RESEARCH
www.commprac.com
ISSN 1462 2815

THE IMPACT OF LARYNGOSCOPE CHOICE ON INTUBATION TECHNIQUE DURING CERVICAL SPINE IMMOBILIZATION: VIDEO LARYNGOSCOPE VS. AIRTRAQ LARYNGOSCOPE

Dr. Naveena P [1], Dr. Adithya G Ashok [2], Dr. Arun Kumar B [3], Dr. Shanu S [4]* and Dr. R Brindha [5]

[1] Associate Professor, Department of Anaesthesiology, Vinayaka Mission's Kirupananda Variyar Medical College and Hospitals, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, India. Email: naveenasen@gmail.com
[2] Postgraduate, Department of Anaesthesiology, Vinayaka Mission's Kirupananda Variyar Medical College and Hospitals, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, India. Email: adithyagashok999@gmail.com
[3] Professor, Department of Anaesthesiology, Vinayaka Mission's Kirupananda Variyar Medical College and Hospitals, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, India. Email: cruise2010.mmc@gmail.com
[4] Assistant Professor, Department of Anaesthesiology, Vinayaka Mission's Kirupananda Variyar Medical College and Hospitals, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, India. *Corresponding Author Email: shanushanmugasundaram@gmail.com
[5] Professor and HOD, Department of Anaesthesiology, Vinayaka Mission's Kirupananda Variyar Medical College and Hospitals, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, India. Email: mskbrins63@gmail.com

DOI: 10.5281/zenodo.12264323

Abstract

Background: One of the most challenging factor one for an anesthetist is performing intubation for patients with unstable cervical spine as most of the devices and manouvers associated with certain amount of cervical spine mobility. Airtraq laryngoscope (AL) is one device which was intended in order to acquire clear picture Regarding the glottis without pharyngeal and tracheal axis alignment. Video laryngoscope (VL) is still more advanced device used in intubation in those suffering from cervical spine injury. **Aim:** The objective of the research is to assess and contrast The efficacy of Airtraq and video laryngoscope in the management The use of tracheal intubation in adult patients with cervical spine conditions injury simulation. **Methodology:** Over the course of a year, 60 A cohort of patients were enrolled in a prospective study comparison research by the anesthetic department is located at Vinayaka Missions Kirupananda Variyar Medical College and Hospital in Salem, Tamil Nadu. Each set of patients was split into two, with one group being intubated using an Airtraq laryngoscope and the other using a video laryngoscope. A comparison of the two groups' hemodynamic characteristics, intubation time, number of tries, and problems was conducted. **Results:** When comparing the airtraq group to the VL group during the first 15 minutes of intubation, the hemodynamic parameters of heart rate and blood pressure were measured shown to be higher. In comparison to the AL group, the VL group experienced significantly fewer problems, a shorter ET tube insertion time, and fewer tries overall. **Conclusion:** The current research proves that video laryngoscope was easier and comfortable for anesthetist when intubating cervical spine patients injury compared to airtraq laryngoscope.

Keywords: Airtraq Laryngoscope, Video Laryngoscope, Cervical Spine Injury, Intubation.

INTRODUCTION

Managing the airway during the time of any surgeries or in emergencies is considered as a prime responsibility of the anesthetist. Most of the morbidities and mortalities that had been associated with anesthesia is mainly because of the difficulty that occur during intubation.[1] It is the duty of the anesthetist to assess the potential problems that might occur during intubation for patients with difficult airways. Among the various injuries that occur in trauma patients the most challenging one for the anesthetist is performing intubation for patients with unstable cervical spine who requires surgical

intervention, as these patients requires particular attention in assessing During intubation, the cervical spine moves. All the devices and the manouvers that are accessible for intubation is related with certain level of cervical spine movement.[2-5]

The first and foremost device which is still to be considered as the gold standard device is the Macintosh Laryngoscope (ML).[6] This conventional device demands for To align the pharynx and tracheal axis, extend the head and flex the cervical spine, for getting a direct view of larynx.[7] Cervical spine movements might be one of the biggest limitation in this device particularly when used in patients with trauma involving the cervical spine. Though manual inline axial stabilization technique (MIAS) could be followed yet it becomes more difficult When observing the larynx with this traditional device.[8,9]

One among the newer devices that has been used for intubation in normal or difficult airways is Airtraq Laryngoscope (AL). In this device the blade is designed with 2 channels, in which An image is transferred from the tip to the proximal portion of the tube using lenses, prisms, and mirrors in the second channel, which is used to pass the endotracheal tube view that creates a good visualisation of pharyngeal and tracheal alignment, the glottis and its surrounding structures axes.[10]

Yet another invention in the field of intubation is the invention of video laryngoscope. It is the Macintosh blade connected to a video unit. This video laryngoscope provides a field view of 80^0, and the motion or captured image can be displayed on the dedicated monitor. It is operated similarly to a Macintosh device for direct laryngoscopy, and while the operator watches the larynx on the video screen, it can also be operated as an indirect laryngoscope.[11]

videos Laryngoscopes Evidence has shown that they enhance the success rates of tracheal intubation in patients with challenging airways, indicating their potential utility in managing difficult airways. As of today in this part of the country not many studies have been conducted in comparing the efficacy between Airtraq laryngoscope and efficacy video laryngoscope and so The objective of this study was to evaluate and compare the effectiveness of the Airtraq and a video laryngoscope, tracheal intubation is performed on adult patients while cervical spine damage simulation is simulated using manual-in-line stabilisation.

METHODOLOGY

The anaesthesia department is located at Vinayaka Missions Kirupananda Variyar Medical College and Hospital in Salem, Tamil Nadu carried out a prospective comparison research over the course of a year. The subjects of our research were 60 adult patients of both sexes Patients who were planned to undergo elective surgery with general anesthesia and endotracheal intubation. Patients between the ages of 18 and 50 with ASA grade I and II, patients having Modified Mallampati score of I – IV, and Modified Cormack- lehane grades between I and IV were used as the participants of our investigation. Patients with ASA grade III and IV, with inter-incisor distance of <3cm, patients who were recognized to have difficult Excluded from the research were individuals with uncontrolled hypertension, heart problems, renal or hepatic insufficiency, laryngoscopy, and intubation at the time of the pre-anesthesia assessment.

Using a closed envelope technique, the patients were segregated into two groups, each consisting of thirty individuals at random.

- Group A: Using an Airtraq laryngoscope for endotracheal intubation, 30 patients underwent general anaesthesia.
- Group B consisted of thirty patients who underwent general anaesthesia and video laryngoscope endotracheal intubation.

All patients participated in the trial gave their informed written permission before the study was initiated, with approval from the institutional Ethics Committee. Every patient had a pre-operative anaesthetic evaluation. In order to avoid neck movements that might impair laryngeal vision during direct laryngoscopy and complicate intubation, patients with cervical spine injuries often need to employ semi-rigid cervical collars or manual in-line stabilisation. We performed manual in-line stabilisation in this trial with the aim of simulating a comparable challenging airway condition for cervical spine immobilisation. Additionally, we fastened a cervical collar to further limit the mobilisation.

Upon entering the operating room, patients were outfitted with the usual monitoring devices, such as an ECG, an arterial blood pressure monitor that does not require penetration of the skin, and a device that measures the oxygen saturation level in the blood. Every one of them had the same anaesthetic procedure. Three minutes of 100% oxygen pre-oxygenation were completed. The induction process involved the administration of Fentanyl at a dosage of 1 microgram per kilogram, propofol at a dosage of 1.5-2 milligrams per kilogram, and midazolam at a dosage of 0.03 milligrams per kilogram. The pillow was taken out, and the neck was immobilised using a technique called MILS (Manual in Line Stabilisation), which was administered by a skilled person who held the mastoid processes and the sides of the neck to prevent the head and neck from moving in either direction. Oro-tracheal intubation was performed after administering a dose of 0.1 mg/kg of vecuronium. carried out using the endotracheal tube and the intubation apparatus that was chosen for each group. This was done after making sure that all muscles had relaxed completely.

The trachea was intubated using a properly sized a tube for the throat. The placement of the endotracheal tube (ETT) was verified by doing bilateral chest auscultation and observing the EtCO2 waveform. Once confirmed, the tube was properly secured.

During the first, third, and fifth minute following endotracheal intubation, measurements were taken of hemodynamic parameters, specifically systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR). The following outcome indicators were assessed during the laryngoscopy and intubation operation.

1) The number of efforts needed to achieve success perform intubation.
2) The duration of endotracheal tube insertion was measured from the initiation of the laryngoscope blade into the patient's mouth until successful intubation was confirmed by the presence of a normal capnogram waveform...
3) Rate of succeed or fail.
4) The following complications were observed: airway damage, the patient experienced bronchospasm, a technical malfunction of the video laryngoscope, and a drop in oxygen saturation levels below 90%.

The data was inputted and analysed using SPSS version 24. The average and standard deviation (SD) were computed for all variables that followed a parametric distribution, whereas the percentage was calculated for all variables that represented frequencies. Statistical inference was conducted utilizing the student t-test and the chi-square test, taking into consideration a significant level of p<.05.

RESULTS

The research participants, totaling 60 individuals, were separated into two groups, each consisting of 30 individuals. Group A subjects received endotracheal intubation through Airtraq laryngoscope and for group V patients it was via video laryngoscope. The demographic characteristics, such as age and gender, the pre-operative measurements like anthropometric variables and ASA status were found to be perfectly The two groups were matched since There was no difference that could be considered statistically significant between them for any of these variables (table 1).

Table 1: Demographic, anthropometric and ASA status comparison between the two groups

Variables	Group A	Group V	P value
Age (mean ± SD)	39.2 ± 11.9	37.4 ± 10.1	0.325#
Male : female	Male =8: Female= 22	Male = 9 Female = 21	0.714*
Weight (mean ± SD)	155.9 ± 7.7	156 ± 8.5	0.655*
Height (mean ±SD)	61.7 ± 7.9	60.2 ± 11.7	0.582*
BMI (mean ± SD)	24.8 ± 3.4	24.6 ± 4.4	0.818*
ASA	Grade 1 = 19 Grade II = 11	Grade 1 = 20 Grade II = 10	0.693#

#- p value derived using chi-square test
* - p value derived using student T test

Table 2: Comparison of hemodynamic parameters between the two groups

Hemodynamic parameter		Group A	Group V	P value
Heart rate	**0 mins**	78±6.2	79.1±6.8	0.568
	5 mins	118.4±8.4	111.3±7.9	**0.004**
	15 mins	114±9.3	104.8±7.2	**0.0004**
	30 mins	107.4±8.4	100.4±10.6	**0.014**
	60 mins	106.7±14.7	100±13.8	0.108
	120 mins	114.2±8.5	105±10	**0.001**
Systolic BP	**0 mins**	124.9±10.9	125.9±9.1	0.417
	5 mins	151.4±8.7	137.2±9.6	**<.00001**
	15 mins	148.2±13.5	133.6±9.1	**<.0001**
	30 mins	143.9±11.2	140.5±7.5	0.231
	60 mins	133.8±14.8	134±13.6	0.173
	120 mins	153.4±10.5	143.2±9	**0.0007**
Diastolic BP	**0 mins**	81.1±6.7	81.3±7.1	0.386
	5 mins	96.4±6	92.7±5.5	**0.0035**
	15 mins	95±7.1	89±8.4	**<.0001**
	30 mins	85.7±5.3	85.1±4.3	0.731
	60 mins	80.1±14.8	79.7±13	0.694
	120 mins	97.2±6.6	94.7±4.2	0.127
MAP	**0 mins**	96.2±5.2	94.6±6.7	0.388
	5 mins	116±5.8	112±5.8	**0.021**
	15 mins	110.9±6.6	107.2±5.2	**0.037**
	30 mins	106.1±6.3	104±4.6	0.209
	60 mins	97.5±13.2	98±11.1	0.418
	120 mins	116.1±8.3	113±5.3	0.141

p value derived using student T test

Once the intubation was performed the hemodynamic parameters for all the patients were measured at regular intervals from 0 minutes. The heart rate was determined to be elevated among group A Individuals seeking medical treatment during the 5th, 15th, 30th and 120th minute post intubation compared to patients in group V and statistical significance was determined for this difference. Comparing the blood pressure, it was found that the systolic BP was higher among group A in the 5th, 15th and 120th minute compared to group V after intubation, Furthermore, the difference was shown to be statistically significant. Similarly, only the fifth and fifteenth minutes following intubation did patients in group A exhibit greater The mean artery pressure (MAP) and the diastolic blood pressure in comparison to those in group V, and this difference was statistically significant (table 2).

Respiratory parameters such as respiratory rate and SPO2 were examined between the two groups starting from the moment of intubation, and it was discovered that there was no discernible difference between them. for both these parameters throughout the entire follow up period of 2 hours (table 3).

Table 3: Comparison of respiratory rate and SPO2 between the two groups

Parameter		Group A	Group V	P value
Respiratory rate	0 mins	14.4±1	13.9±1.2	0.153
	5 mins	14.4±1	14.2±1.3	0.285
	15 mins	13.7±0.9	14.3±1.3	0.053
	30 mins	13.6±0.9	14.2±1.2	0.082
	60 mins	13.5±0.9	14±1	0.175
	120 mins	13.6±0.8	13.8±0.9	0.239
SPO2	0 mins	98±1	98.2±0.6	0.314
	5 mins	98±1.1	98.2±0.8	0.937
	15 mins	98±1.2	98±0.9	0.989
	30 mins	98±0.98	97.7±1	0.683
	60 mins	97.9±1.1	97.9±0.9	0.919
	120 mins	97.9 ±1	98.1±0.9	0.515

The average duration of insertion of ET tube among the patients in Group A was 15.1 seconds, whereas it was 12.3 seconds among patients in group V Furthermore, it was determined that this disparity demonstrated a significant statistical difference. Similarly, the quantity of endeavors made for inserting the ET tube was more among the patients when comparing Group A to Group V. The success rate of ET tube insertion was considered when the attempt for insertion was made in less than 3 attempts and based on this the success rate among group A was 76.6% and for group V it was 93.3% The observed difference was found to be statistically significant, with a p-value below 0.05. (table 4).

Table 4: Comparison of mean time of insertion of ET tube, number of attempts made and success rate between the two groups

Parameters		Group A	Group V	P value
Time of insertion of ET tube (mean ± SD)		15.1 ± 0.67	12.3 ± 0.87	**<.0001**
Number of attempts	1	8	12	**0.0071**
	2	15	16	
	3	7	2	
Success rate		23/30 (76.6%)	28/30 (93.3%)	**0.003**

The occurrence of problems, such as damage to the airway and bronchospasm during ET tube insertion were more common among patients who had Airtraq laryngoscope procedure compared to video laryngoscope technique The observed discrepancy was found to be statistically significant, with a p-value below 0.05. (table 5).

Table 5: Incidence of complications during the procedure between the two groups

Complication	Group A	Group V	P value
Airway injury	6 (20%)	1 (3.3%)	**<.0001**
Bronchospasm	4 (13.3%)	1 (3.3%)	**<.0001**

DISCUSSION

Managing the airway remains as a basic primary skill among anesthetist throughout their carrier, with the invention of many new devices and instruments for this crucial technique the burden has been eased among the anesthetist. Despite with all these advances in the field of medical technology performing an emergency intubation procedure still continues to be a challenging issue even with experienced anesthetist. Studies have shown that the role of airtraq laryngoscope was promising in intubating individuals with cervical spine injuries but the introduction of video laryngoscope has become still more popular as it overcomes certain disadvantages of airtraq laryngoscopes It lowers the time of intubation. The objective of our investigation was to compare the effectiveness between Airtraq and video laryngoscope were used on patients with simulated cervical spine damage. There are a number of demographic factors that include age, gender, height, weight, body mass index, and ASA status. were comparable between the two study groups, so these parameters will not influence the findings of our research subjects.

The outcomes of our study shows that the hemodynamic Parameters such as cardiac rhythm, systolic and diastolic pressure, and average arterial pressure were significantly higher during the first 5 to 15 mins after intubation among the Airtraq group compared to video laryngoscope group, whereas after 15 mins Not a single one discernible variation in the hemodynamic parameters Throughout the entire follow-up period, there was interaction between the two groups. Prior research that had conducted comparisons between airtraq and Mcintosh laryngoscope had showed that the measurements of the measurements of heart rate, blood pressure, and mean arterial pressure exhibited a statistically significant rise.

Amidst Mcintosh group during all the periods in follow-up compared to airtraq group.[12-15] Researchers had shown that airtraq laryngoscope would Obtain a visual of the glottis without aligning the axes of the mouth, throat, and windpipe which would as such requires less force during laryngoscopy procedure, whereas using Mcintosh laryngoscope The lack of alignment of the three airway axes prevents the ability to achieve proper positioning, resulting in the need for increased lifting force and additional manipulations are required during the procedure which would invariably increase the heart rate and the blood pressure.[16,17] Though very little force was required in Airtraq technique compared to Mcintosh laryngoscope, whereas when compared with video-laryngoscope, VL as such requires no force in alignment and viewing the glottis and so there was no increase in heart rate and BP among the patients in VL group even during the first 15 mins after intubation.

Both in Airtraq and VL techniques the airway is very well maintained and there was no change in the respiratory rate and the SPO2 levels throughout the follow-up period. In our current study, we observed a notable increase Regarding the time of intubation, there was a difference observed between the Airtraq group and the VL group, the Airtraq laryngoscope provides enhanced visualization of the glottis., but still the anesthetist finds video laryngoscope to be much easier in intubation compared to airtraq.[18,19] Studies done earlier also had proven the same and few studies had got the feedback from anesthetist about the two procedures and many have quoted VL technique to be much easier for them.[20-22]

The number of attempts were more and the success rate was significantly lesser among airtraq group compared to VL group in our study, when compared with previously done studies we found a mixed type of results where few studies quoted that there was no change in the success rate and few studies mentioned VL technique had a better success rate.[20-24] Complications such as airway injury and bronchospasm were more common among airtraq procedure compared to VL technique In this investigation, the findings are consistent with the results of the meta-analysis study. Done by S R Lewis etal which was conducted with 64 studies.[25] the reasons quoted for these complications were lack of experience and skill by the anesthetist and they were more comfortable towards VL in getting the glottis view more easier.

The present investigation had specific constraints. The sample size may have been greater but due to logistic reasons we limited the sample size to 60. The investigator could not be blinded to the laryngoscope they were using, which might have biased in grading the ease of intubation. All intubations were done only on patients having ASA Grades 1, 2 and on simulation of cervical spine injury patients; the scenario might be different on original patients with cervical spine injury Additional research is required to elucidate the efficacy of these devices in challenging airway scenarios and during emergency circumstances.

CONCLUSION

The present study proves that video laryngoscope was easier and comfortable for anesthetist in intubating patients with cervical spine injury compared to airtraq laryngoscope, as the time taken for inserting ET tube, the quantity of tries and complications was significantly less in video laryngoscope group. Hemodynamically we found VL and airtraq procedures to be safe among patients with cervical spine injury.

Limitations:

The small sample size of 42 patients limits the generalizability of the findings. As this was a single center study with a comparatively short sample size, results of this study cannot be generalized. Generalization requires the support of results from similar large studies

Acknowledgments:

The authors would like to thank all of the study participants and the administration of Department of Anaesthesiology, Vinayaka Mission's Kirupananda Variyar Medical College in Salem, Tamil Nadu, India for granting permission to carry out the research work.

Conflicts of interest: There are no conflicts of interest**.**

Ethical statement:

Institutional ethical committee accepted this study. The study was approved by the institutional human ethics committee, Vinayaka Mission's Kirupananda Variyar Medical College in Salem, Tamil Nadu. Informed written consent was obtained from all the study participants and only those participants willing to sign the informed consent were included in the study. The risks and benefits involved in the study and the voluntary nature of participation were explained to the participants before obtaining consent. The confidentiality of the study participants was maintained.

Funding: Nil.

Authors' contributions:

Dr.Naveena P and Dr Shanu S - conceptualization, data curation, investigation, methodology, project administration, visualization, writing—original draft, writing—review and editing; ***Dr.Adithya G Ashok*** -conceptualization, methodology, writing—original draft, writing—review and editing; ***Dr. Arun Kumar B*** - conceptualization, visualization, supervision, writing—original draft; ***Dr R Brindha*** - methodology, writing—original draft, writing, review and editing. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work. All authors have read and agreed to the published version of the manuscript.

Data Availability:

All datasets generated or analyzed during this study are included in the manuscript.

Informed Consent:

Written informed consent was obtained from the participants before enrolling in the study

References

1) Raza N, Hasan M, Ahmed SM, Bano S, Athar M. A comparative study of McGrath and Airtraq videolaryngoscopes for tracheal intubation. J Anaesthesiol Clin Pharmacol 2017;33:221-5.

2) Kihara S, Watanabe S, Brimacombe J. Segmental cervical spine movement with the intubating laryngeal mask during manual in-line stabilization in patients with cervical pathology undergoing cervical spine surgery. Anaesth Analg 2000;91:195–200.

3) Murthy TV, Bhatia P, Gogna RL. Airway management: uncleared cervical spine Injury. IJNT 2005;2:99–101.

4) Huang WT, Chung YT. Clinical comparisons between GlideScope video laryngoscope and Trachlight in simulated cervical spine instability. J Clin Anaesth 2007;19:110–4.

5) Henderson JJ, Popat MT, Latto IP, Pearce AC. Difficult airway society guidelines for management of the unanticipated difficult intubation. Anaesthesia 2004;59:675–94.

6) Maharaj CH, O'Croinin D, Curley G, Harte BH, Laffey JG. A comparison of tracheal intubation using the Airtraq or the Macintosh laryngoscope in routine airway management: A randomised, controlled trial. Anaesthesia. 2006;61(11):1093-99.

7) Bhandari G, Shahi KS, Asad M, Bhakuni R. Airtraq versus Macintosh laryngoscope: A comparative study in tracheal intubation. Anaesth Essays Res. 2013;7(2):232-36.

8) Paul J, Allegretti DO. Larygoscope blade review. Am J Emerg Med 2008;26:8–9.

9) Turkstra TP, Eng M, Pelz David M, Jones Philip M. Cervical spine motion: a fluoroscopic comparison of the Airtraq laryngoscope versus the Macintosh laryngoscope. Anesthesiology 2009;111(1):97–101.

10) Dhonneur G, Noko S, Amathieu R, El Housseini L, Poncelet C, Tual L. Tracheal intubation using the Airtraq in morbid obese patient undergoing emergency cesarean delivery. Anesthesiology 2007;106:629–3.

11) Varshney P, Ahmed SM, Siddiqui OA, Nadeem A, Ajmal PM. Acomparative evaluation of Airtraq and Hansraj Video laryngoscopes in patients undergoing tracheal intubation with cervical spine immobilization - A randomized prospective study. JAnaesthesiol Clin Pharmacol 2021;37:336-41.

12) Chrisen H, Maharaj B, Elma B, Brian H, Harte MB, John G. Endotracheal intubation in patients with cervical spine immobilization. Anesthesiology 2007;107:53–9.

13) Maharaj CH, Higgins B, Harte BH, Laffey JG. Evaluation of ease of intubation with the Airtraq or Macintosh laryngoscope by anaesthetists in easy and simulated difficult laryngoscopy: a manikin study. Anaesthesia 2006;61:469–77.

14) Costello JF, Maharaj CH, Harte BH. Evaluation of the Airtraq and Macintosh laryngoscopes in patients at increased risk for difficult tracheal intubation. Anaesthesia 2008;63:182–8.

15) Chalkeidis, Georgios K, Apostolos K. A comparison between the Airtraq and Macintosh laryngoscopes for routine airway management by experienced anesthesiologists: a randomized clinical trial. Acta Anaesthesiol Taiwan 2010;48(1):15–20.

16) Vlatten A, Fielding A, Brenard A, Litz S, Mac B, Soder C. Comparison of the Airtraq Laryngoscope to the direct Laryngoscopy in paediatric airway. J Pediatr Intensive Care. 2012;2:71-76.

17) Pean D, Desdotis A, Asthenone K, Lejus C. Airtraq laryngoscope for intubation in Treacher Collins syndrome. Paedia tr Anaesth. 2009;19:698-99.

18) Wan L, Liao M, Li L, Qian W, Hu R, Chen K, et al. McGrath Series 5 videolaryngoscope vs Airtraq DL videolaryngoscope for double-lumen tube intubation: A randomized trial. Medicine (Baltimore) 2016;95.

19) Ali QE, Amir SH, Jamil S, Ahmad S. A comparative evaluation of the Airtraq® And King Vision® video laryngoscope as an intubating aid in adult patients. Acta Anaesthesiol Belg 2015;66:81-5.

20) Abdallah R, Galway U, You J, Kurz A, Sessler DI, Doyle DJA. Randomized comparison between the Pentax AWS video laryngoscope and the Macintosh laryngoscope in morbidly obese patients. Anesth Analg 2011; 113: 1082–7

21) Ithnin F, Lim Y, Shah M, Shen L, Sia AT. Tracheal intubating conditions using propofol and remifentanil targetcontrolled infusion: a comparison of remifentanil EC50 for GlideScope and Macintosh. Eur J Anaesthesiol 2009; 26: 223–8.

22) McElwain J, Laffey JG. Comparison of the C-MAC, Airtraq, and Macintosh laryngoscopes in patients undergoing tracheal intubation with cervical spine immobilization. Br J Anaesth 2011; 107: 258–64.

23) Shippey B, McGuire B, Dalton A. A comparison of the McGrath videolaryngoscope and the Macintosh laryngoscope in patients with cervical spine immobilisation. Anaesthesia 2013; 68: 883

24) Siddiqui N, Katznelson R, Friedman Z. Heart rate/blood pressure response and airway morbidity following tracheal intubation with direct laryngoscopy, GlideScope and Trachlight: a randomized control trial. Eur J Anaesthesiol 2009; 26: 740–5.

25) S. R. Lewis, A. R. Butler , J. Parker , T. M. Cook O. J. Schofield-Robinson and A. F. Smith. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation: a Cochrane Systematic Review. British Journal of Anaesthesia, 2017;119 (3): 369–83.