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Comparison of Hemodynamic Response to Laryngoscopy and Tracheal Intubation in Hypertensive Patients Using Macintosh, McCOY and Truview Video Laryngoscope: A Clinical Study

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Abstract

Background: Laryngoscopy and intubation produce an exaggerated and unpredictable stress response in hypertensive patients which may lead to the development of life-threatening complications such as pulmonary edema, cerebrovascular hemorrhage and myocardial infarction. It is possible to reduce these harmful and undesirable hemodynamic responses to intubation by using different intubation techniques. The objective of this study was to compare the hemodynamic response to laryngoscopy and endotracheal intubation in hypertensive patients aged 40 years to 60 years using Macintosh, McCoy and Tru View Video laryngoscopes. *Materials and Methods:* We studied the hemodynamic response to laryngoscopy and intubation in 90 hypertensive patients posted for elective surgeries requiring general anesthesia, with ASA grading 2 or 3 aged between 40 and 60 years and Mallampati grade 1 and 2 using Macintosh, McCoy and Truview video laryngoscope. The changes in heart rate, systolic and diastolic blood pressure were observed in the post intubation period, every minute for the first 10 minutes. *Results:* Patients intubated using Macintosh or McCoy laryngoscope showed significantly greater ($p < 0.05$) rise in heart rate, systolic and diastolic blood pressure during first ten minutes in post-intubation period as compared to patients intubated using TruView video laryngoscope. Changes in SpO_2 were statistically insignificant and ECG remained within normal limits. Although time taken to intubate was longer with TruviewVideoaryngoscope. *Conclusions:* We conclude that Truview Video laryngoscope provides a better laryngeal view while producing the least hemodynamic response during laryngoscopy and intubation in hypertensive patients as compared to McCoy and Macintosh blades

Keywords: Hemodynamic response in hypertensive patient, Laryngoscopy and intubation, Macintosh, McCoy, Truview videolaryngoscope.

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Introduction

Laryngoscopy is the most frequently performed procedure in anaesthesiology to help visualize vocal cords and glottis for endotracheal intubation during general anesthesia and cardio pulmonary resuscitation. Laryngoscopy induces profound stress response[1,2,3] due to sympathetic stimulation and increase in catecholamine concentration[1,4-6] manifesting as tachycardia, hypertension and dysrhythmias.

However, in hypertensive patients, these changes are more pronounced and unpredictable and may further lead to development of life-threatening complications like pulmonary edema, cerebrovascular hemorrhage and myocardial infarction.

Many studies have been conducted in the past comparing stress response and ease of endotracheal intubation in patients with difficult airway using various laryngoscopes. But there is less data

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available comparing the hemodynamic changes seen in hypertensive patients during laryngoscopy and intubation.

Materials and Methods

After obtaining Institutional Ethical Committee approval and written informed consents, 90 hypertensive patients of either sex undergoing elective surgeries under general anesthesia requiring endotracheal intubation were allocated to one of the three groups of 30 patients each. All the patients were explained in their colloquial language about the procedure.

Inclusion criteria: Age 40 yrs - 60 yrs, ASA grades 2 and 3, Mallampati grades 1 and 2, Hypertensive patients.

Exclusion criteria: Age < 20 yrs and > 60 yrs, ASA grades 4 and more, Mallamapti grades 3 and 4.

Sample Size:

Group M: Patients intubated with Macintosh laryngoscope (n-30).

Group C: Patients intubated with McCoy laryngoscope (n-30).

Group T: Patients intubated with TruView video laryngoscope (n-30).

Procedure Planned

After a detailed preanesthetic checkup, a written informed consent was obtained from patient.

All the patients received their anti-hypertensive medications on the morning of surgery with sip of water.

In the operation theatre, intravenous line, pulse oximeter, electrocardiograph and a non invasive blood pressure monitor were attached. The baseline values of aforementioned hemodynamic parameters were recorded following a stabilization period of 3-5 minutes.

Patients were premedicated with Inj. Ondansetron 0.08mg/kg, Inj. Glycopyrrolate 0.01mg/kg, Inj. Midazolam 0.05mg/kg, Inj. Fentanyl 2 microgram/kg. Preoxygenation with 100% oxygen was done for 3 minutes. Pre Induction HR, SBP and DBP, SpO_2 and ECG were noted.

Anesthesia was induced with Inj. Propofol 2mg/kg. Inj Succinylcholine 1.5 mg/kg was used for facilitation of induction and muscle relaxation.

Post Induction HR, SBP and DBP, SpO_2 and ECG were noted.

1. Patients in group M were intubated in "Sniffing Position".
2. Patients in Groups T and C Were Intubated in "Neutral Position".

Post-intubation HR, SBP and DBP, SpO_2 and ECG were noted every minute, till 10 minutes after intubation.

Patients were given 50% O_2 with 50% N_2O and 0.6–1.0% Isoflurane for maintenance of anesthesia.I/v Inj. Atracurium 0.5mg/kg loading dose was followed by 0.1mg/kg every 20 minutes to maintain muscle relaxation.

After the completion of surgery, neuromuscular blockade was reversed with Inj. Neostigmine 0.05 mg/kg and Inj.Glycopyrrolate 0.01 mg/kg, given intravenously.

Broken teeth, soft tissue edema, bleeding from gums or lips, stridor or hoarseness, sore throat and any other complications were noted.

Data Collection Methods: Data was collected by an independent person and entered in the patient proforma and finally entered in the master chart. Data was presented as mean with standard deviation.One way ANOVA test was used as the statistical tool to test for the significance of observed mean differences.

Results

The demographic profile of patients in the three groups was comparable. There were no significant differences for gender ratio, age, weight, baseline heart rate, systolic, diastolic and mean blood pressure. ASA grading and Mallampati scores were also similar in all the three groups (Table 1).

The baseline values of heart rate were comparable in all the three groups.There were no statistically significant differences in heart rate at pre-induction and post-induction periods amongst the three groups. Group M had the greatest rise in heart rate after intubation and difference in heart rate was statisticallyhighly significant ($p < 0.01$) as compared with the other two groups (i.e. Group C and Group T) during first seven minutes after intubation. At 8 and 9 minutes postintubation, the differences were statistically significant ($p < 0.05$).Thereafter, the heart rates in the three groups were comparable (Table 2).

The baseline values of mean systolic blood pressure were comparable in all the three groups. There were no statistically significant differences in mean SBP at pre-induction and post-induction periods amongst the three groups. Group M had the greatest rise in mean SBP after intubation and difference in mean SBP was statistically highly

Table 1: Mean Heart Rate Per Minute At Various Time Intervals (Beats/Minute)

Time interval	Heart Rate (Beats/Minute)						*p* value
	Group M		Group C		Group T		
	Mean	SD	Mean	SD	Mean	SD	
Baseline	79.67	7.32	78.23	5.87	78.43	5.68	0.6358 (NS)
Preinduction	81.47	7.40	80.37	6.15	80.43	6.01	0.7659 (NS)
Postinduction	84.3	7.28	82.37	6.30	83.07	5.84	0.5105 (NS)
Postintubation	106.87	5.92	94.33	6.42	90.57	6.20	<0.01 (HS)
1 Min	104.83	5.60	91.20	5.65	88.37	5.77	<0.01 (HS)
2 Min	100.67	4.85	89.07	5.09	86.57	5.45	<0.01 (HS)
3 Min	96.87	5.00	86.23	4.58	83.67	5.01	<0.01 (HS)
4 Min	92.97	4.35	83.87	4.26	79.63	4.64	<0.01 (HS)
5 Min	88.73	4.57	81.77	4.22	79.30	4.09	<0.01 (HS)
6 Min	85.07	5.56	80.10	4.30	78.73	3.91	<0.01 (HS)
7 Min	82.63	6.21	79.53	4.63	77.40	3.96	<0.01 (HS)
8 Min	80.93	6.54	78.73	4.93	77.13	3.84	0.0217 (S)
9 Min	79.47	6.79	77.73	5.20	76.27	4.08	0.0821 (S)
10 Min	78.57	6.64	76.37	5.33	75.83	4.17	0.1275 (NS)

significant ($p < 0.01$) as compared with the other two groups (i.e. Group C and Group T) during first nine minutes after intubation. Thereafter, the mean SBP in the three groups were comparable (Table 3).

The baseline values of mean diastolic blood pressure were comparable in all the three groups. There were no statistically significant differences in mean DBP at pre-induction and post-induction periods amongst the three groups. Group M had the greatest rise in mean DBP after intubation and difference in mean DBP was statistically highly significant ($p < 0.01$) as compared with the other

Table 2: Systolic Blood Pressure At Various Time Intervals (mmHg)

Time interval	Systolic Blood Pressure (mmHg)						*p* value
	Group M		Group C		Group T		
	Mean	SD	Mean	SD	Mean	SD	
Baseline	135.67	6.93	134.73	6.51	135.17	6.30	0.8583 (NS)
Preinduction	130.70	6.61	129.77	6.59	130.73	6.37	0.8110 (NS)
Postinduction	124.43	6.63	125.13	6.50	125.53	6.30	0.8016 (NS)
Postintubation	155.80	6.80	147.63	6.77	140.77	6.72	<0.01 (HS)
1 Min	152.93	6.69	145.17	6.94	137.77	6.40	<0.01 (HS)
2 Min	149.53	6.57	142.93	6.66	135.60	6.12	<0.01 (HS)
3 Min	145.70	6.69	139.37	6.10	134.27	5.67	<0.01 (HS)
4 Min	142.80	6.76	137.73	6.10	132.27	5.45	<0.01 (HS)
5 Min	140.73	6.75	135.77	5.59	131.40	5.01	<0.01 (HS)
6 Min	139.20	7.10	134.87	5.49	130.40	4.64	<0.01 (HS)
7 Min	137.40	6.96	133.83	5.56	130.10	4.40	<0.01 (HS)
8 Min	136.47	6.64	133.63	5.63	129.70	4.15	<0.01 (HS)
9 Min	134.27	6.10	133.17	5.50	129.13	4.22	<0.01 (HS)
10 Min	131.43	5.82	131.07	5.58	129.27	4.53	0.2498 (NS)

Table 3. Diastolic Blood Pressure At Various Time Intervals (mmHg)

Time interval	Diastolic Blood Pressure (mmHg)						P value
	Group M		Group C		Group T		
	Mean	SD	Mean	SD	Mean	SD	
Baseline	90.23	4.50	89.60	4.31	89.83	4.62	0.8592 (NS)
Preinduction	88.40	4.08	88.03	3.96	88.93	4.44	0.7029 (NS)
Postinduction	84.93	4.02	84.57	3.98	85.20	4.36	0.8387 (NS)
Postintubation	107.37	4.77	99.90	4.38	94.77	4.16	<0.01 (HS)
1 Min	104.70	4.74	96.87	4.45	91.73	4.40	<0.01 (HS)
2 Min	101.70	4.43	93.83	4.33	89.87	4.10	<0.01 (HS)
3 Min	98.50	4.29	92.37	3.90	89.23	4.01	<0.01 (HS)
4 Min	94.50	4.04	91.87	3.83	88.07	4.05	<0.01 (HS)
5 Min	89.70	4.19	86.73	3.85	84.17	4.21	<0.01 (HS)
6 Min	84.87	4.30	82.63	3.85	80.80	4.04	<0.01 (HS)
7 Min	81.73	4.14	79.73	3.62	78.77	3.80	0.0126 (S)
8 Min	79.87	4.07	78.37	3.48	77.37	3.62	0.0374 (S)
9 Min	78.67	3.55	77.57	3.34	76.33	3.20	0.0306 (S)
10 Min	77.47	3.07	76.77	3.13	75.73	3.07	0.0959 (NS)

two groups (i.e. Group C and Group T) during first six minutes after intubation. During seven to nine minutes post intubation, the differences were statistically significant ($p < 0.05$). Thereafter, the mean DBP in the three groups had no statistically significant differences and were comparable (Table 4).

Discussion

There are several studies focusing on the use of pharmacological agents for blunting the stress response to laryngoscopy and intubation. However, there is only little information regarding the influence of different types of laryngoscope blade on hemodynamic stress response.

McCoy blade has an advantage over Macintosh blade as it has a flexitip, a lever at its proximal end, a spring loaded drum and a connecting shaft. The flexitip controlled by the lever allows for lifting of epiglottis while decreasing the overall movement and force required for performing laryngoscopy and hence, may alter the associated hemodynamic response.

Video laryngoscopes were developed recently with the aim of improving the view of larynx. They have high resolution micro- cameras and small portable screen. They give a view of laryngeal inlet without the need to align the oral, pharyngeal and tracheal axis. Considering the wide variety of video laryngoscopes currently available, we have used Truview video laryngoscope in our study. It is a newly introduced device with an exaggerated curvature and viewing lens. It gives an indirect view of the glottis with a 46 degree anterior refraction.

Table 4. Complications

Complications	Group M		Group C		Group T	
	N	%	N	%	N	%
Soft Tissue Injury	3	10	3	10	3	10
Teeth Injury	1	3.33	1	3.33	0	0
Sore Throat	1	3.33	0	0	0	0
Hoarseness Of Voice	2	6.66	1	3.33	0	0

The observations of this study were compared with other similar studies under the following headings.

Changes In Heart Rate

The mean baseline heart rate in group M was 79.67 ± 7.32 beats per minute, 78.23 ± 5.87 beats per minute in group C and 78.43 ± 5.68 beats per minute in group T. The differences in these values were statistically insignificant.

Similarly, in pre induction period the mean heart rate in group M was 81.47 ± 7.40 beats per minute, 80.37 ± 6.15 beats per minute in group C and 80.43 ± 6.01 beats per minute in group T. The differences in these values were statistically insignificant.

In the postinduction period,the mean heart rate in group M was 84.30 ± 7.28 beats per minute, 82.37 ± 6.30 beats per minute in group C and 83.07 ± 5.84 beats per minute in group T. These values were comparable and statistically insignificant.

However, immediately after intubation, mean heart rate (beats/minute) in Group M rose to 106.87 ± 5.92, in group C to 94.33 ± 6.42 and in group T to

90.57 ± 6.20. The difference in the rise in heart rate was statistically highly significant ($p < 0.01$).

These differences in mean heart rate remained highly significant for the first seven minutes in the post intubation period.

At eight minutes in post intubation period the mean heart rate dropped down to 80.93 ± 6.54 in group M, 78.73 ± 4.93 in group C and 77.13 ± 3.84 in group T. The differences were statistically significant ($p < 0.05$).

At nine minutes in post intubation period the mean heart rate further dropped down to 79.47 ± 6.79 in group M, 77.73 ± 5.20 in group C and 76.27 ± 4.08 in group T. The differences were statistically significant ($p < 0.05$).

Thereafter, the values dropped down to near baseline by the end of ten minutes and the differences in mean heart rate were statistically insignificant.

Our findings were similar to the studies conducted by McCoy EP et al., Nishiyama T et al., Joseph J et al., Mehtab et al.

McCoy et al.[8] noted that there was an increase in heart rate and arterial pressure during first five minutes after laryngoscopy while using Macintosh blade. There were no significant changes in hemodynamic parameters with McCoy blade.

Nishiyama T et al.[9] conducted a study using Macintosh, McCoy and Miller blades to compare the hemodynamic response produced by them and noted that McCoy laryngoscope blade produced the least stress response followed by Macintosh and maximum stress response by Miller blade.

Joseph J et al.[10] compared McCoy and TruView EVO_2 video laryngoscope in 60 patients with cervical spine immobilization and found that TruView video laryngoscope produced comparatively less hemodynamic response.

Mehtab et al.[11] compared Macintosh and McCoy laryngoscope blades and found that the hemodynamic changes produced were less in magnitude and transient with the use of McCoy blade as compared to Macintosh blade.

On the contrary, Roman J et al.[12] did not find any significant differences in hemodynamic parameters with either Macintosh or McCoy blades at any time during the study.

Similarly, Shimoda O et al.[13] did not find any difference in hemodynamic response with Macintosh or McCoy blades.

Nishant et al.[14] compared Macintosh, McCoy and Truview video laryngoscope and did not find any significant differences in the change in heart rate produced by them.

Kanchi M et al.[15] compared hemodynamic response to laryngoscopy and intubation in patients with coronary artery disease undergoing CABG surgery using direct and video laryngoscope and concluded that there were no significant differences in the stress response produced amongst the two groups.

Timanaykar RT et al.[16] conducted a study comparing Truview blade with Macintosh blade for laryngoscopy and intubation and observed that the hemodynamic response produced was comparable among the two groups.

Changes In Mean Systolic Blood Pressure

The mean baseline systolic blood pressure in group M was 135.67 ± 6.93 mmHg, 134.73 ± 6.51 mmHg in group C and 135.17 ± 6.30 mmHg in group T. The differences in these values were statistically insignificant.

In the pre induction period, the mean systolic blood pressure in group M was 130.70 ± 6.61 mmHg, 129.77 ± 6.59 mmHg in group C and 130.73 ± 6.37 mmHg in group T. The differences in these values were statistically insignificant.

In the post induction period, the mean systolic blood pressure in group M was 124.43 ± 6.63 mmHg, 125.13 ± 6.50 mmHg in group C and 125.53 ± 6.30 mmHg in group T. The differences in mean systolic blood pressure values were statistically insignificant.

Immediately after intubation, the mean systolic blood pressure in Group M rose to 155.80 ± 6.80 mmHg, in group C to 147.63 ± 6.77 mmHg and in group T to 140.77 ± 6.72 mmHg. The difference in the rise in mean systolic blood pressure was statistically highly significant ($p < 0.01$).

These differences in mean systolic blood pressure remained highly significant for the first nine minutes in the post intubation period.

The values dropped down to near baseline by the end of ten minutes and the differences in mean systolic blood pressure were statistically insignificant.

Shribman AJ et al.[7] concluded that there is a significant increase in arterial pressure and circulating catecholamine concentration after performing laryngoscopy with or without

intubation.

McCoy EP et al.[8], Nishiyama et al.[9], Joseph et al.[9], Mehtab et al.[11] also observed similar outcomes in their studies.

In contrast, Roman J et al.[12] and Shimoda O et al.[13] (both of whom compared Macintosh and McCoy blades), Nishant et al.[14] (compared Macintosh, McCoy and Truview video laryngoscope), Kanchi M et al.[15] and Timanaykar RT et al.[16] did not find any significant differences in hemodynamic response.

Changes In Mean Diastolic Blood Pressure

The mean baseline diastolic blood pressure in group M was 90.23 ± 4.50 mmHg, 89.60 ± 4.31 mmHg in group C and 89.83 ± 4.62 mmHg in group T. The differences in these values were statistically insignificant.

In the pre induction period, the mean diastolic blood pressure in group M was 88.40 ± 4.08 mmHg, 88.03 ± 3.96 mmHg in group C and 88.93 ± 4.44 mmHg in group T. The differences in these values were statistically insignificant.

In post induction period, the mean diastolic blood pressure in group M was 84.93 ± 4.02 mmHg, 84.57 ± 3.98 mmHg in group C and 85.20 ± 4.36 mmHg in group T. the differences in these values were statistically insignificant.

The mean diastolic blood pressure in Group M in immediate post intubation period rose to 107.37 ± 4.77 mmHg, in group C to 99.90 ± 4.38 mmHg and in group T to 94.77 ± 4.16 mmHg. The difference in the rise in mean diastolic blood pressure was statistically highly significant ($p < 0.01$).

These differences in mean diastolic blood pressure remained highly significant for the first six minutes in the post intubation period.

At seven to nine minutes post intubation the mean diastolic blood pressure dropped down and the differences in the values between the groups remained statistically significant ($p < 0.05$).

The values dropped down to near baseline by the end of ten minutes and the differences in mean diastolic blood pressure were statistically insignificant.

Our findings were similar to the studies conducted by Shribman et al.[7], McCoy EP et al.[8], Nishiyama T et al.[9], Joseph J et al.[10], Mehtab et al.[11].

On the contrary, Roman J et al.[12], Shimoda O et al.[13], Nishant et al.[14], Kanchi M et al.[15] and Timanaykar RT et al.[16] did not find any significant differences in hemodynamic response to laryngoscopy and intubation with the three blades.

One of the reasons for this difference in hemodynamic response to laryngoscopy and intubation may be that, all the above studies were conducted in normotensive patients while our study is done in hypertensive patients.

Also, the degree of muscle relaxation during laryngoscopy and intubation has some effect on the hemodynamic stress response. None of the studies conducted have measured the degree of muscle relaxation in the patient.

The differences in anti-hypertensive medications taken by the patients may also be one of the reasons resulting in differences in the observations in various studies.

The expertise of the anesthesiologist performing laryngoscopy and intubation and the time taken may be other factors leading to varied hemodynamic response in different studies.

Complications

No statistical differences were found in the complications like soft tissue injury, teeth injury, sore throat, and hoarseness of voice.

One of the limitations of our study was that we did not use all the three blades in the same patient. Further, we did not blind the anesthesiologist performing the intubation for data collection as it was difficult, hence observer bias may exist.

Another limitation of our study was that we also did not measure the degree of muscle relaxation at the time of tracheal intubation which may affect the hemodynamic response produced.

Conclusion

Truview video laryngoscope offers a better laryngeal view for intubation while producing least hemodynamic response to laryngoscopy and intubation in hypertensive patients as compared to Macintosh and McCoy laryngoscope blades.

Complications like soft tissue injury, teeth injury, sore throat and hoarseness of voice were similar with video laryngoscope, McCoy and Macintosh blades.

References

1. King Bd, Harris Lc, Greifenstein Fe, Elder Jd, Dripps Rd. Reflex circulatory responses to direct laryngoscopy and tracheal intubation performed during general anesthesia. Anesthesiology 1951;12: 556-66.
2. Forbes Am, Dally Fg. Acute hypertension during induction of anesthesia and endotracheal intubation

in normotensive man. British Journal of Anesthesia 1970;42:618-24.

3. Latto IP, Rosen M. Pathophysiological effects of tracheal intubation. In: LATTO IP ROSEN M, eds. Difficulties in tracheal intubation. London: Balliere Tindall, 1987.pp.12-33.
4. Wycoff Co. Endotracheal Intubation: Effects on blood pressure and pulse rate. Anesthesiology 1960; 21:153-8.
5. Russell Wj, Morris Rg, Frewin Db, Drew Se. Changes in plasma catecholamine during endotracheal intubation. British Journal of Anesthesia 1981;53: 837-9.
6. Derbyshire Dr, Chmelewski A, Fell S, et al. Plasma catecholamine responses to tracheal intubation. British Journal of Anesthesia 1983;55:855-60.
7. Shribman A, Smith G, Achola K. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. British Journal of Anesthesia 1987;59:295-9.
8. McCoy EP, Mirakhur RK, Rafferty C, et al. A comparison of the forces exerted during laryngoscopy. The Macintosh versus the McCoy blade. Anaesthesia 1996;51(10):912-915.
9. Nishiyama T, Higashizawa T, Bito H, et al. Which laryngoscope is the most stressful in laryngoscopy; Macintosh, Miller, or McCoy? Masui 1997;46:1519-24.
10. Joseph J, Sequeira T, Upadya M. Comparison of the use of McCoy and TruView EVO_2 laryngoscopes in patients with cervical spine immobilization. Saudi J Anaesth 2012 Jul;6(3):248-53.
11. Mehtab A Haidry, Fauzia A Khan. Comparison of hemodynamic response to tracheal intubation with Macintosh and McCoy laryngoscopes. J Anaesthesiol Clin Pharmacol 2013 Apr-Jun;29(2): 196–199.
12. Roman J, Beltran de Heredia B, Garcia-Velasco P, et al. Hemodynamic response to intubation with Macintosh and McCoy blades. Rev Esp Anesthesiol Reanim. 1996;43:177–9.
13. Shimoda O, Ikuta Y, Isayama S, et al. Skin vasomotor reflex induced by laryngoscopy: Comparison of the McCoy and Macintosh blades. Br J Anaesth. 1997;79:714–8.
14. Kumar N, Lambar K, Ratra M. A randomized study of Macintosh and Truview EVO_2 laryngoscopes in the intubation scenario: Comparison. J Anaesthesiol Clin Pharmacol. 2010;26:64–8.
15. Kanchi M, Nair HC, Banakal S, Murthy K, Murugesan C. Haemodynamic response to endotracheal intubation in coronary artery disease: Direct versus video laryngoscopy. Indian J Anaesth 2011 May;55(3):260-5.
16. Timanaykar RT, Anand LK, Palta S. A randomized controlled study to evaluate and compare Truview blade with Macintosh blade for laryngoscopy and intubation under general anesthesia. J of Anesthesiol Clin Pharmacol 2011 Apr-Jun;27(2):199-204.