Original Article

Comparison of face-to-face tracheal intubation and conventional head-end tracheal intubation using Airtraq™ video-laryngoscope in adults – A randomised study

Swati Bharti, Sujata Chaudhary, Rashmi Salhotra, Seema Meena[1]

Department of Anesthesiology, Critical Care and Pain Medicine, University College of Medical Sciences and Guru Teg Bahadur Hospital, Shahdara, Delhi, [1]Department of Anesthesiology, Institute of Human Behaviour and Allied Sciences, Delhi, India

Abstract

Background and Aims: Tracheal intubation can be difficult in certain scenarios where the head-end of the patient is not accessible as in entrapped casualties. A face-to-face technique using a video-laryngoscope can prove to be useful in such scenarios. However, the two positions of tracheal intubation namely, face-to-face and head-end, using video-laryngoscope have never been compared in patients.

Material and Methods: Fifty patients of either sex, between 18 and 60 years, ASA class I/II, MPC I/II, scheduled to undergo surgical operations requiring general anesthesia with tracheal intubation were randomly allocated to either Group F (face-to-face intubation) or Group H (head-end intubation). Intubation was performed using Airtraq™ video-laryngoscope in both groups. Time taken for successful intubation, device insertion time, glottic view as per Cormack and Lehane (CL) grade, ease, attempts, the incidence of failed intubation, and hemodynamic parameters were noted.

Results: The time taken for successful intubation in Group F was significantly longer than in Group H (38.09 ± 19.45 s vs. 19.32 ± 9.86 s, respectively; $P < 0.001$). Three cases of failed intubation were noted in Group F compared to none in Group H ($P = 0.235$). Glottic view, ease, attempts, and hemodynamic parameters were comparable among the groups ($P > 0.05$).

Conclusion: The time taken for successful tracheal intubation was longer in face-to-face technique than in head-end technique in patients with the normal airway. However, both techniques were similar in terms of glottic view, ease of intubation and number of intubation attempts, the incidence of failed intubation, and hemodynamic changes. Therefore, face-to-face tracheal intubation is a good alternative to secure the airway when the head-end is not accessible.

Keywords: Airtraq, airway, face-to-face, intubation, oro-tracheal intubation, video-laryngoscope

Introduction

Airway management by tracheal intubation is considered a major responsibility and a vital skill for anesthesiologists. Recent years have witnessed the introduction of many new techniques for airway management. Video-laryngoscopy is a reliable, faster, and comfortable method of laryngoscopy, and tracheal intubation and is a good substitute for direct laryngoscopy, especially in difficult airway management.[1]

At times, the head-end of the patient is not accessible for intubation, for example, in entrapped casualties, and limited space such as in an ambulance or helicopter.[2] In such scenarios, the face-to-face technique of tracheal

Address for correspondence: Dr. Swati Bharti,
65, Jemini Park, Nangli Sakrawati, Najafgarh, New Delhi - 110 043, India.
E-mail: swatibharti2012@gmail.com

Access this article online

Quick Response Code:

Website: https://journals.lww.com/joacp

DOI: 10.4103/joacp.joacp_161_22

How to cite this article: Bharti S, Chaudhary S, Salhotra R, Meena S. Comparison of face-to-face tracheal intubation and conventional head-end tracheal intubation using Airtraq™ video-laryngoscope in adults – A randomised study. J Anaesthesiol Clin Pharmacol 2023;39:609-14.

Submitted: 27-Apr-2022 **Revised:** 20-Aug-2022
Accepted: 11-Sep-2022 **Published:** 22-May-2023

intubation helps in securing the airway from the front of the patient.

Airtraq™ (Prodol Meditec S.A. Vizcaya, Spain) is a tube/guide channel video-laryngoscope, which can facilitate tracheal intubation in patients with normal or difficult airways. The disposable blade of Airtraq™ consists of two side-by-side channels, one for the optics and the other for the endotracheal tube (ETT). A wireless liquid crystal display (LCD) monitor is mounted on the top of the handle, allowing the operator to focus on the patient's face and monitor the screen simultaneously.[3] The screen can be flipped and rotated to allow intubations from any position. The image can be rotated upside down when necessary.[4] It can be used for endotracheal intubation by inserting the device from any relative operator-to-patient position.[5]

Various techniques have been described to facilitate intubation when there is limited access to the head end of the patient, including the inverse, face-to-face, ice-pick, claw–hammer, and lying position.[6-9] All these different positions were more or less similar where the airway was secured while standing on one side of the patient, facing the patient from the front. that is, face-to-face. However, most positions have primarily been studied with manikins and very limited literature is available describing face-to-face tracheal intubation in actual patients. We did not find any human study comparing the two positions of tracheal intubation namely, head-end and face-to-face. Therefore, the present study was designed to compare face-to-face tracheal intubation and conventional head-end tracheal intubation using Airtraq™ video-laryngoscope in adults with normal airways undergoing elective surgeries under general anesthesia.

The primary outcome measure was time taken for successful tracheal intubation and secondary outcome measures were intubating conditions in terms of device insertion time, glottic view, ease of intubation, need for additional maneuvers to facilitate intubation, attempts of intubation, the incidence of failed intubation, and hemodynamic response to laryngoscopy and intubation.

Material and Methods

This randomized trial was undertaken after obtaining approval from the Institutional Ethics Committee - Human Research (IEC-HR), University College of Medical Sciences, University of Delhi; IEC-HR/2018/36/20R; October 26, 2018; Chairman – Prof. Nalin Mehta. This study was prospectively registered with the Clinical Trials Registry of India (CTRI/2018/12/016611). This study was conducted from November 2018 to April 2020 with the first case being recruited after the clinical trials registry was done. The study was conducted in accordance with the Declaration of Helsinki of 1975, as revised in 2013, for experiments on humans. Written informed consent was obtained from all participating subjects.

Fifty adult patients of either sex between the age group 18 and 60 years, belonging to ASA physical status I and II, Modified Mallampati Class I and II, having mouth opening >3 finger breadths, thyromental distance >6 cm, and body mass index (BMI) <30 kg/m^2 were included in this study. Patients having anticipated difficult bag and mask ventilation or difficult intubation, history of upper respiratory tract infection in the last 15 days, cervical spine disorder, coagulation disorders, features of raised intracranial pressure, or risk of pulmonary aspiration of gastric content, for example, pregnant females, patients with a full stomach, gastroesophageal reflux disease, or undergoing surgeries involving the oral cavity, larynx, pharynx, and neck were excluded.

Preoperative evaluation of the patient was done 1 day before the surgery and patients were kept nil orally overnight before surgery. Tablet alprazolam 0.25 mg and ranitidine 150 mg were administered the night before and the morning of surgery with sips of water.

In the preoperative area, baseline heart rate, systolic and diastolic blood pressure, mean arterial pressure, and SpO_2 were recorded. In the operating room, continuous monitoring in the form of lead II electrocardiography, pulse oximetry, and non-invasive blood pressure was started and an IV line was secured. Airtraq™ was prepared and an appropriately sized ETT (7.5 mm for females and 8.0 mm for males) was mounted.

Patients were randomly allocated using a computer-generated random number table to one of the two groups: Group F (laryngoscopy performed using Airtraq™ video-laryngoscope with the laryngoscopist standing face-to-face on the right side of the patient) or Group H (laryngoscopy performed using Airtraq™ video-laryngoscope with the laryngoscopist standing at the head-end of the patient). All intubations were performed by either one of the two senior anesthesiologists who were trained to acquire proficiency in the use of Airtraq™ video-laryngoscope by performing a minimum of 20 intubations on manikin from both the positions of the operator, namely, face-to-face and head-end, before commencing the study.

General anesthesia was induced using morphine 0.1 mg/kg i.v. and propofol 2.0–2.5 mg/kg i.v. After ensuring successful bag-mask ventilation, vecuronium 0.1 mg/kg i.v. was administered to facilitate tracheal intubation. Capnography

was instituted after induction of anesthesia. Laryngoscopy was performed as per group allocation. Cormack and Lehane grade was assessed and if the CL grade was ≤II, intubation was performed. However, if the initial laryngoscopic view was CL grade ≥III, backward–upward–rightward pressure (BURP) maneuver was performed. If the grade on laryngoscopy now improved to CL grade ≤II, intubation was attempted. Proper placement of ETT was confirmed by auscultation and end-tidal carbon dioxide (EtC_{O2}) measurements. The tracheal tube was fixed after confirming equal air entry in both lung fields. All patients were ventilated with 33% O_2 in N_2O and sevoflurane 1–2% for maintenance of anesthesia.

The primary outcome measure was the *intubation time* (time from the device entering the oral cavity to the entry of ETT through vocal cords as seen on the video monitor). The secondary outcome measures included *device insertion time* (time taken from the device entering the oral cavity until clear visualization of the glottis), *glottic view* (*Cormack and Lehane grading* – grade 1: most of the glottis is visible; grade 2: only the posterior extremity of the glottis is visible; grade 3: only epiglottis visible; grade 4: epiglottis is not seen), *ease of intubation* (easy: tracheal intubation without maneuver; satisfactory: tracheal intubation with maneuver; difficult: tracheal intubation not possible even with maneuvers), *need for optimization maneuvers* to facilitate intubation, *number of intubation attempts* (if the tube/device was withdrawn from the oral cavity to be re-inserted, it was counted as a new attempt), *the incidence of failed intubation* (intubation not possible within 120 s or three attempts, or requirement of switching over to direct laryngoscopy using Macintosh laryngoscope). Heart rate, systolic and diastolic blood pressure, mean arterial pressure, and saturation were recorded just before laryngoscopy at 1, 3, 5, 10, and 15 min after intubation. Incidence of hypoxemia ($SpO_2 \leq 90\%$), mucosal damage with blood staining after the removal of the device, and any tooth or tongue trauma were also recorded.

Considering the variability of intubation time in face-to-face tracheal intubation of 2.46 s (interquartile range [IQR]: 10.3–18.8) with a median of 14 s.[4] Assuming the same variability in head-end tracheal intubation, to estimate an absolute difference of 2 s in median intubation time at $\alpha = 5\%$ and power = 80%, a sample of 25 patients was required in each group.

Data were entered in a Microsoft excel spreadsheet. All statistical analyses were done using SPSS v. 20.0. Quantitative parameters (age, weight, intubation time, device insertion time) were compared between the groups by unpaired *t*-test/Mann–Whitney *U* test as applicable. Hemodynamic parameters (heart rate, SBP, DBP, and MAP) were compared using repeated measure analysis of variance (ANOVA), followed by Dunnett's test. Qualitative parameters (gender, ASA grading, Modified Mallampati class, Cormack and Lehane grade, number of intubation attempts, and ease of intubation) were compared using the Chi-square test/Fischer's exact test. Data are presented as the mean ± standard deviation with a 95% confidence interval (CI), or as a number (proportion). A *P* value of <0.05 was considered significant.

Results

Fifty-seven patients were assessed for eligibility. Seven patients were excluded. Fifty patients were finally randomized and allocated into two groups of 25 each [Figure 1].

The demographic data are shown in Table 1. The patient's airway management data are shown in Table 2. The device insertion time and intubation time were significantly longer in group F when compared to group H. Ease of intubation, the number of intubation attempts, and use of maneuvers were comparable among the groups.

Intubation was observed to be "easy" in 92% of the cases in the head-end group and 72% in the face-to-face group. Fewer patients (8%) required optimization maneuvers to improve glottic exposure while intubating from the head-end as compared to 28% of patients in the face-to-face group.

Table 1: Demographic profile

	Group F (*n*=25)	Group H (*n*=25)	*P*
Age (years)†	30.4±9.6	38.0±12.8	0.024*
Weight (kg)†	56.3±7.9	55.8±9.5	0.823
Gender (M:F)‡	6:19	8:17	0.529
ASA grading (I:II)‡	23:2	20:5	0.417
MP class (I:II)‡	15:10	11:14	0.258

**P<0.05=significant; †values are expressed as mean±SD; ‡values are expressed as ratio*

Table 2: Patient airway management data

	Group F (*n*=25)	Group H (*n*=25)	*P*
Device insertion time† (s)	18.80±8.70	9.56±4.37	<0.001*
Intubation time† (s)	38.09±19.45	19.32±9.86	<0.001*
Number of cases with successful intubation‡	22 (88%)	25 (100%)	0.235
Number of intubation§ attempts (1:2)	22:3	25:0	0.235
Cormack and Lehane grade§ (I:II)	23:2	25:0	0.490
Ease of intubation§ (easy: satisfactory:difficult)	18:4:3	23:2:0	0.110
Need for optimization maneuver‡	7 (28%)	2 (8%)	0.138

**P<0.05=significant; †values are expressed as mean±SD; ‡values are expressed as numbers; §values are expressed as a ratio*

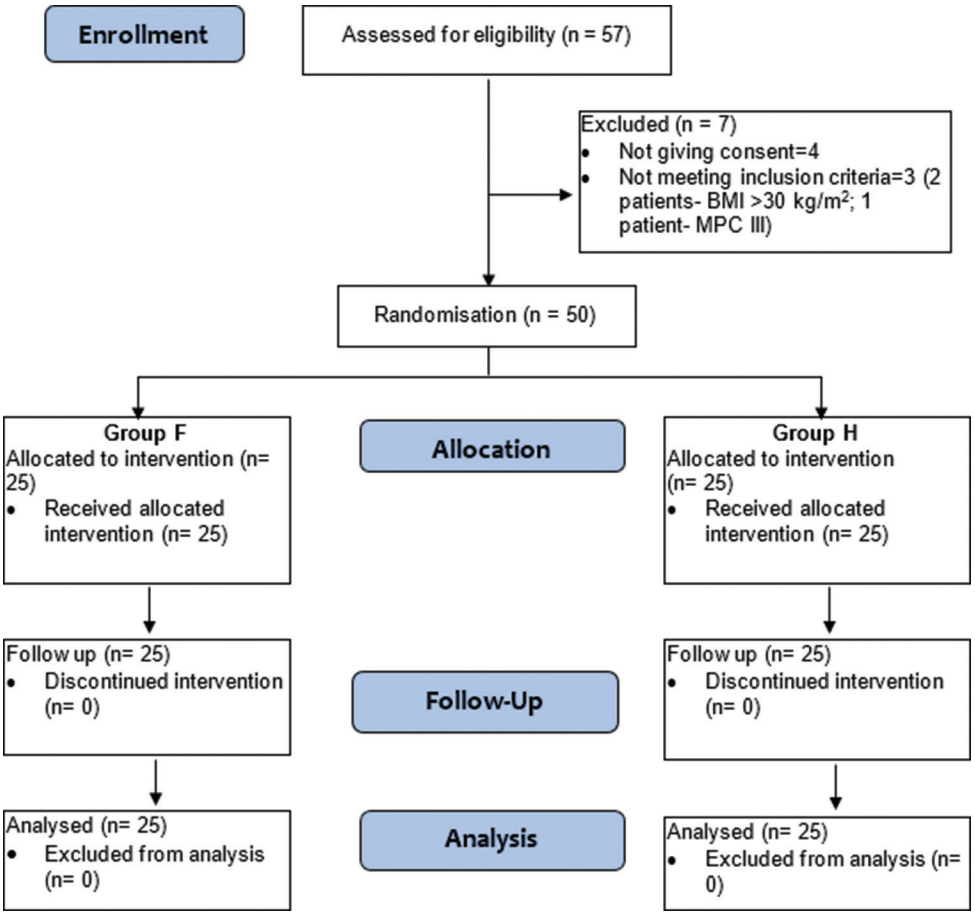

Figure 1: Consolidated Standards of Reporting Trials (CONSORT) flow diagram

Intubation was not possible in three cases (12%) by face-to-face technique. However, all 25 patients were successfully intubated by Airtraq™ from the head-end (100%) in the first attempt.

Baseline systolic, diastolic, and mean arterial pressure and heart rate were comparable among the two groups. A significant rise in heart rate and blood pressure following laryngoscopy and intubation compared to the baseline value was seen in both groups. However, in this study, hemodynamic parameters were comparable at the corresponding observed time points among the two groups [Figures 2 and 3].

There was no incidence of desaturation and SpO_2 was maintained at >96% in all patients throughout the study period. No major trauma was noted in any patient. Out of a total of 50 patients, only 1 patient in group H had trauma during tracheal intubation with blood staining on the video-laryngoscope blade and ETT after extubation.

Discussion

The major findings of the study are that the intubation time and device insertion time were significantly longer during the face-to-face technique than in the head-end technique. However, both techniques were similar in terms of glottic view, ease of intubation, the number of intubation attempts, the need for optimization maneuvers, the number of cases with successful intubation, hemodynamic changes, and complications.

The longer intubation time seen in face-to-face technique can be attributed to the relatively new and unconventional position of the anesthesiologist during the intubation procedure. A similar result was seen in a manikin study conducted by Madziala *et al.*,[10] where the time to successful intubation was longer during face-to-face technique (54.5 [IQR; 38.5–59.5] s) than when positioned behind the head of the patient (43.5 [IQR; 34–53.5] s) by final year medical students. Madziala *et al.*[11] in another randomized crossover manikin trial including novice paramedics reported almost similar intubation time for face-to-face tracheal intubation using Airtraq™ video-laryngoscope (36.5 [IQR; 33.5–42.5] s) as our study (38.09 ± 19.45 s). Although previous studies have documented shorter intubation time in face-to-face tracheal intubation than the present study, most of these studies are manikin studies and intubating conditions in actual patients and manikins are quite different.[2,4,5,9,12-14]

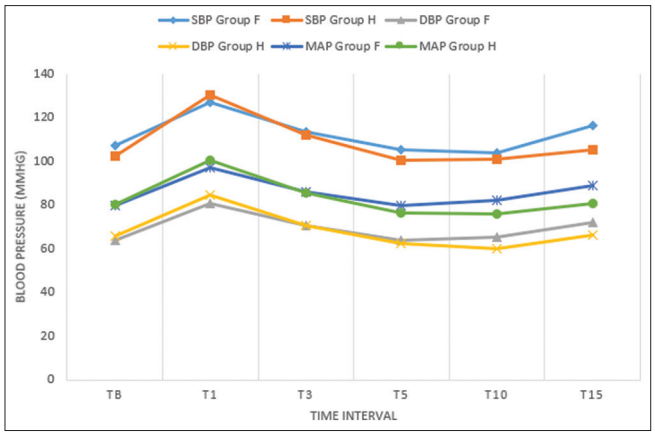

Figure 2: Blood pressure changes among the study groups. SBP: Systolic blood pressure, DBP: Diastolic blood pressure, MAP: Mean arterial pressure, TB: Before intubation, T1: 1 min after endotracheal intubation, T3: 3 min after endotracheal intubation, T5: 5 min after endotracheal intubation, T10: 10 min after endotracheal intubation, T15: 15 min after endotracheal intubation

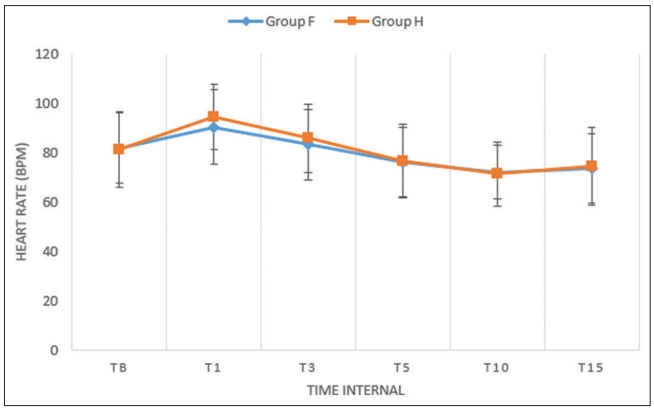

Figure 3: Heart rate changes among the study groups. TB: Before intubation, T1: 1 min after endotracheal intubation, T3: 3 min after endotracheal intubation, T5: 5 min after endotracheal intubation, T10: 10 min after endotracheal intubation, T15: 15 min after endotracheal intubation

Various scores have been used by researchers for the assessment of airway visualization during video-laryngoscopy, namely, the percentage of glottic opening (POGO) score, Cormack and Lehane grading, and the Fremantle score. POGO score would have been a better parameter but we used Cormack and Lehane grading in our study. Consistent with findings from other studies, Airtraq™ video-laryngoscope provided a better view of the glottis (Cormack and Lehane grade I or II) in both scenarios.[2,4,9,10,12,13] Glottic view as per the Cormack and Lehane grading was comparable in the two groups. However, as reported by many researchers, a better laryngoscopic view does not always ensure that the intubation will be easy.[9,12,15]

In several cases, difficulty in placing the tube into the trachea even after achieving a good laryngoscopic view was encountered. ETT was found to be abutting against the posterior arytenoids or entering into the para-glottic space and maneuvering the tube through the vocal cords was not always smooth as it has to pass through a fixed slot in the device. Optimal external laryngeal manipulation along with some additional maneuvers in handling the Airtraq™ helped in dealing with this situation. Similar difficulty in advancing the ETT into the trachea through the glottic opening has been reported by various other researchers while using video-laryngoscopes for tracheal intubation.[9,12,15]

The difference in success rate and the total number of attempts of tracheal intubation in the two groups, though statistically comparable, can be attributed to the greater experience of the anesthesiologists in intubation from the head-end where the device is to be held in the left hand and ETT is pushed forward with the right hand. On the other hand, during face-to-face tracheal intubation, the anesthesiologist holds the device in the right hand and the tube is pushed forward with the left hand.

The face-to-face approach is an unconventional method of tracheal intubation that needs further practice and training. Similar to our study, Madziala *et al*.[10] reported a higher success rate of tracheal intubation by final-year medical students when positioned behind the head of the patient rather than face-to-face during a simulated cardiovascular resuscitation.

In contrast to our study, Venezia *et al*.[16] reported a 100% success rate for the two-person sitting face-to-face technique. In our study, face-to-face intubation was done by a single person standing on the right side of the patient, facing the patient from the front while the patient was lying in the supine position. However, in some previous studies, face-to-face intubation was done with the patient in a sitting position.[4,5,13,16,17] Sitting position is considered to be more favorable for face-to-face tracheal intubation than supine owing to the fact that in the sitting position, soft tissues of the neck are pulled down due to the effect of gravity, making it easier to intubate the trachea.[16] Also, in obese, full stomach, and congestive heart failure patients, a sitting position is advantageous.[16,18]

In our study, intubation was performed by a single anesthesiologist per case similar to the studies of Hilker *et al*. and Robinson *et al*.[19,20] However, in the study conducted by Venezia *et al*.,[16] two novice operators were involved in each intubation procedure using a Macintosh laryngoscope. They reported that subjects were more comfortable performing two-person sitting face-to-face intubation as compared to the standard technique. As compared to the success rate of face-to-face tracheal intubation in our study (88%) where intubation was done by a single intubator per case, the overall rate of successful tracheal intubation for the two-person sitting face-to-face technique was 100% in the study by Venezia *et al*.[16] The two-person technique seems to be beneficial as an additional person means additional hands, which if needed can be used to increase the oral opening or for suctioning blood/secretions. In the literature search, we did not find any study comparing one-person vs. two-person techniques

for face-to-face intubation using either a Macintosh laryngoscope or any video-laryngoscope.

We observed a significant rise in heart rate and blood pressure following laryngoscopy and intubation in both groups owing to the sympathoadrenal response due to the stimulation of supraglottic and infraglottic regions. Prolonged intubation time may also affect this intubation response. However, in this study, hemodynamic parameters were comparable at all corresponding observed time points among the two groups.

There was no significant difference between the two groups in the incidence of complications. Similar to our study, Arslan *et al*.[12] reported no difference in complications associated with face-to-face tracheal intubation using Airtraq™, GlideScope™ and Fastrach™ devices.

This is the first human study where two positions of tracheal intubation namely, face-to-face and head-end, are compared using video-laryngoscope. There are certain limitations of the present study. Firstly, this study was conducted on patients with normal airways in a normal operation theater setting where the head-end was otherwise accessible for manipulation and intervention. Thus, results cannot be extrapolated to patients with difficult airways and in out-of-hospital scenarios. Secondly, intubation was performed by experienced anesthesiologists. Hence, results may not be applicable to less experienced personnel. Thirdly, the element of bias due to a long experience in head-end technique than in face-to-face technique could not be eliminated.

From the above findings, we conclude that face-to-face tracheal intubation is a good alternative to secure the airway when the head-end is not accessible. Further comparisons of face-to-face intubation techniques in actual emergency settings including operators with different levels of experience are needed. Face-to-face intubation in a sitting position involving two operators should be studied further.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1. Kilicaslan A, Topal A, Tavlan A, Erol A, Otelcioglu S. Effectiveness of the C-MAC video laryngoscope in the management of unexpected failed intubations. Rev Bras Anestesiol2014;64:62-5.
2. Choi HY, Oh YM, Kang GH, Kang H, Jang YS, Kim W, *et al*. A randomized comparison simulating face to face endotracheal intubation of Pentax Airway Scope, C-MAC Video Laryngoscope, Glidescope Video Laryngoscope, and Macintosh Laryngoscope. Biomed Res Int 2015;2015:961782.
3. Dhonneur G, Zraier S, Sebbah JL, Haouache H. Urgent face-to-face tracheal re-intubation using VideoAirtraq™ in ICU patients placed in the sitting position. Intensive Care Med 2014;40:625-6.
4. Amathieu R, Sudrial J, Abdi W, Luis D, Hahouache H, Combes X, *et al*. Simulating face-to-face tracheal intubation of a trapped patient: A randomized comparison of the LMA Fastrach™, thGlidesccope™ and the Airtraq™ laryngoscope. Br J Anaesth2012;108:140-5.
5. Wetsch WA, Carlitscheck M, Spelten O, Teschendorf P, Hellmich M, Genzwürker HV, *et al*. Success rates and endotracheal tube insertion times of experienced emergency physicians using five video laryngoscopes: A randomised trial in a simulated trapped car accident victim. Eur J Anaesthesiol2011;28:849-58.
6. Tesler J, Rucker J, Sommer D, Vesely A, McClusky S, Koetter KP, *et al*. Rescuer position for tracheal intubation on the ground. Resuscitation 2003;56:83-9.
7. Wetsch WA, Hellmich M, Spelten O, Schier R, Böttiger BW, Hinkelbein J. Tracheal intubation in the ice-pick position with video laryngoscopes: A randomised controlled trial in a manikin. Eur J Anaesthesiol2013;30:537-43.
8. Má GR, Freire-Vila E, Criado-Alonso MJ, Fernández-Goti MC. Airtraq laryngoscope: Embracing video laryngoscopy. Saudi J Anaesth2016;10:246–7.
9. IMPORTANT SAFETY INSTRUCTIONS A-360 Wi-Fi CAMERA – Airtraq. Available from: http://www.airtraq.com /download/IFU/A360_IFU.pdf.
10. Madziala A, Evrin T, Wieczorek W, Kaminska H, Nadolny K, Ladny JR, *et al*. Can the face-to-face intubation technique be used during cardiopulmonary resuscitation? A prospective, randomised, crossover manikin trial. Disaster Emerg Med J 2017;2:145–9.
11. Madziala A, Majer J, Madziala M. Comparison of ETView SL, Airtraq, and Macintosh laryngoscopes for face-to-face tracheal intubation: A randomized crossover manikin trial. Am J Emerg Med 2016;34:1893–4.
12. Arslan ZI, Alparslan V, Ozdal P, Toker K, Solak M. Facetoface tracheal intubation in adult patients: A comparison of the Airtraq™, Glidescope™ and Fastrach™ devices. J Anesth2015;29:893-8.
13. Zraier S, Bloc S, Chemit M, Amathieu R, Dhonneur G. Intubation in the operating theatre using the Video-Airtraq laryngoscope in difficult circumstances by a face-to-face tracheal intubation technique. Br J Anaesth2014;112:1118–9.
14. Szarpak L, Truszewski Z, Galazkowski R, Evrin T, Czyzewski L. A randomized crossover trial comparing the C-MAC and Macintosh laryngoscopes for face-to-face intubation in a manikin. Am J Emerg Med 2016;34:920–2.
15. Mathew N, Gaude YK, Joseph TT, Kini KG. Comparison of haemodynamic responses to tracheal intubation using Macintosh and Airtraq laryngoscope in patients with simulated cervical spine injury. Sri Lankan JAnaesthesiol 2018;26:124–30.
16. Venezia D, Wackett A, Remedios A, Tarsia V. Comparison of sitting face-to-face intubation (two-person technique) with standard oral-tracheal intubation in novices: Amannequin study. J Emerg Med 2012;43:1188–95.
17. Ynineb Y, Boglietto E, Bonnet F, Quesnel C, Garnier M. Face-To-Face double-lumen tube intubation with the Airtraq video laryngoscope for emergency thoracic surgery: A case report. Semin CardiothoracicVascAnesth2022;26:90-4.
18. Adams AK. Tracheal intubation with the patient in the sitting position. Br J Anaesth1991;67:804.
19. Hilker T, Genzwuerker HV. Inverse intubation: An important alternative for intubation in the streets. PrehospEmerg Care 1999;3:74–6.
20. Robinson K, Donaghy K, Katz R. Inverse intubation in air medical transport. Air Med J 2004;23:40–3.