

Split Type Postman videolaryngoscope: The newer device versus the standard Macintosh laryngoscope in simulated difficult airway - A new hope for difficult intubation scenarios

Address for correspondence:

Prof. Qazi E. Ali,
Department of Anaesthesiology
and Critical Care, Jawaharlal
Nehru Medical College, A.M.U.,
Aligarh, Uttar Pradesh, India.
E-mail: qaziehsanali@
gmail.com

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Nisanth N S, Qazi E. Ali, Syed H. Amir

Department of Anaesthesiology, Jawaharlal Nehru Medical College, A.M.U, Aligarh, Uttar Pradesh, India

ABSTRACT

Background and Aims: Studies on simulated difficult airway provide an opportunity to evaluate the performance of intubation devices for use in limited neck mobility. We did a comparative study between Split Type Postman videolaryngoscope and Macintosh laryngoscope, evaluating their efficacy for tracheal intubation in a simulated difficult airway. **Methods:** Sixty American Society of Anesthesiologists (ASA) physical status I and II patients aged between 20 and 60 years, having body mass index $<30 \text{ kg m}^{-2}$, posted for elective surgery under general anaesthesia were allocated to two groups. Endotracheal intubation was done with either Split Type Postman videolaryngoscope or Macintosh laryngoscope after placing a rigid cervical collar around the neck to simulate a difficult airway. The primary outcome measure was time for tracheal intubation as assessed from the time of introduction of laryngoscope between incisors till visual confirmation of passage of endotracheal tube through the vocal cords by the anaesthesiologist. Success rate of intubation, number of attempts required for successful intubation, haemodynamic alterations and airway complications were measured as secondary outcomes. **Results:** Time taken for endotracheal intubation was significantly shorter in Postman group (26.23 ± 7.18 vs. 31.43 ± 9.83 s) ($P = 0.012$) compared to Macintosh group. The groups were comparable in terms of incidence ($P = 0.491$) of successful intubation, with significantly lesser number of attempts required for intubation in Postman group ($P = 0.022$). The incidence of airway trauma and postoperative sore throat was comparable between the groups. **Conclusion:** Split Type Postman videolaryngoscope was superior with respect to intubation characteristics when compared to conventional laryngoscope.

Key words: Endotracheal tube, general anaesthesia, intubation, laryngoscope

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INTRODUCTION

Securing the airway in the emergency department can sometimes be challenging and expertise of the anaesthesiologist may often be required. This scenario is common in the setting of road traffic accidents and head injury, wherein maintaining cervical stability is important while securing a definitive airway.^[1] Direct laryngoscopy needs the alignment of oro-pharyngo-tracheal axis for best results, but attempts to obtain it may compromise cervical spine stability.^[2] This necessitates the need for adequate training with alternative devices and techniques.^[3] Videolaryngoscopes have come up as an effective alternative, with lesser requirement of

the lifting force and better visualisation with minimal neck extension.^[4]

Simulating difficult airway in the operating room with the use of rigid cervical collar and manual in

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line stabilisation (MILS) have been done in many studies to find the effectiveness of intubating devices and techniques in cervical immobilisation.^[5,6] These studies have shown that videolaryngoscopes are better than direct laryngoscopes in terms of success rate of intubation, laryngeal view and duration of intubation.

The new Split Type Postman Videolaryngoscope (Shenzhen Tianlang Medical Equipment Co. Ltd, Shenzhen, China) is a recently introduced videolaryngoscope having a channelled blade [Figure 1]. It has a reusable core, disposable blade and monitor that helps in visualising the glottic structures and also to record it. Because of the presence of 92° channelled blade, stylet is not required for intubation. The core is completely enclosed by the blades, avoiding the necessity of sterilisation after each use. The monitor can also be rotated and tilted as per convenience.

Since this is a newly introduced videolaryngoscope, there is no literature available comparing its efficacy as an intubating device. Here, we compared the characteristics of Split Type Postman videolaryngoscope as an intubating device in difficult airway. This was done by simulating a difficult airway by restricting the neck movement in the operating room (OR) using a rigid cervical collar and comparing the intubation characteristics with a Macintosh laryngoscope. We hypothesised that due to the favourable anatomy of the videolaryngoscope, it would fare as a better intubating device compared to the Macintosh laryngoscope.

METHODS

After obtaining approval from the Institutional Ethics Committee (clearance letter-D. no.: 243/FM,



Figure 1: Split Type Postman videolaryngoscope

dated 11/05/2019) and registering in the Clinical Trials Registry-India (CTRI/2019/11/021953), this single-blind, randomised, prospective study was conducted for a period of 18 months from November 2019. Sixty adult patients were enrolled after obtaining informed written consent.

The study included American Society of Anesthesiologists (ASA) physical status I and II patients of both gender, aged between 20 and 60 years, undergoing routine surgery requiring tracheal intubation in a tertiary care centre. Patients having history of difficult intubation in the past, patients with anticipated difficult intubation (Mallampati [MP] III/IV or thyromental distance less than 6 cm or mouth opening less than 5 cm), parturients, patients with valvular heart diseases, those with previous history of myocardial infarction/unstable angina, hypertension, body mass index (BMI) >30 kg m⁻² or those having any pathology of the oral cavity that might obstruct the insertion of the device were excluded from the study.

After satisfying the eligibility criteria and obtaining informed written consent from the patients, they were randomised into Group Postman and Group Macintosh using a computerised random number generator. The random number generated and the allocation to study group were concealed in sealed envelopes, which were opened after induction. To circumvent observer bias, the same anaesthesiologist did all the endotracheal intubations. The researcher had more than 20 years of clinical expertise and was well versed with the use of videolaryngoscopes. The learning curve for the videolaryngoscope was achieved by performing 20 intubations, 10 in mannequin and 10 in patients.

During preoperative assessment, patient's age, gender, BMI, MP class and mouth opening were assessed. After patient arrival in the OR, baseline parameters including peripheral oxygen saturation (SpO₂), non-invasive blood pressure (NIBP) and electrocardiogram (ECG) were recorded. Premedication was done with midazolam 0.03 mg kg⁻¹, fentanyl 2 µg kg⁻¹ and glycopyrrolate 0.01 mg kg⁻¹ intravenously. Following preoxygenation for 3 min, induction was done with intravenous propofol (1.5–2.5 mg kg⁻¹) and after checking the adequacy of mask ventilation, muscle relaxation was achieved with intravenous succinylcholine (1.5 mg kg⁻¹). Thereafter, the pillow supporting the head was removed and a rigid, appropriate-sized Philadelphia Collar (Tynor Orthotics

Pvt Ltd, Punjab, India) was placed around the neck to simulate a difficult airway. Intubation was then done as per the group assigned. Surgery started following recording of heart rate and NIBP at 10 min post-intubation. The anaesthetic management was carried out as per the department protocol by the anaesthesiologist, after the recording of the last haemodynamic parameter under study. Post-surgery, patients were shifted to recovery room and observed for 1 h for complications if any.

The primary outcome was time for tracheal intubation. Success rate of intubation, number of attempts required for successful intubation, haemodynamic alterations and airway complications were measured as secondary outcomes.

Intubation time was considered from the time of introduction of the laryngoscope between incisors till the endotracheal tube (ETT) was passed beyond the vocal cords, as confirmed by direct visualisation in Macintosh group and visualisation through screen in Postman videolaryngoscope group by the anaesthesiologist. It was assessed by a blind observer who was unaware of the patient group and intubation procedure.

The success rate of endotracheal intubation and the number of attempts for successful intubation were noted for each laryngoscope. An attempt was defined as insertion followed by withdrawal of the laryngoscope from the mouth, either following intubation or for reasons like change of blades or for repositioning. A maximum of two attempts with a device was allowed, failing which intubation was considered failed, the collar was removed and intubation done using Macintosh laryngoscope.

Haemodynamic variables including heart rate and mean arterial pressure (MAP) before induction were considered as baseline values. Further measurements were taken immediately post-intubation and at 3, 5 and 10 min post-endotracheal intubation. Incidence of dental trauma and airway trauma evidenced by blood on laryngoscope was assessed. Presence of sore throat was assessed 24 h post-extubation by an independent observer blinded to the way of intubation.

Sample size for the present study was calculated with duration of intubation as the primary objective. A trial study was done with 10 patients being allocated

to each group. Mean intubation time and standard deviation was observed as 27.9 ± 6.7 s and 33.8 ± 8.6 s in Postman and Macintosh groups, respectively. The alpha level was kept as 0.05 and beta level as 0.2 for the study. Sample size calculated was 27 patients per group. Sixty patients were enrolled to account for refusal and those lost to follow-up. Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) version 22.0 for Windows. Numbers and percentages were used to present categorical variables like sex, intubation attempts and success rate of first intubation. Mean and standard deviation were used to represent numerical variables like age, BMI and haemodynamic variables. Student's unpaired *t*-test was used to analyse demographic variables and time taken for endotracheal intubation. Frequency of successful endotracheal intubation, number of attempts and trauma to the airway were examined by Chi-square test or Fisher's exact test. For comparison of intragroup changes in heart rate and MAP, repeated-measures analysis of variance (ANOVA) was applied and unpaired *t*-test was used for intergroup analysis of the same. *P* value less than 0.05 was taken as statistically significant.

RESULTS

Seventy patients were assessed for eligibility and after exclusion, 60 patients were randomised to the study. Four patients were not incorporated in the analysis. One patient needed elective ventilation, and surgery got postponed in another patient. Two patients in the Macintosh group with failed intubation were also excluded from the analysis [Figure 2].

The two groups in the study were comparable on demographic variables like age, gender, BMI and airway assessment [Table 1].

Intubation time, the primary outcome in our study setting, was significantly lower in

Table 1: Demographic data and airway assessment

| Characteristics | Postman group | Macintosh group | <i>P</i> |
|---------------------------|---------------|-----------------|----------|
| Age (years) | 40.88±12.6 | 39.01±10.97 | |
| Gender (male:female) | 12:17 | 9:18 | |
| BMI (kg m ⁻²) | 23.78±2.56 | 22.87±2.61 | |
| Thyromental distance (cm) | 7.3±0.5 | 7.6±0.7 | 0.235 |
| MP grading* | | | |
| MP I | 13 (44.82%) | 10 (37.03%) | |
| MP II | 16 (55.17%) | 17 (62.96%) | 0.554 |

BMI=body mass index, MP=Mallampati, SD=standard deviation. *The values are number of patients or mean±SD. The variables mentioned in the table were analysed using Chi-square test/unpaired *t*-test as applicable

the Postman group compared to Macintosh group (26.23 ± 7.18 s vs. 31.43 ± 9.83 s) ($P = 0.012$) [Table 2]. Except for two patients in the Macintosh group, all other patients were intubated successfully within the maximum limit of two attempts. Although the overall success rate of intubation was comparable between the study groups (100% in Postman group and 93.10% in Macintosh group) ($P = 0.491$), the incidence of first-attempt intubation was significantly higher in the Postman group (86.2% vs. 59.26%) ($P = 0.022$). Three cases reported blood on the laryngoscope in Postman group, whereas this number was four in Macintosh group ($P = 0.613$). Three cases of sore throat in the postoperative period were found in both Postman and Macintosh groups ($P = 0.926$).

Accentuated haemodynamic response in terms of raised heart rate and MAP was present following tracheal intubation in both the study groups. The changes in haemodynamic variables were significant in the readings taken immediately post-intubation and at 3 min following intubation ($P < 0.05$) and reached their pre-induction values around fifth minute post-intubation in both the groups. Analysis of heart rate and blood pressure showed that the two groups were comparable [Tables 3 and 4].

DISCUSSION

The use of direct laryngoscopy for intubation in patients with cervical instability can further aggravate the injury as it requires some degree of neck extension. Different videolaryngoscopes as intubation aids are increasingly becoming common in the management of such patients, both in elective and emergency settings. Suitably designed videolaryngoscopes remove the need for neck extension, as they do not necessarily require alignment of oro-pharyngo-tracheal axis.^[7] Our study was thus aimed at comparing a new videolaryngoscope (Split Type Postman Videolaryngoscope) in this study setting with conventional Macintosh laryngoscope.

Time taken for intubation was significantly lower in the Postman group when compared to Macintosh group. However, in our study setting, this was clinically insignificant, as evidenced by no event of serious desaturation in any patient in the Macintosh group during attempts of intubation. Contrary to our finding, literature challenging the utility of videolaryngoscopes in reducing intubation time

Table 2: Comparison of characteristics of tracheal intubation

| Parameters | Postman group | Macintosh group | P |
|--------------------------------------|---------------|-----------------|-------|
| Time of intubation (s) | 26.23±7.18 | 31.43±9.83 | 0.012 |
| Incidence of successful intubation | 29 (100%) | 27 (93.10%) | 0.491 |
| Attempts for successful intubation : | | | |
| First | 25 (86.20%) | 16 (59.26%) | |
| Second | 4 (13.80%) | 11 (40.74%) | 0.022 |
| Incidence of injury* | 3 (10.34%) | 4 (14.81%) | 0.613 |
| Incidence of sore throat* | 3 (10.34%) | 3 (11.11%) | 0.926 |

SD=standard deviation. *The values are n (%) of patients or mean±SD. The variables mentioned in the table were analysed using Fisher's exact test/unpaired t-test/Chi-square test as applicable

Table 3: Mean heart rate of patients at various times in the two groups

| Heart rate (per minute) | Postman group | Macintosh group | P |
|---------------------------|---------------|-----------------|-------|
| Pre-intubation | 80.90±9.32 | 82.53±7.80 | 0.236 |
| Immediate post-intubation | 89.46±10.22 | 87.26±8.87 | 0.205 |
| After 3 min | 85.33±9.75 | 86.26±10.35 | 0.356 |
| After 5 min | 81.20±9.11 | 83.53±10.59 | 0.156 |
| After 10 min | 76.96±7.98 | 75.90±10.51 | 0.329 |

| Post hoc test* | Postman group | Macintosh group |
|--|---------------|---|
| $P_{\text{immediate post-intubation}}$ | <0.001 | $P_{\text{immediate post-intubation}}$ <0.001 |
| $P_{\text{3 min}}$ | =0.005 | $P_{\text{3 min}}$ <0.001 |
| $P_{\text{5 min}}$ | =0.424 | $P_{\text{5 min}}$ =0.437 |
| $P_{\text{10 min}}$ | =0.114 | $P_{\text{10 min}}$ =0.470 |

ANOVA=analysis of variance. On applying repeated-measures ANOVA within groups, the P value was <0.001 in both groups. *Post hoc test compares pre-intubation heart rate with heart rate immediately post-intubation and at 3, 5 and 10 min post-intubation

Table 4: Mean arterial pressure of patients at various times in the two groups

| Mean arterial blood pressure (mm of Hg) | Postman group | Macintosh group | P |
|---|---------------|-----------------|-------|
| Pre-intubation | 93.63±7.23 | 93.13±9.05 | 0.813 |
| Immediate post-intubation | 98.63±5.19 | 99.87±4.87 | 0.085 |
| After 3 min | 95.60±3.98 | 97.13±5.19 | 0.204 |
| After 5 min | 93.00±4.53 | 95.17±6.10 | 0.124 |
| After 10 min | 91.60±5.58 | 92.37±6.05 | 0.150 |

| Post hoc test* | Postman group | Macintosh group |
|--|---------------|---|
| $P_{\text{immediate post-intubation}}$ | <0.001 | $P_{\text{immediate post-intubation}}$ =0.006 |
| $P_{\text{3 min}}$ | =0.012 | $P_{\text{3 min}}$ =0.033 |
| $P_{\text{5 min}}$ | =0.466 | $P_{\text{5 min}}$ =0.158 |
| $P_{\text{10 min}}$ | =0.100 | $P_{\text{10 min}}$ =0.294 |

ANOVA=analysis of variance. On applying repeated-measures ANOVA within groups, the P value was <0.001 in both groups. *Post hoc test compares pre-intubation mean arterial blood pressure with blood pressures immediate post-intubation and at 3, 5 and 10 min post-intubation

compared to direct laryngoscopy in a similar study group is available.^[8-10] One of the reasons for faster intubations in the videolaryngoscope group in our study can be attributed to the presence of channelled blade, which reduces the need for the use of stylet and minimises the need for adjustments with the ETT.

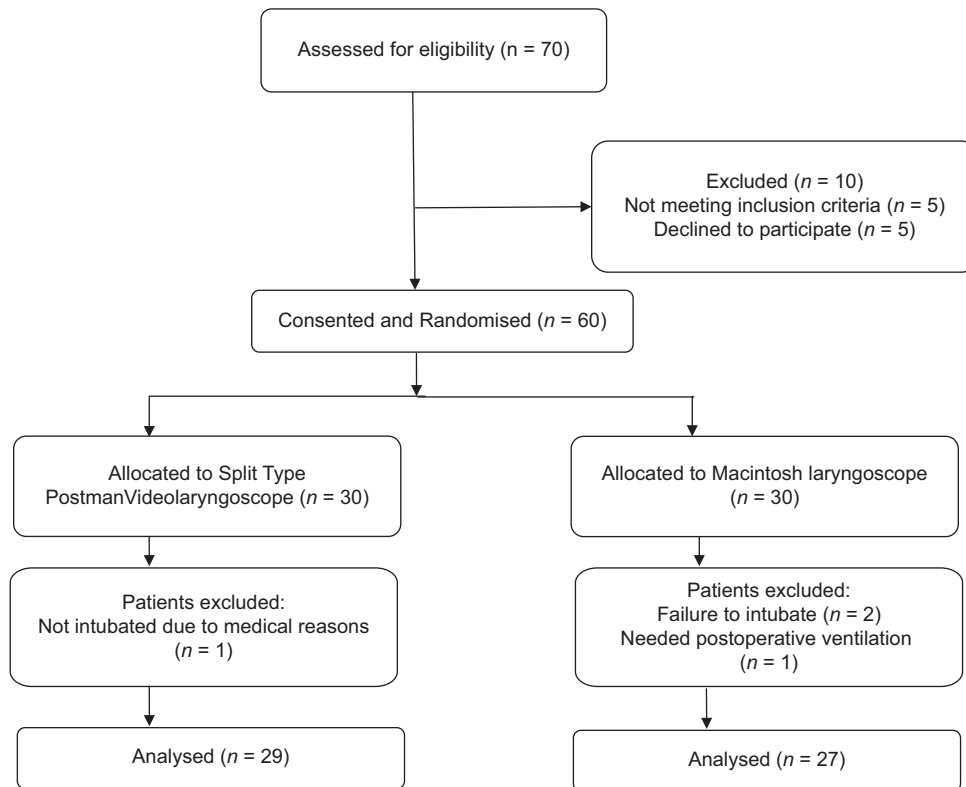


Figure 2: CONSORT flow diagram. CONSORT = consolidated standards of reporting trials. n=number

This advantage of quicker intubation with devices having channelled blade in difficult airway has been demonstrated in other studies also.^[11-15]

There were two cases of failed intubation in the Macintosh group, wherein we had to remove the collar and resort to direct laryngoscopy for securing the airway. Compared to this, there were no cases of failed intubation in the Postman group. Though the overall success rate for intubation was comparable, the rate of first-attempt intubation was significantly higher in the Postman group ($P = 0.022$). This is in accordance with the findings of Bhola *et al.*^[16] and Kumar *et al.*, who demonstrated superiority of videolaryngoscopes with respect to success rate in different settings of difficult airway.^[17] The anatomical curvature of the channelled blade and presence of video camera result in better glottic view with Split Type Postman videolaryngoscope, thus improving the success rate. Lesser number of attempts in securing the airway leads to fewer airway complications that can have a significant impact on the prognosis of the patients. Higher success rate of first-attempt intubation also provides greater safety margin for use by paramedics and in out-of-the-hospital settings, wherein the use of videolaryngoscopes seems to be better than conventional laryngoscopy.

On intergroup analysis, changes in haemodynamic parameters brought by laryngoscopy and tracheal intubation were comparable at various time intervals in our study. Haemodynamic variables reached pre-induction levels by the fifth minute in both the groups. The force required for laryngoscopy was significantly less with the use of videolaryngoscopes, leading to lesser haemodynamic variations post-intubation. Although there are many studies in different clinical settings showing attenuated haemodynamic response with videolaryngoscopes,^[18-20] our findings are similar to those of studies done by Akbar *et al.*^[21] and Seo *et al.*^[22] in simulated cervical immobilisation, wherein videolaryngoscopes produced comparable haemodynamic response.

The extent of airway injury and postoperative sore throat was comparable between the two groups, although certain studies have shown that airway trauma with videolaryngoscopes is comparatively less.^[23]

There were some limitations in our study. Firstly, though patients and the observer noting the time for intubation were blinded to the device being used, since the devices under study were structurally different, it was not possible to blind the anaesthesiologist.

Therefore, double blinding was not possible and this may have led to bias. Secondly, cervical collar was used to simulate a difficult airway, which may not accurately mimic the actual clinical setting needing cervical immobility, wherein MILS is usually used, and therefore, conclusions may vary. Clinical practice in patients requiring cervical immobility may be accompanied by constraints like presence of blood in the airway and limited mouth opening due to maxillofacial trauma. Hence, extrapolation of results of this study setting to emergency scenarios wherein cervical immobilisation is required cannot be completely justified. Lastly, blood pressure was measured non-invasively. Further studies in larger patient groups are required to substantiate the findings.

CONCLUSION

Our study concludes that Split Type Postman videolaryngoscope seems superior to conventional laryngoscopy with respect to time taken for endotracheal intubation and needed fewer attempts for successful intubation. Hence, it can be used as a primary intubating device in patients in whom cervical immobilisation is required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Crosby ET. Airway management in adults after cervical spine trauma. *Anesthesiology* 2006;104:1293-318.
- Swain A, Sahu S, Swain BP. Cervical spine movement during intubation. *J Neuroanaesthesiol Crit Care* 2017;4:S76-80.
- Paik H, Park HP. Randomized crossover trial comparing cervical spine motion during tracheal intubation with a Macintosh laryngoscope versus a C-MAC D-blade videolaryngoscope in a simulated immobilized cervical spine. *BMC Anesthesiol* 2020;20:201.
- Kelly FE, Cook TM. Seeing is believing: Getting the best out of videolaryngoscopy. *Br J Anaesth* 2016;117:i9-13.
- Goel R, Anand K, Singh M, Rani M, Kaur A. Comparison of different types of stylets with no-stylet technique for intubation with C-MAC D-Blade® videolaryngoscope in simulated difficult airway: A prospective randomized study. *Turk J Anaesthesiol Reanim* 2021;49:445-52.
- Kleine-Brueggene M, Greif R, Schoettker P, Savoldelli GL, Nabecker S, Theiler LG. Evaluation of six videolaryngoscopes in 720 patients with a simulated difficult airway: A multicentre randomized controlled trial. *Br J Anaesth* 2016;116:670-9.
- Chaparro-Mendoza K, Luna-Montúfar CA, Gómez JM. Videolaryngoscopes: The solution for difficult airway management or just another strategy? Non-systematic review. *Rev Colomb Anestesiol* 2015;43:225-33.
- Lewis SR, Butler AR, Parker J, Cook TM, Smith AF. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation: A cochrane systematic review. *Br J Anaesth* 2017;119:369-83.
- Suppan L, Tramer MR, Niquille M, Groscurin O, Marti C. Alternative intubation techniques vs Macintosh laryngoscopy in patients with cervical spine immobilization: Systematic review and meta-analysis of randomized controlled trials. *Br J Anaesth* 2016;116:27-36.
- Ilyas S, Bradley WPL, Segal R, Taylor H, Lee K, Balkin M, et al. A prospective randomised controlled trial comparing tracheal intubation plus manual in-line stabilisation of the cervical spine using the Macintosh laryngoscope vs the McGrath® Series 5 videolaryngoscope. *Anaesthesia* 2014;69:1345-50.
- Singleton BN, Morris FK, Yet B, Buggy DJ, Perkins ZB. Effectiveness of intubation devices in patients with cervical spine immobilization: A systematic review and network meta-analysis. *Br J Anaesth* 2021;126:1055-66.
- Chandy J, Pillai R, Mathew A, Philip AV, George SP, Sahajanandan R. A randomized clinical trial comparing the King Vision (channeled blade) and the CMAC (D blade) videolaryngoscopes in patients with cervical spine immobilization. *J Anaesthesiol Clin Pharmacol* 2021;37:604-9.
- Amor M, Nabil S, Bensghir M, Moussaoui A, Kabbaj S, Drissi Kamili N, et al. A comparison of Airtraq™ laryngoscope and standard direct laryngoscopy in adult patients with immobilized cervical spine. *Ann Fr Anesth Reanim* 2013;32:296-301.
- Aleksandrowicz D, Wieczorek A, Gaszynski T. Intubation with cervical spine immobilization: A comparison between the KingVision videolaryngoscope and the Macintosh laryngoscope: A randomised controlled trial. *Eur J Anaesthesiol* 2018;35:399-401.
- Liu EHC, Goy RWL, Tan BH, Asa T. Tracheal intubation with videolaryngoscopes in patients with cervical spine immobilization: A randomized trial of the Airway Scope®, and the GlideScope®. *Br J Anaesth* 2009;103:446-51.
- 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;58:269-74.
- Kumar D, Gombar S, Ahuja V, Malhotra A, Gupta S. GlideScope versus D-blade for tracheal intubation in cervical spine patients. *Indian J Anaesth* 2019;63:544-50.
- Meshram TM, Ramachandran R, Trikha A, Rewari V. Haemodynamic responses following orotracheal intubation in patients with hypertension---Macintosh direct laryngoscope versus Glidescope® videolaryngoscope. *Indian J Anaesth* 2021;65:321-7.
- 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;22:365-71.
- Altun D, Ali A, Çamci E, Özönür A, Seyhan Ö. Hemodynamic response to four different laryngoscopes. *Turk J Anaesthesiol Reanim* 2018;46:434-40.

21. Akbar SHM, Ooi JSM. Comparison between C-MAC video-laryngoscope and Macintosh direct laryngoscope during cervical spine immobilization. *Middle East J Anaesthesiol* 2015;23:43-50.
22. Seo KH, Kim KM, John H, Jun JH, Han M, Kim S. Comparison of C-MAC D-blade videolaryngoscope and McCoy laryngoscope efficacy for nasotracheal intubation in simulated cervical spinal injury: A prospective randomized comparative study. *BMC Anesthesiol* 2020;20:114.
23. Rendeki S, Keresztes D, Woth G, Mèrei Á, Rozanovic M, Rendeki M, *et al.* Comparison of Vivid Trac®, Airtraq®, King Vision®, Macintosh laryngoscope and a custom made videolaryngoscope for difficult and normal airways in mannequins by novices. *BMC Anaesthesiol* 2017;17:68.