

TO COMPARE THE HAEMODYNAMIC RESPONSE TO LARYNGOSCOPY AND TRACHEAL INTUBATION USING THE STANDARD MACINTOSH LARYNGOSCOPE VERSUS VIDEOLARYNGOSCOPE AMONG HEALTHY ADULT INDIVIDUALS RECEIVING GENERAL ANAESTHESIA FOR ELECTIVE SURGERY

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ABSTRACT

BACKGROUND

Laryngoscopy and endotracheal intubation are associated with various undesirable effects. The more common response to airway manipulation is hypertension (HTN) and tachycardia mediated by the cardioaccelerator nerves and sympathetic chain ganglia. Numerous efforts have been made by anaesthesiologists to obtund these untoward reflexes by the use of various measures such as by using drugs or by using different methods of intubation.

MATERIALS AND METHODS

100 patients of either sex of ASA grade I and II and Mallampati grade I and II of age 18 - 60 years were included in the study. Patients < 18 years of age and > 60 years of age and Mallampati grade III and IV were excluded from the study. A standard anaesthesia technique was used in all the patients. Both groups were matched demographically. Haemodynamic variables at baseline were also comparable.

RESULTS

It was observed that rise in pulse rate, systolic blood pressure, diastolic blood pressure and mean BP was significantly less in videolaryngoscope group as compared to Macintosh group ($p < 0.01$).

CONCLUSION

It was concluded that videolaryngoscope produces significantly less marked haemodynamic response.

KEY WORDS

Macintosh Laryngoscope, Truview PCD Videolaryngoscope, Mean Pulse Rate, Mean Systolic Blood Pressure, Mean Diastolic Blood Pressure.

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BACKGROUND

Laryngoscopy and endotracheal intubation are an integral part of anaesthetic management. Infact, most of the advances made by our specialty can be attributed to manage the airway. The first known description on the surgical procedure of intubation was given in the 1020 by Ibn Sinā in "The Canon of Medicine" in order to facilitate breathing.^{(1),(2)}

Like all the interventional procedures, laryngoscopy and endotracheal intubation are associated with various undesirable effects. In adults and adolescents, the more common response to airway manipulation is hypertension (HTN) and tachycardia mediated by the cardioaccelerator nerves and sympathetic chain ganglia including release of renin from the renal juxtaglomerular apparatus, which is innervated by β -adrenergic nerve terminals.⁽²⁾

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Reflex changes in cardiovascular system are most marked after laryngoscopy and intubation and lead to average increase in blood pressure by 40 - 50% and heart rate by 20%.⁽³⁾ These reflex changes are better tolerated in normotensive and healthy individuals with no systemic diseases. But they are greatly exaggerated and detrimental in patients with hypertension and cardiovascular diseases even if treated and brought under control beforehand.⁽⁴⁻⁷⁾ In patients with head injury, cerebral autoregulation is disturbed and increase in heart rate and blood pressure may result in increase in cerebral blood flow and therefore rise in ICP.⁽⁸⁾

Numerous efforts have been made in this direction. Anaesthesiologists have been trying to obtund these untoward reflexes by the use of various measures such as: Curtailing or shortening the duration of laryngoscopy to less than 15 seconds. Lightwand technique is accompanied by less haemodynamic changes after tracheal intubation than the laryngoscopic technique in normotensive patients, but not in hypertensive patients.⁽⁸⁾

Use of McCoy laryngoscope and laryngeal mask airway is associated with minimum stress response to laryngoscopy and intubation as compared to Macintosh and Miller laryngoscopy.^(9,10) Videolaryngoscope does not need direct exposure of vocal cords and produces lesser haemodynamic

changes due to the reduction in the lifting force necessary to obtain a clear view of the glottis. It provides an optical view "around the corner," allowing a view of the glottis via the prismatic lens without having to align oral, pharyngeal and tracheal axes.⁽¹¹⁾

This prospective randomised study was conducted to compare the haemodynamic response to laryngoscopy and tracheal intubation using the standard Macintosh laryngoscope versus Videolaryngoscope.

Aims and Objectives

1. To compare the haemodynamic response to laryngoscopy and tracheal intubation using the standard Macintosh laryngoscope versus Videolaryngoscope among healthy adult individuals receiving general anaesthesia for elective surgery.
2. Complications of laryngoscopy with Macintosh and Videolaryngoscope.

MATERIALS AND METHODS

It is a randomised controlled trial. After obtaining approval from the Ethical Committee, the present double blind study entitled "To compare the haemodynamic response to laryngoscopy and tracheal intubation using the standard Macintosh laryngoscope versus videolaryngoscope" was conducted on patients of ASA grade I and II in 100 number of patients of either sex, Department of Anaesthesiology, JA Group of Hospitals of GR Medical College, Gwalior (MP) after a well written informed consent from the patients. This prospective study was conducted from Dec. 2015 to Aug. 2017.

Patients of ASA grade I and II, age > 18 years of either sex and Mallampati grade I and II were included for the study. Patients of ASA grade III and IV; Mallampati grade III and IV; history of hypertension, cardiovascular disease, difficulty with mask ventilation during anaesthesia were excluded from the study.

100 patients of ASA grade I and II of either sex scheduled for surgery under general anaesthesia were divided into 2 groups, (n= 50 each) randomly according to the type of laryngoscope. Sample size was taken for convenience during the study.

They were randomised using computer generated random numbers and allocated into two groups, Group M and Group A used as follows: Group M patients were intubated with Macintosh Laryngoscope and Group A with Videolaryngoscope.

All patients were uniformly pre-medicated with Inj. Glycopyrrolate 0.01 mg/kg IM 30 minutes before induction of anaesthesia.

Upon arrival of the patient in the operation room, intravenous access with 18G cannula was established. 500 mL of crystalloid infusion was started. All the baseline vital parameters (HR, SBP, DBP, MAP) were recorded. Oxygen saturation (SPO₂) were recorded by using pulse oximeter.

Patients were pre-oxygenated with 100% oxygen for 3 minutes by facemask. After premedication with IV Inj. Pentazocine 0.5 mg/kg, general anaesthesia was induced with IV Inj. Thiopentone Sodium 5 - 7 mg/kg body weight, Endotracheal intubation was facilitated with IV Inj. Succinylcholine 1.5 - 2.0 mg/kg bodyweight, after which IPPV

was done for 60 seconds. Laryngoscopy and intubation was done in 'Morning Sniff' position with Macintosh laryngoscope and in neutral position with Videolaryngoscope. In our study, we use Macintosh Laryngoscope Blade No. 3 and Truview PCD videolaryngoscope Blade No. 3.

Endotracheal tube checked, cuff inflated and well secured. Bilateral air entry checked, and the lung was ventilated further.

General anaesthesia was maintained with nitrous oxide and oxygen (66:33) and Isoflurane (1 - 1.5%) with Bain's anaesthetic circuit. Loading and intermittent dosage of non-depolarising muscle relaxant atracurium were used to maintain general anaesthesia.

All the haemodynamic parameters Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP) and Oxygen Saturation (SPO₂) were recorded 30 seconds before induction (I₀), at the time of laryngoscopy and intubation (E₀), 1 minute (E₁), 2 minutes (E₂), 3 minutes (E₃) and 5 minutes (E₅) after endotracheal intubation.

Laryngoscopes used in Our Study

1. Macintosh Laryngoscope

Macintosh introduced his curved blade, while most laryngoscope blades were long and straight. The straight blades were used to directly hold the epiglottis. Macintosh's curved blade works differently. It indirectly opens the epiglottis by applying pressure to a space between the root of the tongue and epiglottis called the vallecula. The flange running along the left lower edge of Macintosh's blade was also a novel innovation. It was designed to move the tongue to the side, which improved the view of the larynx and made more room for a breathing tube. The Macintosh Laryngoscope remains one of the most popular blades worldwide.



Figure 1. Macintosh Laryngoscope

2. Truview PCD Videolaryngoscope

It consists of reusable stainless steel blades, a view tube, an oxygen insufflation port, a camera head that attaches to the proximal part of the view tube, a handle that provides the light source and a portable (5.5" battery-powered) monitor. The distal lens is essentially a prism with a 47-degree anterior view. The proximal lens magnifies the acquired image.

1. Monitor, 2. Dedicated Camera, 3. Rechargeable Handle, 4. Eyepiece, 5. Oxygen Port, 6. Optical View Tube (Distal End), 7.

Optical View Tube Blade (Distal tip), 8. OptiShape™ Preformed Stylet.



Figure 2. Truview PCD Videolaryngoscope

How to Use the Device

The device is held in left hand and passed into the mouth over the tongue in the midline. Blade connected to a dedicated 5-in. LCD monitor via a unique camera for obtaining clear visual pictures of the intubation process. In this way, clinical safety is greatly improved and the incidence of incorrectly positioned endotracheal tube is reduced. The addition of oxygen during the intubation procedure via the unique oxygen port on the blades serves to slow the rate of desaturation, prevents the accumulation of mist and secretions on the lenses and ensures a clear visual picture of the entire procedure. Videolaryngoscope is a device with a unique blade that provides an optical view of the glottis via prismatic lens without having to align oral, pharyngeal and tracheal axes.

Statistical Analysis

The statistical analysis of this study was carried out by unpaired ‘t’ test and also paired ‘t’ test, where p value < 0.05 was statistically significant and p value > 0.05 was statistically insignificant and p value < 0.01 was statistically highly significant. Software used was SPSS version 21.

RESULTS

		Group M		Group A	
		(n)	(%)	(n)	(%)
Age Group (yrs.)	19-30	16	32	18	36
	31-40	12	24	16	32
	41-50	8	16	6	12
	51-60	8	16	5	10
	>60	6	12	5	10
Mean age (± SD)		41.7 ± 15.4		39.2 ± 16.13	
Weight Groups (kg)	41-60	22	44	22	44
	61-80	27	54	25	50
	>80	1	2	3	6
	Mean age (± SD)		62.3 ± 8.79		63.72 ± 9.93
Height Groups (cm)	150-155	8	16	9	18
	156-160	20	40	17	34
	161-165	11	22	12	24
	166-170	8	16	11	22
	>170	3	6	1	2
Mean age (± SD)		161.3 ± 5.58		161.68 ± 5.43	
Gender	Male	31	62	23	46
	Female	19	38	27	54
Successful Intubation	Yes	50	100	50	100
	No	0	0	0	0

Table 1. Distribution of Patients according to Age, Weight, Height, Sex, Successful Intubation

Sl. No.	Time (min)	Group M (Mean ± SD)	Group M (p-value)	Group A (Mean ± SD)	Group A (p-value)	Group M v/s Group A (p-value)
1	I ₀	82±8.8	--	84.7±12.28	--	0.3370
2	E ₀	92.04±11.25	0.0001	87±13.49	0.0100	0.0452
3	E ₁	99.89±10.08	0.0001	87.56±12	0.0020	0.0001
4	E ₂	95.26±9.84	0.0001	82.08±12.21	0.0302	0.0001
5	E ₃	89.18±8.94	0.0006	79.84±12.62	0.0003	0.0001
6	E ₅	82±9.67	0.9379	76.48±12.54	0.0001	0.0151

Table 2. Intragroup Statistical Analysis of Mean (±SD) Pulse Rate (bpm) in Two Study Groups

Sl. No.	Time (min)	Group M (Mean ± SD)	Group M (p-value)	Group A (Mean ± SD)	Group A (p-value)	Group M v/s Group A (p-value)
1	I ₀	117.42±10.78	--	119.28±13.21	--	0.4423
2	E ₀	131.44±9.36	0.0001	122.26±14.22	0.0001	0.0002
3	E ₁	134.10±10.28	0.0001	120.16±12.78	0.4057	0.0001
4	E ₂	123.75±10.69	0.0004	114.88±11.97	0.0006	0.0002
5	E ₃	116.30±10.24	0.3639	110.04±10.25	0.0001	0.0029
6	E ₅	110.91±9.16	0.0001	105.56±10.84	0.0001	0.0090

Table 3. Intragroup Statistical Analysis of Mean (±SD) Systolic Blood Pressure (mmHg) in Two Study Groups

Sl. No.	Time (min)	Group M (Mean ± SD)	Group M (p-value)	Group A (Mean ± SD)	Group A (p-value)	Group M v/s Group A (p-value)
1	I ₀	73.97±6.26	--	75.76±8.70	--	0.2405
2	E ₀	80.88±13.79	0.0019	78.3±8.33	0.0001	0.2602
3	E ₁	83.14±7.82	0.0001	76.88±8.65	0.1904	0.0003
4	E ₂	77.37±7.25	0.0035	73.66±6.28	0.0512	0.0074
5	E ₃	74.14±5.59	0.8608	71.04±5.58	0.0005	0.0066
6	E ₅	71.53±4.43	0.0067	69.26±6.14	0.0001	0.0365

Table 4. Intragroup Statistical Analysis of Mean (±SD) Diastolic Blood Pressure (mmHg) in Two Study Groups

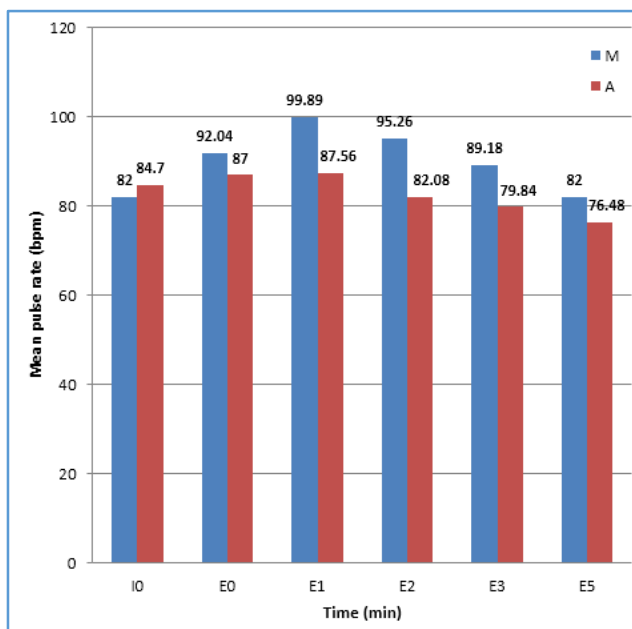
Sl. No.	Time (min)	Group M (Mean ± SD)	Group M (p-value)	Group A (Mean ± SD)	Group A (p-value)	Group M v/s Group A (p-value)
1	I ₀	88.18±7.10	--	89.58±9.60	--	0.4091
2	E ₀	98.71±7.36	0.0001	92.94±9.66	0.0001	0.0011
3	E ₁	99.77±7.88	0.0001	91.02±9.12	0.1231	0.0001
4	E ₂	92.42±7.45	0.0005	87.18±7.69	0.0567	0.0008
5	E ₃	87.85±5.81	0.7079	83.32±5.99	0.0001	0.0002
6	E ₅	84.32±5.06	0.0001	80.82±6.79	0.0001	0.0043

Table 5. Intragroup Statistical Analysis of Mean (±SD) of Mean Blood Pressure (mmHg) in Two Study Groups

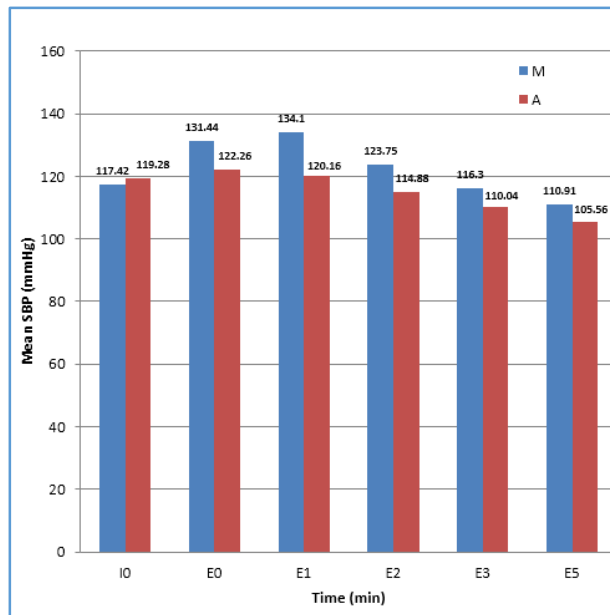
Variable	Group M	Group A
Complications	Nil	Nil

Table 6. Complications between the Two Study Groups

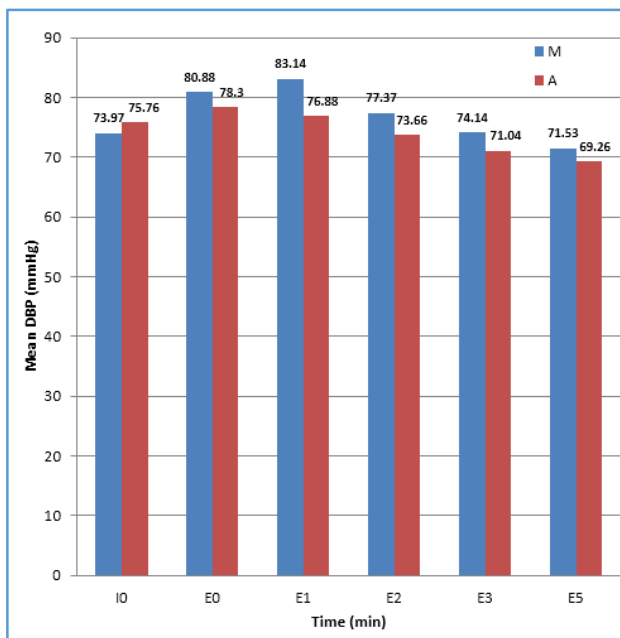
As shown in table, no complications were observed in both the groups.



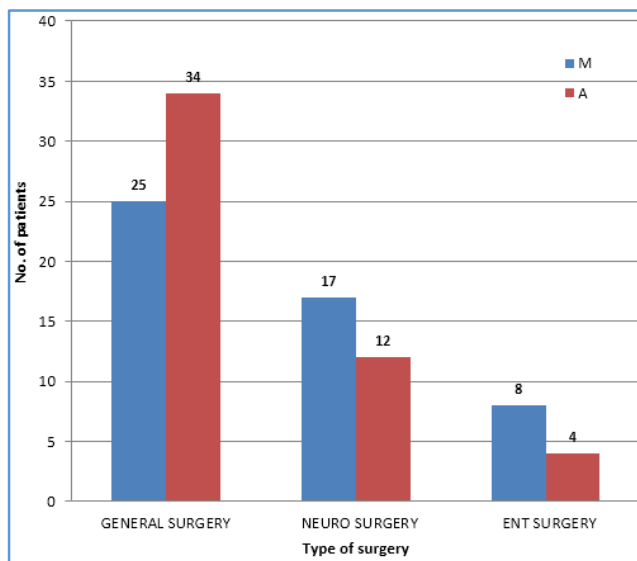
Graph 1. Statistical Analysis of Mean Pulse Rate (bpm) between the Two Study Groups



Graph 2. Statistical Analysis of Mean Systolic Blood Pressure (mmHg) between the Two Study Groups



Graph 3. Statistical Analysis of Mean Diastolic Blood Pressure (mmHg) between the Two Study Groups



Graph 4. Distribution of Patients according to Nature of Surgical Procedures in Study Groups

DISCUSSION

Securing and maintenance of airway is one of the major responsibilities of an anaesthesiologist. The process of laryngoscopy is known to have profound cardiovascular effects. This includes pressor response and tachycardia along with an increase in catecholamine concentration mainly norepinephrine.

Obtundation of this reflex response remains a major concern for the anaesthesiologist. Deep anaesthesia, topical anaesthesia, Opioids, Calcium channel blockers, beta blockers, laryngeal mask airway and different types of laryngoscope blades have been tried with varying success.⁽¹²⁻¹⁹⁾

It has been observed that amount of forces exerted during laryngoscopy and intubation is the key determinant for mechanical stimulation of stretch receptors present in the

respiratory tract. Thus, use of different types of laryngoscope blades can help decreasing this response.⁽²⁰⁾

In our study, we use Truview PCD videolaryngoscope, which is a new intubation device used for endotracheal intubation. It is designed to enable a view of glottis opening without aligning the oral with laryngeal and pharyngeal axis as an advantage over direct endotracheal intubation and allows intubation with minimal head manipulation and positioning.

Demographic Data

In the present study all the intubation were successfully performed in both the groups, which was in accordance with observation of various other studies.⁽²¹⁻²⁴⁾ However, some studies^(25,26) show higher success rate with videolaryngoscope as compared to Macintosh laryngoscope. The lower success rate in Macintosh group might be due to inclusion of Mallampati grade 1 and 2 patients.

Mean duration of intubation is also significantly higher with Truview laryngoscope than with Macintosh laryngoscope. Various other studies also supported this observation.^(23,26)

The Truview required a midline entrance and difficulty with manipulation of tongue, which may prolong the duration of laryngoscopy and intubation with videolaryngoscope. Videolaryngoscope also requires a hand eye coordination for tracheal intubation, which might increase the intubation time observed.

The lower success rate in Macintosh group might be due to inclusion of Mallampati grade III and IV patients in their study, while our study included only Mallampati grade I and II patients.

Haemodynamic Parameters

Heart Rate

Laryngoscopy and intubation resulted in highly significant ($p < 0.01$) rise in heart rate in both the groups as compared to baseline. But the rise is more significant in Macintosh group as compared to videolaryngoscope group. In Group M, increase in pulse rate was statistically highly significant ($p < 0.01$) at the time of laryngoscopy and ETI and 1 min, 2 mins and 3 mins after ETI as compared to baseline and come to baseline at 5 mins after ETI.

Whereas in Group A, increase in heart rate is highly significant ($p < 0.01$) at time of laryngoscopy and at 1 min after ETI. Thereafter, significant ($p < 0.05$) decrease in heart rate at 2 mins and highly significant ($p < 0.01$) decrease in heart rate at 3 mins and 5 mins was observed as compared to baseline. The results were in accordance with observations of other studies.^(27,28)

Videolaryngoscope does not require alignment of oral, pharyngeal and laryngeal axis and thus less manipulation and consequently less sympathetic stimulation, particularly in cases of difficult intubation which results in lesser haemodynamic changes as compared to Macintosh laryngoscope.

However, study conducted by Timanayankar RT et al⁽²¹⁾ observed a significant rise in heart rate and systolic blood pressure under the stimulus of laryngoscopy and intubation in both the groups ($p < 0.05$). They returned to near baseline values by 10 mins in both the groups, but the difference is insignificant ($p > 0.05$) in between the groups.

Intergroup statistical analysis of mean (\pm SD) systolic blood pressure (mmHg) shows highly significant ($p < 0.01$) decrease in mean (\pm SD) systolic blood pressure in Group A as compared to Group M at different time intervals.

The results were in accordance with observations of various other studies.^(29,30)

Intergroup statistical analysis of mean (\pm SD) diastolic blood pressure (mmHg) shows insignificant ($p > 0.05$) rise at the time of laryngoscopy and intubation and highly significant ($p < 0.01$) fall in Group A as compared to Group M at different time intervals.

Study conducted by Jungbauer A et al⁽²⁷⁾ concluded that less rise in diastolic blood pressure in Truview group is due to the 42-degree slope in blade and also glottis view was obtained by applying approximate external force of 19.6 newton. While the pressure applied was more (32.3 newton) with Macintosh laryngoscope.

Mean Blood Pressure

Intergroup statistical analysis of mean (\pm SD) blood pressure shows highly significant ($p < 0.01$) decrease in mean blood pressure in Group A as compared to Group M at the time of laryngoscopy and thereafter.

Videolaryngoscope is associated with less rise in mean blood pressure since anterior view design of videolaryngoscope is associated with less lifting force at laryngoscopy and consequently an attenuated intubation response when compared to Macintosh laryngoscope.

Videolaryngoscope does not require alignment of oral, pharyngeal and laryngeal axis and do not need direct exposure of vocal cords and thus produces lesser haemodynamic changes due to reduction in lifting force necessary to obtain clear view of glottis.

No complications were observed with the use of either Macintosh laryngoscope or Videolaryngoscope. The Truview blade is designed to enable indirect laryngoscopic view, thus the anaesthetist applies less force on anterior larynx, resulting in fewer patients with bleeding and soft tissue damage. A study conducted by Jungbauer et al⁽²⁷⁾ observed trauma to gums and teeth with use of Macintosh laryngoscope, as they have included Mallampati group III and IV patients in their study.

No complications or trauma to soft tissue structures and teeth observed in our study might be due to exclusion of Mallampati grade III and IV patients from our study.

Limitations of our Study

A number of Important Limitations Exist regarding this Study like-

- Our study was not blinded.
- Results seen may differ in the hands of less experienced users.
- Mallampati grade III and IV patients not included in our study.
- Factors other than laryngoscopy may have contributed to haemodynamic findings.
- The depth of anaesthesia or adequacy of muscle relaxation, which might affect haemodynamic changes were not monitored in our study.

CONCLUSION

When compared to Macintosh laryngoscope, videolaryngoscope significantly reduces variations in haemodynamic parameters like heart rate; systolic blood pressure; diastolic blood pressure and mean blood pressure after endotracheal intubation. Videolaryngoscope required significantly more time for intubation as compared to Macintosh laryngoscope.

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