly longer with the McGrath Mac VL (11.33 ± 2.52 seconds) compared to the Macintosh laryngoscope (7.47 ± 1.32 seconds, p<0.001).

Similarly, the mean time for intubation was also longer in the McGrath group (20.58 ± 2.18 seconds) than in the Macintosh group (16.39 ± 1.78 seconds, p<0.001).

Despite this, the McGrath group provided a better laryngeal view, reflected in a higher POGO score (91.30 ± 12.07%) compared to the Macintosh group (81.40 ± 16.96%, p<0.001)

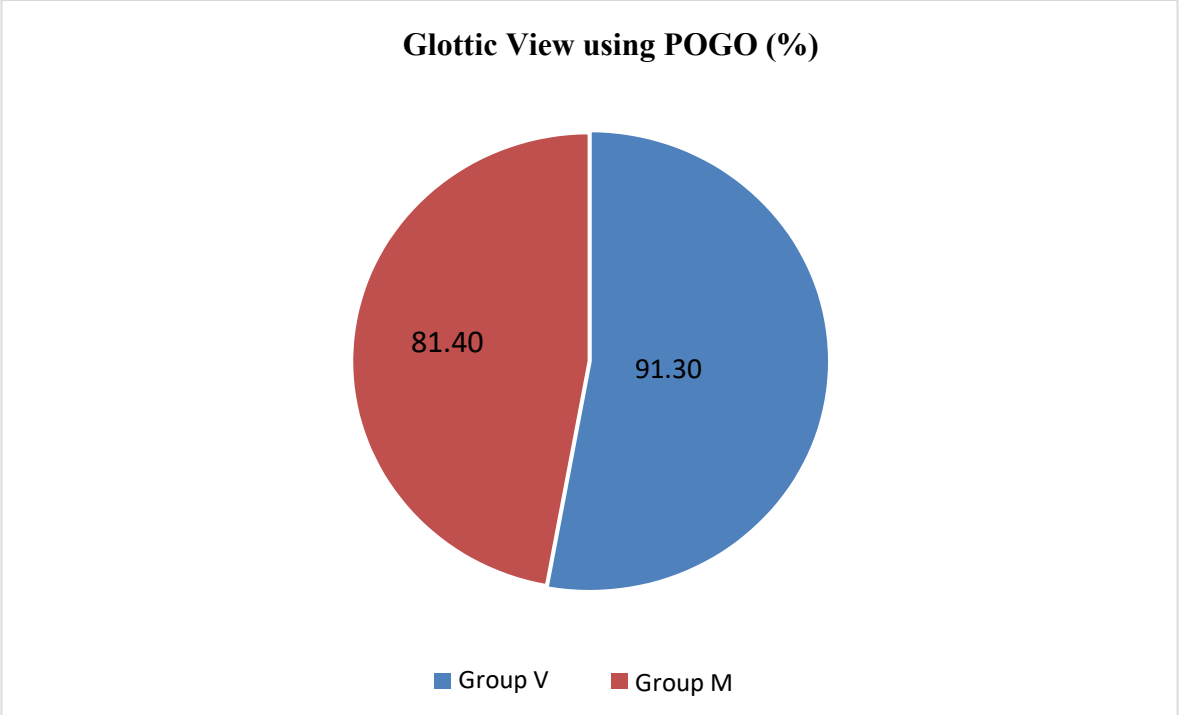

Figure 2: Glottic View using POGO (%)

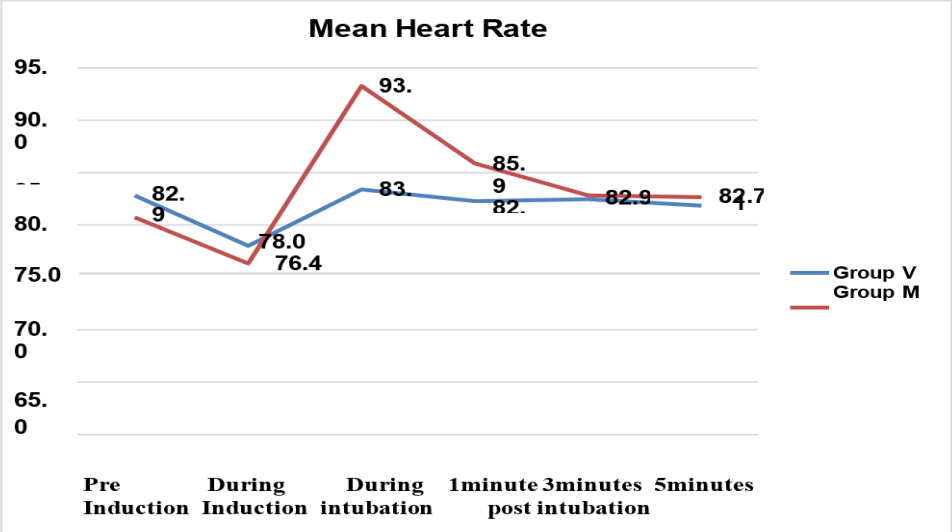

Figure 3: Mean Heart Rate

The comparison of mean heart rate (graph 1) showed no significant difference at baseline and during induction.

However, during intubation, the Macintosh group had a significantly higher mean heart rate (93.28 ± 9.07) compared with the McGrath group (83.46 ± 8.91, p<0.001). At 1minute post intubation, heart rate continued to be higher in the Macintosh group (85.9 ± 7.6) compared to the McGrath group (82.83 ± 9.4, p=0.040).

At 3- and 5-minutes post intubation, the differences were not statistically significant.

Table 3: Comparison of Mean Systolic Blood Pressure

Interval	Group V [Mean±SD](mmHg)	Group M [Mean±SD](mmHg)	t Value	p Value
Pre- Induction	123.5±11.7	122.1±11.2	0.601.df=98	0.549
During Induction	112.2±11.1	110.9±11.3	0.564.df=98	0.574
During Intubation	119.1±10.4	133.5±12.8	-6.216df=98	<0.001
1 minute post intubation	118.5±8.7	125.1±9.8	-3.560df=98	<0.001
3minutes post intubation	118.2±8.1	121.1±9.1	-1.659df=98	0.100
5minutes post intubation	117.5±8.0	120.4±8.6	-1.748df=98	0.084

The systolic blood pressure values (Table 3) were comparable between the groups at pre-induction and during induction. A significant difference was observed during intubation, wherein the Macintosh group recorded higher systolic pressure (133.5 ± 12.8 mmHg) compared with the McGrath group (119.1 ± 10.4 mmHg, p<0.001). This difference persisted at one-minute post-intubation, with the Macintosh group showing higher systolic pressure (1 25.1 ± 9.8) compared to the McGrath group (118.5 ± 8.7, p<0.001).

At 3- and 5-minutes post intubation, systolic pressures were not significantly different between the groups.

Table 4: Comparison of mean diastolic pressure

Interval	Group V [Mean±SD] (mmHg)	Group M [Mean±SD] (mmHg)	t Value	p value
Pre-Induction	77.1±12.8	77.2±6.8	-0.019df=98	0.985
During Induction	71.3±7.0	71.7±10.4	-0.249df=98	0.804
During Intubation	76.4±7.6	87.0±8.1	-6.765df=98	<0.001
1minute post intubation	74.0±11.6	79.0±6.7	-2.655df=98	0.009
3minutes post intubation	75.0±6.3	77.0±5.8	-1.614df=98	0.110
5minutes post intubation	73.3±11.5	77.0±6.1	-2.032df=98	0.045

The comparison of diastolic blood pressure (Table 4) showed no significant difference at pre-induction and during induction. During intubation, diastolic pressure was significantly higher in the Macintosh group (87.0 ± 8.1 mmHg) compared with the McGrath group (76.4 ± 7.6, p<0.001). At 1minute post intubation, the Macintosh group again had higher diastolic pressure (79.0 ± 6.7) than the McGrath group (74.0 ± 11.6, p=0.009). At 3 minutes post intubation, there was no significant difference,

but at 5 minutes post intubation, the Macintosh group continued to record slightly higher diastolic pressure (77.0 ± 6.1) compared with the McGrath group (73.3 ± 11.5, p=0.045).

Discussion

Both the groups were comparable in terms of mean age, gender and Mallampati grade. The mean thyromental distance in Group V was 8.43±1.10183 cm and Group M was 8.61±0.6932 cm and were comparable in terms of thyromental and hyomental distance. In our study, it was observed that mean time for laryngoscopy in Group V was11.33±2.52 seconds whereas in Group M was 7.47±1.32 seconds and p-value was <0. 001. These results indicate that there is statistically significant difference in time taken for laryngoscopy between the groups and time taken for glottic visualization was more with McGrath Mac VL. Stuti Bhamri et al [6] conducted a similar study in pediatric patients with normal airway and they concluded that mean time for glottis visualization was less with McGrath videolaryngoscope (5.66±4.58 seconds) as compared with Macintosh laryngoscope (8.50±5.59 seconds). This is in contrast to our study as mean time of laryngoscopy was more with McGrath Mac video laryngoscope. Muhamed et al [7] conducted a study comparing Hugmed video laryngoscope and Macintosh laryngoscope and concluded that mean time taken for visualization of vocal cords was 5.04±1.01 seconds for Hugmed video laryngoscope and 5.78±1.87 seconds for Macintosh laryngoscope indicating statistically significant difference between the groups (p value 0.016). The results were different for our study as McGarth Mac video laryngoscope had more time for laryngoscopy as compared with Macintosh laryngoscope. Kim et al [8] also conducted a similar study and concluded that mean time for glottic visualization was less with McGrath video laryngoscope which is similar to our study.

The study observations indicate that in this study, there is a statistically significant variation in the time taken for intubation (p value <0.001). The mean time taken for intubation in Group V was 20.58±2.18 seconds while in Group M it was 16.39±1.78 seconds and this was statistically significant (p-value <0.01). Ray et al[16] in his study discussed that time taken for intubation with Macintosh laryngoscope was less as compared to McGrath Mac VL and number of attempts increased when done by a novice. These results were similar to our study. Jong et al [9] conducted a similar study and concluded that there was no significant difference in mean time for intubation. Saxena et al [10] in their study compared Truview video laryngoscope with Macintosh laryngoscope and concluded that intubation time was more with Truview laryngoscope. As observed in our study, significant difference was seen in POGO scoring between the two groups. (p value <0.001)(Fig 1). The results show that McGrath Mac VL gives a better view of the glottis as compared with Macintosh laryngoscope. Melike Korkmaz Toker et al [11] conducted a similar study and had similar observation. Sargin et al [12] conducted a similar study and concluded McGrath laryngoscope had a higher POGO scoring as compared with Macintosh laryngoscope. From the above studies and comparing results from our study, it can be concluded that POGO scoring is higher with McGrath Mac video laryngoscope and that McGrath video laryngoscope improves POGO scoring when compared to Macintosh laryngoscope in routine airway too. In this study, we observed there was no significant difference between the groups in regard to number of attempts taken for intubation for a skilled anesthesiologist. Kriege et al [13] conducted a similar study and concluded that McGrath Mac VL had higher first pass success rate in comparison to Macintosh laryngoscope (p value<0.01). In 2024. Manuel Taboada et al[15] concluded that MacGrath Mac improved "easy intubation" rates, increased first-attempt success, provided better glottic views, reduced the need for additional airway devices, and decreased operator reported difficulty when compared to the standard Macintosh laryngoscope. In our study, significant difference was observed in heart rate during intubation and 1minute post intubation between the groups. Patients intubated with McGrath Mac videolaryngoscope had a stable heart rate during intubation (83.46±8.91) while Macintosh group had significant higher heart rate (93.28±9.07).

Results were not significant at intervals of 3 and 5 minutes post intubation (p value >0.005).Sargin et al [12]in a similar study concluded that hemodynamic parameters did not significantly differ between the McGrath Mac video laryngoscope (baseline heart rate 80.35±13.83,1 minute after intubation 88.48±13.47,2 minutes after intubation 81.35±13.30) and Macintosh laryngoscop e (baseline heart rate 83.90±12.77, 1 minute after intubation 90.94±12.31, 2 minutes after intubation 84.88±12.74). Melike Korkmaz Toker et al [11] in their study concluded that there was no significant difference in heart rate between McGrath video laryngoscope (88.7±7.5) and Macintosh laryngoscope (93.4±8.5) post intubation. Comparing our study with the above studies, statistically significant difference in mean heart rate between the groups was seen. Statistically significant difference was seen in systolic and diastolic blood pressure during intubation and one minute post intubation between the groups (McGrath laryngoscope 119±10.4/76.4±7.6 and Macintosh laryngoscope 135±12.8/79.0±6.7, p value <0.001 during intubation). Patients intubated with McGrath Mac video laryngoscope had significantly less increase in both systolic and diastolic blood pressure as

compared to patients intubated with Macintosh laryngoscope. Post intubation at various intervals such as 3- and 5-minutes post intubation, there was no significant difference in hemodynamic parameters between the groups. Masashi et al [14] concluded that McGrath Mac VL reduces incidence of hypertension after tracheal intubation.

Conclusion

This study concludes that McGrath Mac VL has an advantage over conventional Macintosh laryngoscope in aspects such as POGO scoring and hemodynamic parameters. Though time taken for intubation and laryngoscopy was more with McGrath Mac VL, it can be safely used in unanticipated difficult airway patient's airway as it reduces the drugs needed for blunting hemodynamic response and provides a better POGO score.

Limitation:

- Sample size was small and may not represent the actual population.
- Invasive blood pressure system can be used for more accurate and for beat-to-beat variation in the hemodynamic parameters.
- Difficulty in blinding the operator

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