Original research article

Comparative Assessment of Intubating Conditions using Macintosh Laryngoscope with Video Laryngoscope in Adult Patient Undergoing Elective Surgical Procedures in a Tertiary Care Hospital

Heena Iqbal Memon[1], Niteen Khanderao Nadanwankar[2]

[1]Junior Resident, Department of Anaesthesiology, Shankarrao Chavan Government Medical College, Vishnupuri, Nanded

[2]Associate Professor, Department of Anaesthesiology, Shankarrao Chavan Government Medical College, Vishnupuri, Nanded

Corresponding Author: Dr. Heena Iqbal Memon

E-mail: heenamemon2014@gmail.com

Abstract

Introduction: The gold standard method of airway management for general anaesthesia and resuscitation is tracheal intubation with laryngoscope. Airway manipulation or instrumentation is noxious producing adverse reflex mediated cardiovascular changes. Tuoren video laryngoscope was designed with highly angled blades that pass around the tongue and allow a "look around the corner" to the glottis opening. The view obtained includes tip of the blade and therefore allows visual guidance of the tip of the blade into the vallecula. This present study was undertaken to evaluate and compare the efficacy of Macintosh laryngoscope and Tuoren video laryngoscope with respect to time for intubation.

Methods: The present prospective randomized comparative clinical study was conducted in a tertiary care hospital amongst 100 patients belonging to ASA physical grading I and II of either gender, aged 18- 60 undergoing elective surgical procedures under general anaesthesia. They were randomized in to two groups: 1. Group ML (Macintosh laryngoscope): 50 patients and 2. Group VL (Tuoren Video laryngoscope): 50 patients.

Results: The mean age of patients in Group ML was 39.48±10.07 years and Group VL was 37.34±10.56 years. 6 Patients from Group ML required BURP while, 6 patients required lifting force in Group ML In this study, 4 patients required use of stylet while 6 patients required use of bougie in Group ML. 38 (76%) patients in Group ML and 23 (46%) patients in Group VL had slight difficulty during intubation. (IDS Score >0 & <5). The mean time taken for intubation in Group ML was 30.12±2.03 sec. and in Group VL was 20.9±1.59 sec. The mean basal HR in Group ML was 80.36 ±11.09 and in Group VL was 81.38±10.44. Mean HR after intubation at 1 min in Group ML was increased to 97.80±12.12 while it was 87.56 ± 10.78 in Group VL. A statistically significant difference was seen in both the groups (p=0.001). Mean Arterial blood pressure after intubation at 1 min in Group ML was decreased to 106.82±5.55 while it was further decreased to 94.64± 6.61 in Group VL.

Conclusion: Finally, we conclude that Tuoren video laryngoscope when compared to Mcintosh laryngoscope improves the visualization of the larynx, is associated with less difficult airway maneuvers, lesser airway morbidity, takes less time for intubation and reduces the stress response to laryngoscopy.

Keywords: Mcintosh, laryngoscope, intubation, Tuoren video laryngoscope, airway management

Introduction

The gold standard method of airway management for general anaesthesia and resuscitation is tracheal intubation with laryngoscope. There are several advantages of tracheal intubation including intubation isolates respiratory system from gastrointestinal system. Macintosh laryngoscope is most commonly used device for directly visualising the structure of larynx and for tracheal intubation. Video laryngoscopy is a newly developed technique to improve tracheal intubation success.[1]

Video imaging techniques provide improved view of glottis and thus successful intubation without any tongue retraction, optimal head and neck positioning, optimal external laryngeal manipulation and use of tube introducers. Airway manipulation or instrumentation is noxious producing adverse reflex mediated cardiovascular changes. Tuoren video laryngoscope was designed with highly angled blades that pass around the tongue and allow a "look around the corner" to the glottis opening. The edges of the blade are slanted to avoid damage to teeth and mouth. It has an additional advantage of a video camera. The view obtained includes tip of the blade and therefore allows visual guidance of the tip of the blade into the vallecula. In recent years, video laryngoscopes (VLS) based on the principles of indirect laryngoscopy have been introduced into clinical practice. [2] When compared with direct laryngoscopy, VLS is found to provide a significantly better view of the larynx, which may be useful in situations of difficult intubation.[3]

This present study was undertaken to evaluate and compare the efficacy of Macintosh laryngoscope and Tuoren video laryngoscope.

Material and Methods:

The present prospective randomized comparative clinical study was conducted in a tertiary care hospital amongst 100 patients belonging to ASA physical grading I and II of either gender, aged 18- 60 undergoing elective surgical procedures under general anaesthesia. They were randomized in to two groups:

1. Group ML (Macintosh laryngoscope): 50 patients
2. Group VL (Tuoren Video laryngoscope): 50 patients

The patients belonging to these two groups were undertaken to study comparative intubating conditions and stress response while using the aforementioned laryngoscope blades.

Sample Size estimation:

With α of 0.05, β of 0.20 (power of 80%), using reference value of 69.71 ± 12.44 (n=35) of Heart Rate 2 minutes after Intubation in C-MAC group cases as compared to 76.86 ± 12.76 (n= 35) for among Macintosh group cases using below mentioned formula, the sample size calculated was 47.996 per group, we rounded it to 50.

Wherein=

sample size

E = margin of error

Z = margin given for each confidence interval (Z=1.96 for 95% CI)

α = The probability of type I error

β= The probability of type II error (Zβ=0.84 for 95% CI)

σ = standard deviation

The confidence interval is estimated at 95%
μ2 – μ1: The value of allowable difference is the true mean difference between a test drugs (μ2) and
5261.622 5535.79

Inclusion criteria: Patients undergoing elective surgery under General anaesthesia with the orotracheal tube, aged 18-65 years of both genders and ASA physical status class I-II.
Exclusion criteria: ASA physical status class III and above, Patients with oral pathology or masses, patients at risk of aspirations, anticipated difficult intubation, emergency surgeries and patients with cervical instability.

Assessment and preparation:
Careful history taking, general and systemic examinations as well as investigations were done to rule out any severe comorbidities. A meticulous airway assessment was done to find out the patients with difficult airway.

Methodology:
After NBM confirmation, patient was taken in operation theatre, all monitors were attached (non-invasive blood pressure), pulse-oximeter, cardio scope) and baseline parameters were noted an intravenous line was taken with large bore cannula.

Patients were premedicated with inj Glycopyrrolate 0.2 mg IM 45 minutes before the induction. On operating table, Inj. ondansetron 8 mg IV, Inj. Fentanyl 2 mcg/Kg IV, Inj. Midazolam 0.1 mg/Kg IV were given. All patients were induced with IV Inj. Propofol 2 mg/kg until eyelash reflex was abolished. IV Inj. vecuronium 0.1 mg/kg IV was given for neuromuscular blockade. Patient was ventilated with bag mask ventilation for 3 mins with 100% oxygen. After 3 mins, laryngoscopy was done and intubation was accomplished by appropriate sized cuffed ETT with Macintosh laryngoscope and Tuoren video laryngoscope blade in Group VL. Placement of ETT was confirmed with bilateral chest auscultation and Et CO2 waveform and tube was secured. Further heart rate, blood pressure and saturation were measured at 1, 3 and 5 minutes after intubation. After endotracheal intubation, anaesthesia was maintained with 1-1.5% sevoflurane, 60% nitrous oxide, and 40% oxygen. Injection Vecuronium 0.25 mg/kg was used for further maintenance of muscle relaxation.
On laryngoscopy with either of the scopes if glottic visualisation was not adequate, an experienced second assistant was directed to give external laryngeal manipulation (BURP manuever - backward, upward, rightward pressure) to bring the glottis in alignment for a proper visualisation of the vocal cords and to facilitate endotracheal intubation. In cases where difficulty was faced, a malleable stylet was used to facilitate intubation.

Cormack and Lehane Classification: [4] was done according to the degree of glottic exposure.
Grade I: Glottis fully exposed, the entire laryngeal aperture is fully visualized No difficulty expected, no extrinsic pressure required.

Grade II: Visualisation of only the posterior commissure of the laryngeal aperture Optimal external laryngeal manipulation may be required to intubate.
Grade III: Visualisation of only epiglottis. May have difficulty in intubation and can be overcome by use of stylet/bougie.
Grade IV: No glottic structures seen difficult and may even be impossible to intubate. Special methods of intubation required.

The time for successful intubation was measured using a stop watch from the time when the blade was introduced into the mouth until the first breath of the patient was confirmed by capnograph. Following laryngoscopy with either of the scopes, trauma or any amount of blood seen on the scope, lips, gums, oropharynx, tongue, and breakage or trauma to the teeth were considered as airway morbidity. Ease of intubation was assessed by using Intubation Difficulty Score (IDS) it has 7 parameters and each parameter is given 1 point as follows:

Intubation Difficulty Scale Score:

IDS Score	Degree of Difficulty
0	Easy
O<IDS<5	Slight
IDS>5	Moderate to Major
IDS=∞	Impossible Intubation

an IDS score of 0 was taken as an easy intubation, 1-4 as minor difficult intubation and more than 5 as major difficult intubation.

DATA ANALYSIS:

Data was coded and analyzed in statistical software IBM SPSS Statistics Version 25. Quantitative variables were expressed in terms of mean and SD whereas categorical variables in frequency and percentage. Inferential statistics included a test of significance for comparing difference in two groups and within the group difference by unpaired test. Two independent sample test was used to compare mean change from baseline in two groups. Within the group difference of mean was compared using paired t test. Chi square test was used to compare difference in proportion in two groups. $P<0.05$ was considered statistically significant for all comparison.

RESULTS:

The present prospective randomized comparative clinical study was conducted in a tertiary care hospital amongst 100 patients belonging to ASA physical grading I and II of either gender, aged 18- 60 undergoing elective surgical procedures under general anaesthesia.

Table no. 1: Distribution of patients according to their mean age and weight of Group ML and Group VL.

Variable	Group ML		Group VL		P value
	Mean	SD	Mean	SD	
Age	39.48	±10.07	37.34	±10.56	0.302 (No significant difference)
Weight	66.22	±8.27	61.50	±15.28	0.059 (No significant difference)

Table no.1 shows that the mean age of patients in Group ML was 39.48±10.07 years and Group VL was 37.34±10.56 years. The mean weight of patients in Group ML was

66.22±8.27 kgs and in Group VL was 61.50 ±15.28 years. There was no statistically significant difference between the mean ages and weight of two groups.

Table no.2: Distribution of patients according to the perioperative parameters of Group ML and Group VL.

Variable	Group ML		Group VL		P value
	Mean	SD	Mean	SD	
Number of Burps	0.12	0.32	0.00	0.00	0.011 (significant difference)
Lifting Force	0.12	0.32	0.00	0.00	0.011 (significant difference)
Position of Vocal Cords	0.00	0.00	0.00	0.00	-
Number of Intubation attempts	0.26	0.56	0.00	0.00	0.002 (significant difference)
Number of Anesthetist	0.00	0.00	0.00	0.00	-
Number of alternative techniques	0.20	0.40	0.00	0.00	0.001 (significant difference)

Table no.2 shows that in this present study, 6 Patients from Group ML required BURP. There was a statistically significant difference in both the groups (p = 0.011). 6 patients required lifting force in Group ML. The difference was statistically significant (p= 0.011). The vocal cords were abducted in all patients of both the groups. 11 patients in Group ML required 1 extra attempt for successful intubation in Group ML while all patients of Group VL were intubated successfully. (p=0.001). In this study, 4 patients required use of stylet while 6 patients required use of bougie in Group ML while no alternative technique was needed for patients in Group VL. The difference was statistically significant. (p=0.011).

Table no.3: Distribution of patients according to Intubation Difficulty Scale Score in Group ML and Group VL.

Intubation Difficulty Score	Group ML		Group VL	
	No.	%	No.	%
0 (No Difficulty)	13	24.0%	27	54.0%
0< IDS >5 (Slight Difficulty)	37	76%	23	46.0%
>5 (Moderate to Major Difficulty)	0	0%	0	0%
Total	50	100.0%	50	100.0%
	p value = 0.002 (significant difference)			

P value is estimated by using chi square test

Table no.3 shows that in Group ML, 12 (24%) patients while in Group VL 27 (54%) patients had no difficulty while intubation (IDS Score=0). 38 (76%) patients in Group ML and 23 (46%) patients in Group VL had slight difficulty during intubation. (IDS Score >0 & <5). There was no moderate to major difficulty in intubating any patient from both the groups. (IDS Score>5). A significant difference was seen in both the groups. (p= 0.002)

Table no. 4: Time Taken for Intubation (in sec) in Group ML and Group VL.

Time Taken for Intubation (in sec)	Group ML		Group VL		P value
	Mean	SD	Mean	SD	
	30.12	2.03	20.9	1.59	0.001 (significant difference)

*P value is estimated by using t test

Table no.4 shows that the mean time taken for intubation in Group ML was 30.12±2.03 sec. while the mean time for intubation in Group VL was 20.9±1.59 sec. It was found to be statistically significant. (p=0.011)

Table no.5: Mean Heart Rate of Group ML and Group VL.

Time (Minutes)	Group ML(n=50)		Group VL(n=50)		P value	Summary
	Mean	SD	Mean	SD		
Basal	80.36	11.09	81.38	10.44	0.637	Not Significant
1	97.80	12.12	87.56	10.78	0.001	Significant
3	95.18	12.11	84.60	10.62	0.001	Significant
5	92.98	11.71	82.42	10.59	0.001	Significant

P value is estimated by using t test

Table no.5 shows that the mean basal HR in Group ML was 80.36 ±11.09 and in Group VL was 81.38±10.44. Mean HR after intubation at 1 min in Group ML was increased to 97.80±12.12 while it was 87.56 ± 10.78 in Group VL. A statistically significant difference was seen in both the groups (p=0.001). Mean HR after intubation at 5 min in Group ML was decreased to 92.98 ± 11.71 while it was further decreased to 82.42 ± 10.59 in Group VL. A statistically significant difference was seen in both the groups (p=0.001).

Table no.6: Mean Arterial Pressure of Group ML AND Group VL.

Time (Minutes)	Group ML(n=50)		Group VL(n=50)		P value	Summary
	Mean	SD	Mean	SD		
Basal	89.50	6.41	88.88	6.41	0.626	Not Significant
1	106.82	5.55	94.64	6.61	0.001	Significant
3	102.86	5.19	91.46	6.70	0.001	Significant
5	99.26	5.08	89.26	6.99	0.001	Significant

Table no. 6 shows that the mean arterial blood pressure in Group ML was 89.50±6.41 and in Group VL was 88.88±6.41 no significant difference was seen in both the groups. (p=0.626).

Mean Arterial blood pressure after intubation at 1 min in Group ML was decreased to 106.82±5.55 while it was further decreased to 94.64± 6.61 in Group VL. A statistically significant difference was seen in both the groups. (p=0.001). Mean Arterial blood pressure after intubation at 5 min in Group ML was decreased to 99.26±5.08 while it was further decreased to 89.26±6.99 in Group VL. A statistically significant difference was seen in both the groups. (p=0.001).

Discussion:

This present study was undertaken to evaluate and compare the efficacy of Macintosh laryngoscope and Tuoren video laryngoscope with respect to time for intubation, Cormeck Lahane grading, ease of intubation, number of attempts, optimisation manoeuvrers required, haemodynamic changes and complications related to laryngoscopy and intubation.

In our study, there was no statistically significant difference between the mean demographic parameters of two groups.

In the present study, 23 cases were seen having CL grade I in Group ML and 27 cases with CL grade II whereas in Group VL 27 cases were seen with CL grade I and 23 cases with CL grade II. No statistically significant difference was observed for glottic exposure in both groups. (p= 0.424)

Archana K N [5] and Reena et al [6] observed no any statistically significant difference in two groups which was similar to our study.

Although Kaplan et al [4] demonstrated improvement in the Cormack Lehane score while using video laryngoscopy to obtain a direct naked eye view with external laryngeal manoeuvres and a video monitor view within the same attempt. Murphy et al [8] in 2014 compared and concluded that the kings video laryngoscope improves the laryngoscopic view achieving a better glottic view in normal as well as difficult airway.

In our present study, 6 Patients from Group ML required BURP while no any patients required it in Group VL. There was a statistical difference in both the groups. (p = 0.011) while 6 patients required lifting force in Group ML while no any patient needed a lifting force in Group VL in our study. The difference was statistically significant. (p= 0.011). A statistical difference (p=0.011) was seen in the number of attempts required as 11 patients required 1 more attempt for a successful intubation from Group ML. Also, use of stylet was seen in 4 patients while 6 patients required use of bougie in Group ML while no alternative technique was needed for patients in Group VL. The difference was statistically significant. (p=0.011)

In our study, most patients in Group ML needed use of manoeuvres for laryngoscopy. This might be due to video laryngoscopes provide an indirect view of vocal cord on the screen, while in case of direct laryngoscopy the oral, pharyngeal and laryngeal axis need to be in a straight line for which, such manipulations are required and the manipulation needs to be continued until the passage of the ETT to maintain the glottic view.

Shalaka R Sonavane et al [9] also suggested that patients intubated with video laryngoscope required less optimization manoeuvers which correlates with our study. Although Garhwal et al [10], there was a greater need of manipulation maneuvers in Macintosh group as compared to video laryngoscope group.

In our study, all the patients were successfully intubated with video laryngoscope in first attempt.
Mogahed et al [11] and Choi et al [12] also observed that the success of first trial of intubation was achieved more with video laryngoscope compared to direct laryngoscope which was similar to our study. However, Elhadi et al [13] found no statistical difference between the two groups for number of intubations attempted for successful intubation.
In our study there was a significant difference in overall IDS score in both the groups. In Group ML, 12 patients (24%) while in Group VL 27 patients (54%) had no difficulty while intubation (IDS Score=0). 38 patients (76%) in Group ML and 23 patients (46%) in Group VL had slight difficulty during intubation. (IDS Score >0 & <5). There was no moderate to major difficulty in intubating any patient from both the groups. (IDS Score>5). A significant difference was seen in both the groups. (p= 0.002)
M M Chandrashekaraiah et al [14] found no significant difference in two groups. McElwain et al [15] however concluded in his study that video laryngoscope significantly reduced IDS score which correlates with our study. Gupta et al [16] also found IDS score to be significantly less in video laryngoscope group as compared to Mcintosh group which is also similar to our study.

The mean time for intubation taken in Group ML was (30.12±2.03) and Group VL was (20.9±1.59). Statistical difference was seen between two groups. (p=0.011) Hodgett et al87 also found lesser mean time for intubation in video laryngoscope group compared to Macintosh group.
Archana K N et al [5] stated mean time required for video laryngoscope group was 24.8±8.5 compared to 33.8±9.12 in Macintosh group which is statistically significant.
Dashti et al [17] also stated that the intubation time was prolonged in video laryngoscope group as compared to Macintosh group. However, Bhola et al [18] studied that the mean time required for intubation by video laryngoscope was more than Macintosh.

In present study, trauma was observed in 9 patients in Group ML among which 4 suffered injury to lips, 3 suffered trauma to teeth, 2 suffered oromucosal injuries while no any patient had trauma in Group VL. There was a statistically significant difference between two groups (p= 0.011). The reason may be that DL requires an undue pressure on gums, teeth, and periglottic structures for maximum exposure of vocal cords. Mogahed et al [19], also observed more complications with use of DL compared to VL which correlates with our study.
Mrunalini Parasa et al [20] observed oropharyngeal trauma, sore throat and hoarseness of voice in video laryngoscope group. Joseph et al [21] concluded that mucosal injuries were more in video laryngoscope group as compared to Macintosh group.

Baseline Mean heart rate was 80.36±11.09 in Group ML and 81.34±10.53 in Group VL. No statistically significant difference was seen in both groups. (p.0.05) Thus, in our study the rise in mean heart rate was more in group ML as compared to Group VL (p=0.001). Varsha, et al (2019) [22] observed that in the Macintosh group, there was a statistically significant rise in heart rate compared to the Airtraq group during the 2nd and 3rd min after intubation after which the heart rate came down in the 4th min which correlates with our study. Shribaman et al [23] stated that video laryngoscope require lesser airway handling and thus lead to less sympathetic response. In contrast, Parasa et al [20] observed that a higher rise in heart rate with video laryngoscope than Macintosh.

In our study the rise in blood pressure was more in group ML as compared to Group VL (p=0.001). Mogahed et al [19] noted significant increase in heart rate and blood pressure at 2 and 5 mins in Macintosh group after intubation when compared with video laryngoscope group which correlates with our study. Similarly, Elhadi et al [13] also showed that the rise in blood pressure and heart rate were significantly less with Video laryngoscope group when compared to Macintosh group. Woo et al98 observed no any significant difference between the two groups.
In disagreement, Parasa et al [20] observed that haemodynamic response was evident with video laryngoscope than Macintosh. A higher rise in systolic BP, diastolic BP, MAP was seen after intubation with video laryngoscope.

Conclusion:
In present study, we conclude that Tuoren video laryngoscope when compared to Mcintosh laryngoscope improves the visualization of the larynx, is associated with less difficult airway maneuvers, lesser airway morbidity, takes less time for intubation and reduces the stress response to laryngoscopy.

References:
1. van Zundert A, Pieters B, Doerges V, Gatt S. Videolaryngoscopy allows a better view of the pharynx and larynx than classic laryngoscopy. Br J Anaesth. 2012 Dec;109(6):1014-5.
2. Kaplan MB, Ward DS, Berci G. A new video laryngoscope - an aid to intubation and teaching. J Clin Anesth. 2003; 14:620–6.
3. Kaplan MB, Hagberg CA, Ward DS, Brambrink A, Chhibber AK. Comparison of direct and video-assisted views of the larynx during routine intubation. J Clin Anaesth. 2006,18: 357-362.
4. Cormack RS, Lehane J. "Difficult tracheal intubation in obstetrics". Anaesthesia. 1984; 39 (11): 1105-11.
5. Archana KN, Gopi A, Vyshnavi S. CMAC Video Laryngoscope versus Macintosh Laryngoscope for Intubation in Elective Surgery: A Clinical Trial. Indian J Anesth Analg. 2018;5(12):198387.
6. Reena. Comparison of King Vision video laryngoscope (channeled blade) with Macintosh laryngoscope for tracheal intubation using armored endotracheal tubes. J Anaesthesiol Clin Pharmacol. 2019 Jul-Sep;35(3):359-362.
7. Kaplan MB, Ward DS, Berci G. A new video laryngoscope—an aid to intubation and teaching. J Clin Anesth. 2003; 14:620–6.
8. Murphy LD, Kovacs GJ, Reardon PM, Law JA. Comparison of the king vision video laryngoscope with the macintosh laryngoscope. J Emerg Med. 2014 Aug;47(2):239-46.
9. Sonavane SR, Gvalani SK, Bhokare PP. Comparison between Conventional Macintosh Laryngoscope and King Vision Video Laryngoscope in Endotracheal Intubation for Elective Surgeries: A Prospective Randomized Study. Res Inno in Anesth 2020; 5(2):28–32.
10. Garhwal AM, Bhure AR, Bhargava SV, Marodkar KS, Jain AR, Nandwani HP, et al. A clinical assessment of Macintosh blade, Miller blade and King Vision TM Videolaryngoscope for laryngeal aexposure and difficulty in endotracheal exposure. J Evidence Based Med Healthcare 2016;3(31):1380.
11. Mogahed MM, Elghamri MR, Anwar AG. Comparative study of intubation performance between macintosh, the channeled king vision and the C-MAC D-blade videolaryngoscope in controlled hypertensive patients. J Anesth Clin Res

2017;8(11):780.
12. Kim SW, Kim JH, Kim YM, Park JT, Choi SP. Comparison of three types of intubation stylets for tracheal intubation with a McGrath MAC® video laryngoscope by novice intubators in simulated cervical immobilisation: A randomised crossover manikin study. Hong Kong Journal of Emergency Medicine. 2018;25(1):27-32.
13. Elhadi SM, Rady WK, Elfadly AM. A comparative study between the macintosh laryngoscope and the king vision video laryngoscope in endotracheal intubation. Res Opin Anesth Intensive Care 2016; 3:168-72.
14. Chandrashekaraiah, M.M., Sahitya, V.A., Narayan, P. and Adeel, S., 2021. Simulated Difficult Airway: CMAC D Blade or Glidescope?. *Sri Lankan Journal of Anaesthesiology*, 29(1):7–12.
15. McElwain J, Malik MA, Harte BH, Flynn NM, Laffey JG. Comparison of the CMAC video laryngoscope with the Macintosh, Glidescope, and Airtraq laryngoscopes in easy and difficult laryngoscopy scenarios in manikins. Anaesthesia. 2010,65(5):483-9.
16. Gupta N, Garg R, Saini S, Kumar V. GlideScope video laryngoscope-assisted nasotracheal intubation by cuff-inflation technique in head and neck cancer patients. *Br J Anaesth.* 2016; 116:559–60.
17. Dashti M, Amini S, Azarfarin R, Totonchi Z, Hatami M. Hemodynamic changes following endotracheal intubation with glidescope video-laryngoscope in patients with untreated hypertension. Res Cardiovasc Med. 2014;3(2).
18. Bhola R, Bhalla S, Gupta R, Singh I, Kumar S. Tracheal intubation in patients with cervical spine immobilization: A comparison of McGrath(®) video laryngoscope and Truview EVO2(®) laryngoscope. Indian J Anaesth. 2014 May;58(3):269-74.
19. Mogahed MM, Elghamri MR, Anwar AG. Comparative Study of Intubation Performance between Macintosh, the Channeled King Vision and the C-MAC D-Blade Videolaryngoscope in Controlled Hypertensive Patients. J Anesth Clin Res. 2017;8(780):2.
20. Parasa M, Yallapragada SV, Vemuri NN, Shaik MS. Comparison of Glidescope videolaryngoscope with Macintosh laryngoscope in adult patients undergoing elective surgical procedures. Anesth Essays Res 2016; 10:245-9.
21. Joseph S, George B, Surekha. Comparison of hemodynamic responses to laryngoscopy and orotracheal intubation between Macintosh laryngoscope and king vision video laryngoscope in adult surgical patients. *Indian J Clin Anaesth* 2019;6(4):607-613.
22. Varsha AV, George G, Pillai R, Sahajanandan R. Comparative evaluation of hemodynamic responses and ease of intubation with airtraq video laryngoscope versus macintosh laryngoscope in patients with ischemic heart disease. Ann Card Anaesth. 2019 Oct-Dec;22(4):365-371.
23. Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. Br J Anaesth. 1987;59(3):295–299.

ABBREVIATIONS:

ASA- American Society of Anesthesiology
BURP- Backward, upward and rightward pressure
CL Grading: Cormack Lehane Grading
ETT- Endotracheal tube
IDS- Intubation Difficulty Scale Score
ML- Macintosh laryngoscope
NBM- Nil by mouth
SD- Standard Deviation

VLS – video laryngoscopes
VL- Tuoren Video laryngoscope