Turk J Anaesthesiol Reanim 2017; 45: 361-6 DOI: 10.5152/TJAR.2017.57778

Original Article / Özgün Araştırma

Effect of Cricoid Pressure on Laryngeal View During Macintosh, McGrath MAC X-Blade and GlideScope Video Laryngoscopies

Macintosh, McGrath MAC X-Blade ve GlideScope Videolaringoskopi Sırasında Uygulanan Krikoid Basıncın Laryngeal Görüntüye Etkisi

Zehra İpek Arslan, Mine Solak

Department of Anaesthesiology and Reanimation, Kocaeli University School of Medicine, Kocaeli, Turkey

Cite this article as: Arslan Zİ, Solak M. Effect of Cricoid Pressure on Laryngeal View During Macintosh, McGrath MAC X-Blade and GlideScope Video Laryngoscopies. Turk J Anaesthesiol Reanim 2017; 45: 361-6.

Abstract / Öz

Objective: Cricoid pressure is useful in fasted patients requiring emergency intubation. We compared the effect of cricoid pressure on laryngeal view during Macintosh, McGrath MAC X-Blade and GlideScope video laryngoscopy.

Methods: After obtaining approval from the Human Research Ethics Committee and written informed consent from patients, we enrolled 120 patients (American Society of Anesthesiologists I-II, age 18-65 years) undergoing elective surgery that required endotracheal intubation in this prospective randomised study. Patients were divided into three groups (Macintosh, McGrath MAC X-Blade and GlideScope).

Results: Demographic and airway variables were similar in the groups. Cormack-Lehane grades were improved or unchanged on using cricoid pressure in Macintosh and McGrath MAC X-Blade groups. However, laryngeal views worsened in 12 patients (30%), remained unchanged in 26 patients (65%) and improved in 2 patients (5%) in the GlideScope group (p<0.001). Insertion and intubation times for Macintosh and McGrath MAC X-Blade video laryngoscopes were similar. Insertion times for GlideScope and Macintosh video laryngoscopes were similar, but were longer than those for the McGrath MAC X-Blade video laryngoscope (p=0.02). Tracheal intubation took longer with the GlideScope video laryngoscope than with the other devices (p<0.001 and p=0.003). Mean arterial pressures after insertion increased significantly in Macintosh and GlideScope groups (p=0.004 and p=0.001, respectively) compared with post-induction values. Heart rates increased after insertion in all three groups compared with post-induction values (p<0.001). Need for optimisation manoeuvres and postoperative minor complications were comparable in all three groups.

Conclusion: Although all three devices are useful for normal or difficult intubation, cricoid pressure improved Cormack-Lehane grades of Macintosh and McGrath MAC X-Blade video laryngoscopes but statistically significantly worsened that of the GlideScope video laryngoscope.

Keywords: Macintosh, McGrath MAC X-Blade, GlideScope, cricoid pressure, laryngeal view, intubation, Cormack-Lehane

Amaç: Acil entübasyon gereken tok hastalarda krikoid basınç faydalıdır. Macintosh, McGrath MAC X-blade ve Glidescope videolaringoskop ile entübasyon sırasında uygulanan krikoid basıncın laringeal görüntü üzerine etkisini karşılaştırdık.

Yöntemler: İnsan araştırmaları etik kurul onayı ve yazılı aydınlatılmış hasta onamı alındıktan sonra çalışmaya (ASA I-II, 18-65 yaşında) entübasyon gerektiren elektif cerrahi operasyona alınacak 120 hasta dahil edildi. Hastalar, üç gruba ayrıldı (Macintosh, McGrath MAC ve Glidescope).

Bulgular: Grupların demografik ve havayolu verileri benzerdi. Macintosh ve McGrath MAC X-blade gruplarında krikoid basınç ile Cormack-Lehane evreleri iyileşti veya hiç değişmedi. Ancak, Glidescope grubunda laringeal görüntü 2 hastada iyileşti (%5), 12 hastada kötüleşti (%30) ve 26 hastada hiç değişmedi (%65) (p<0,001). Macintosh ve McGrath MAC X-bade gruplarının yerleştirme ve entübasyon süreleri benzerdi. Glidescope'un yerleştirme süreleri Macintosh ile benzer ancak McGrath MAC X-blade'den uzundu (p=0,02). Glidescope ile tracheal entübasyon diğer iki havayolu aracından uzun sürdü (p<0,001 ve p=0,003). Yerleştirme sonrası ortalama arter basınçları, (indüksiyon sonrası değerlerle karşılaştırıldığında) Macintosh ve Glidescope gruplarında belirgin yükseldi (p=0,004 ve p=0,001). Kalp hızları indüksiyon sonrası değerler ile kıyaslandığında üç grupta da artmıştır (p<0,001). Manevra gereksinimi ve minor postoperatif komplikasyonlar üç grupta da benzerdi.

Sonuç: Üç havayolu aracı da normal ve zor entübasyonda yararlı olmalarına rağmen, krikoid basınç Macintosh ve McGrath MAC X-Blade'in Cormack-Lehane evrelerini iyileştirirken, Glidescope'un Cormack-Lehane evrelemesini istatistiksel olarak belirgin kötüleştirmiştir.

Anahtar Kelimeler: Macintosh, McGrath MAC X-Blade, GlideScope, krikoid basınç, laringeal görüntü, entübasyon, Cormack-Lehane

Introduction

Maintaining airway security is the major responsibility of an anaesthetist. Although Macintosh laryngoscopy is the gold standard, complications due to failed laryngoscopy may be life-threatening (1). Applying cricoid pressure is a preferred method in unfasted patients who require emergency intubation and who are at high risk of aspiration

Address for Correspondence/Yazışma Adresi: Zehra İpek Arslan E-mail: zehraipek48@gmail.com

Received / Geliş Tarihi : 12.01.2017
Accepted / Kabul Tarihi : 28.07.2017
Available Online Date / Çevrimiçi Yayın Tarihi : 29.11.2017

or regurgitation. Both speed and success of tracheal intubation improve survival (2, 3).

The McGrath MAC X-Blade video laryngoscope (Aircraft Medical Ltd., Edinburgh, UK) is the lightest video laryngoscope (4). It has a liquid crystal display screen and a removable plastic slim X-Blade. The McGrath MAC X-Blade video laryngoscope provides a better glottis view than the Macintosh laryngoscope in difficult airways (5).

The GlideScope video laryngoscope (Saturn Biomedical Systems, Burnbary, BC, Canada) has a high-resolution camera embedded within the blade, a light-source and a 60° curved blade. The GlideScope video laryngoscope has been shown to reduce the number of intubation attempts and improve the glottal structure view compared with direct laryngoscopy, particularly in difficult airways (6). These two video laryngoscopes are compact and portable. Thus, they can be used both inside and outside the hospital.

In 2015, the Difficult Airway Society published the unanticipated difficult airway guideline and recommended to release the cricoid pressure if intubation is impossible, as it worsened the Cormack-Lehane grade of some videolaryngoscopes (7).

To the best of our knowledge, this is the first prospective randomised study that primarily aimed to compare the Macintosh, McGrath MAC X-Blade and GlideScope video laryngoscopes with respect to their laryngoscopic views with or without cricoid pressure. The secondary aim of this prospective randomised study was to compare the X-Blade of the McGrath MAC and GlideScope video laryngoscopes with the Macintosh laryngoscope with respect to the insertion and tracheal intubation times, success rates, need for optimisation manoeuvres, effects on haemodynamic parameters and postoperative minor complications.

Methods

Official approval was obtained from the Local Human Research Ethics Committee (KOU KAEK 2015/267) and written informed consent was obtained from the patients. The study was registered at ClinicalTrials.gov (registration number: NCT 02588157).

We recruited 120 patients in this study. Inclusion criteria included patients with American Society of Anesthesiologists I-II, who were between 18 and 65 years of age and were undergoing elective surgery that required tracheal intubation. Exclusion criteria included the presence of laryngeal or pharyngeal pathology, a known or expected difficult airway (i.e. interincisor distance <2.5, Mallampati 3-4, thyromental distance <6 cm, sternomental distance <12 cm and body mass index>35 kg m^{2-1}), high cardiac or respiratory system insufficiency, recent upper respiratory tract infection (during the past 10 days) and pregnancy.

After an intravenous (iv) cannula was inserted at the preoperative care unit, midazolam (0.03 mg kg^{-1} iv) was administered for premedication. After arriving in the operating theatre, patients were monitored using electrocardiography, pulse oximetry (SpO_2), heart rate (HR), non-invasive blood pressure and expiratory end-tidal carbon dioxide levels. Patients were preoxygenated for 3-5 min with 100% oxygen using a face mask. We recorded the paitents' preoperative demographic and airway variables, including age, sex, weight and height; sternomental, thyromental and interincisor distances; Mallampati classification with phonation; mandibular protrusion (type A, lower incisors protrude anterior to the upper incisors; type B, lower incisors can be brought edge to edge with the upper incisors and type C, lower incisors cannot be brought edge to edge with the upper incisors); tooth morphology (full/lacking/none); macrognathia or micrognathia.

Patients were randomised into three groups, i.e. Macintosh, McGrath MAC X-Blade and GlideScope, using a sealed envelope technique. All steps were then applied concordant with an While oxygenation was applied using a facemask, propofol (2-3 mg kg^{-1} iv) and fentanyl (1 mgr kg^{-1}) were administered for anaesthesia induction. Subsequently, succinylcholine (1 mg kg^{-1}) was rapidly administered. Cricoid pressure was applied during all the intubations by an unblended independent anaesthesia resident with at least 4 years experience. Cormack-Lehane grades under cricoid pressure were taken as the baseline view and then, as the cricoid pressure was gradually decreased, the change in the laryngeal view was recorded (8). During the intubation procedure, a pillow was placed beneath the patients' head and the head was in the neutral position.

Patients were intubated using one of the three laryngoscopes for 1 min following succinylcholine administration. All intubations were performed by the staff with at least 5 years of experience and who had performed at least 50 successful intubations using each device. The men were intubated using an 8.0-mm polyvinylchloride endotracheal tube and women were intubated using a 7.5 mm tube. Patients were intubated according to the manufacturers' recommendations (9, 10). For the McGrath MAC X-Blade, a conventional, angled malleable stylet-shaped like the McGrath MAC was used. For the GlideScope, its dedicated stylet GlideRite was used.

The primary outcome measure included the determination of the effect of cricoid pressure on the laryngeal view during intubation using the three videolaryngoscopes. Secondary outcome measures were the insertion time, intubation times, number of intubation attempts (success rate), mucosal damage, need for optimisation manoeuvres, oesophageal intubation, effects on haemodynamic parameters and minor postoperative complications.

The insertion time was defined as the time that elapsed from the moment the device entered the oral cavity until optimal glottic visualisation was achieved (including optimisation manoeuvres). To determine the optimal glottic visualisation, handling force and reinsertion manoeuvres were used in GlideScope and McGrath MAC X-Blade groups.

The intubation time was defined as the time that elapsed from the moment the device entered the oral cavity until the endotracheal tube was clearly visualised entering the vocal cords. If the first attempt failed and the second attempt succeeded, the intubation time was defined as the time that elapsed from the moment the device first entered the oral cavity until successful intubation.

The need for manoeuvres, number of intubation attempts, bloodstains on the device (mucosal damage), mouth/tooth/tongue damage, presence of oesophageal intubation and hypoxaemia (decrease in saturation to <92%) were also recorded.

The mean arterial pressure (MAP) and HR of patients were recorded preoperatively (baseline), after induction, after device insertion (post-insertion) and at 1, 2 and 3 min after intubation. No other medications were administered during data collection. Near the end of surgery, however, tramadol (1 mg kg^{-1} iv) and ondansetron (0.5 mg kg^{-1} iv) were administered to prevent postoperative pain and vomiting.

If the duration of endotracheal intubation exceeded 120 s or if intubation was deemed impossible after three attempts, it was recorded as 'failed'. In addition, episodes of hypoxaemia (SpO_2), postoperative sore throat, dysphagia, coughing, hoarseness, bronchospasm and aspiration were recorded by an independent, blinded observer just after the surgery in the postanesthesia care unit.

Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences version 20.0 (IBM SPSS Statistics; Armonk, NY, USA). The Kolmogorov-Smirnov test was used for assessing the assumption of normality. Continuous variables that were normally distributed were expressed as mean± standard deviation (SD) and those which were non-normally distributed were expressed as medians (25-75 percentiles). Relations between two categorical variables were compared using the X^2 test (Monte Carlo). For non-normally distributed continuous variables, differences between the groups were analysed using the Kruskal-Wallis test. Pair-wise multiple comparisons were made using Tukey's and Dunn's tests. Friedman's two-way ANOVA was used to determine differences between repeated measures. A value of $p<0.05$ was considered to indicate statistical significance.

From data by Corda et al. (11) and to detect a 20% worsened Cormack-Lehane grade and a 90% power with a=0.05, we calculated our sample size to be 29 per group (a total of 87 for the three groups). Then, we decided to enrol 40 patients per group (a total of 120) with consideration of possible exclusions.

Results

Overall, 120 patients (40 patients per group) were included in this trial. No patients were excluded from the study. Demographic variables and airway characteristics of the patients were similar in the three groups (Tables 1, 2). Mandibular protrusions were type A, except for two patients in each group. First-attempt intubation was 100% with Macintosh video laryngoscope, 95% with McGrath MAC X-Blade video laryngoscope and 98% with GlideScope video laryngoscope (Table 2). All intubations were successful at the second attempt. Cormack-Lehane grades were not changed or improved in Macintosh or McGrath MAC X-Blade groups on apply-

Table 1. Patient demographic and airway characteristics

Characteristics	Macintosh group (n=40)	McGrath MAC X-Blade group (n=40)	GlideScope group (n=40)	p
Sex (F/M)	35/5	33/7	32/8	0.8
Age (years)	42 (31.5-49.8)	47 (29-56.8)	40 (33-57.8)	0.4
Height (cm)	162 (156-167)	163 (160-168)	163 (160-167.8)	0.2
Weight (kg)	68.4±13.9	70.2±13.9	65.8±11.8	0.3
ASA (I/II)	27/13	25/15	26/14	1.0
Mallampati (I/II)	21/19	22/18	22/18	1.0
Interincisor distance (cm)	4.5 (4-5)	4.5 (4-5)	4.5 (4-5)	0.6
Thyromental distance (cm)	8 (7.6-10)	8.8 (7-9)	8 (7.5-9)	0.7
Sternomental distance (cm)	15 (14-16)	16 (14.3-16.8)	15 (14-17)	0.7
Tooth morphology (Full/lacking/absent)	33/4/3	30/6/4	29/6/5	0.9

The values are shown as the numbers or means±SD or as medians (25-75 percentiles).
ASA: American Society of Anesthesiologists

Table 2. Patient airway management data

Characteristics	Macintosh group (n=40)	McGrath MAC X-Blade group (n=40)	GlideScope group (n=40)	p
Mask ventilation	25/13/2	20/17/3	22/14/4	0.8
(easy/airway/two-handed)	6 (4.3-7)	5 (4-6.8)	6.5 (5-9)[a]	0.03*
Insertion time (s)	12 (9-15.8)	13 (11-17)	18 (14-22)[b,c]	<0.001**
Intubation time (s)	40/0	38/2	39/1	0.8
No of intubation attempts (1/2)	25/15/0	32/8/0	26/2/12	<0.001**
Cormack-Lehane grade with cricoid pressure (Not improved/improved/worsened)	(61.5%/37.5%/0%)	(80%/20%/0%)	(65%/5%/30%)	<0.001**
Cormack-Lehane grade before Cricoid pressure I/II	16/24	24/16	34/6	
Cormack-Lehane grade after Cricoid pressure I/II	30/10	32/8	24/16	0.12
Manoeuvre needed (yes/no)	6/34	1/39	4/36	0.2
Sore throat (yes/no)	10/30	9/31	9/31	1.0
Dysphagia (yes/no) (Full/lacking/absent)	11/29	9/31	4/36	0.2

Values are given as numbers or as medians (25-75 percentiles).

The required insertion and intubation times and Cormack-Lehane grades with cricoid pressure were significantly different for each device: *p<0.05, **p<0.001

[a]Insertion time of the McGrath MAC X-Blade video laryngoscope – insertion time of the GlideScope video laryngoscope (p=0.02)

[b]Intubation time of the Macintosh video laryngoscope – intubation time of the GlideScope video laryngoscope (p<0.001)

[c]Intubation time of the McGrath MAC X-Blade video laryngoscope – intubation time of the GlideScope video laryngoscope (p=0.003)

ing cricoid pressure but worsened in the GlideScope group (p<0.001). Insertion times for Macintosh and McGrath MAC video laryngoscopes were similar. Insertion times for the GlideScope video laryngoscope were similar to that for the Macintosh video laryngoscope, but were longer than those for the McGrath MAC X-Blade video laryngoscope (p=0.02) (Table 2). Intubation times for Macintosh and McGrath MAC X-Blade video laryngoscopes were similar, whereas the intubation time for the GlideScope video laryngoscope was statistically significantly longer than that for the other two laryngoscopes (p<0.001 and p=0.003, respectively) (Table 2). Need for optimisation manoeuvres were similar among the groups.

The Macintosh and GlideScope devices significantly increased MAP after insertion compared with the post-induction value (p=0.004 and p=0.001, respectively) (Figure 1). McGrath MAC X-Blade laryngoscopy increased MAP, but the difference was not statistically significant. All three devices increased HR after insertion compared with the post-induction HR value (p<0.001) (Figure 2).

Mucosal damage occurred in two patients each in the McGrath MAC X-Blade and GlideScope groups. Mouth damage was found in two patients in the McGrath MAC X-Blade group and in one patient in the GlideScope group. Tooth damage occurred in one patient in the McGrath MAC

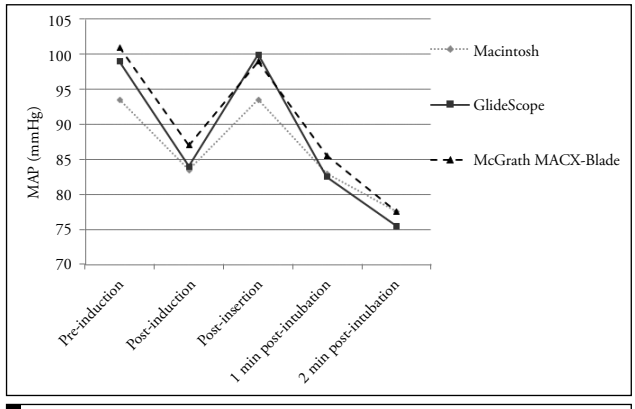

Figure 1. MAP variations using the Macintosh, GlideScope and McGrath MAC X-Blade video laryngoscopes
Values were given as median. MAP: mean arterial pressure

X-Blade group. Postoperative hoarseness was detected in only one patient, who was in the Macintosh group. Bronchospasm was not observed in any patient.

Discussion

The main result of this study was that the laryngeal view change under cricoid pressure and the tracheal intubation time for the McGrath MAC X-Blade video laryngoscope was similar to that for the Macintosh laryngoscope. Cricoid pres-

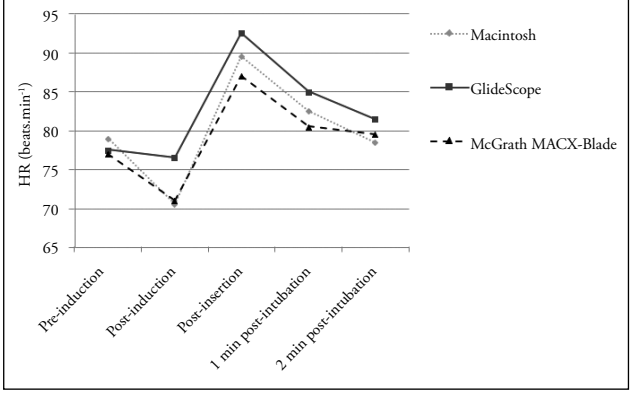

Figure 2. HR variations using Macintosh, GlideScope and McGrath MAC X-Blade video laryngoscopes
Values were given as median. HR: heart rate

sure worsened the Cormack-Lehane grade obtained using the GlideScope laryngoscope and prolonged its tracheal intubation time.

Cricoid pressure is a part of patient safety in rapid sequence induction intubation. It is used to prevent the regurgitation of gastric contents (12). However, the effect of cricoid pressure on laryngeal view is controversial. It was previously shown that cricoid pressure worsened the view in 12.5% cases when using the Macintosh blade (13). A large published study found that pressing on the neck greatly affected the laryngeal view obtained from the curved blade on 106 cadavers. Cricoid pressure frequently worsened (29%) the Macintosh laryngoscopy (14). Randomised studies examined the effect of cricoid pressure and showed that it worsened the laryngeal view by approximately 20% during Macintosh laryngoscopy (15, 16). If the cricoid pressure was released, tracheal intubation became easier (17). In our study, none of the view worsened under cricoid pressure during Macintosh laryngoscopy. However, the laryngeal view did not change under cricoid pressure in 61.5% patients and was improved in 38% patients in the Macintosh group.

Loughnan et al. (18) showed that 41% of the views were improved when cricoid pressure was applied during intubation with a C-MAC video laryngoscope and 45% of the views were unchanged and 14% of the views worsened. The standard C-MAC video laryngoscope has only a Macintosh blade with an additional video camera and no angle as the GlideScope or the others like the C-MAC D-Blade.

Some authors reported that the video laryngoscope improved laryngeal visualisation under the Sellick manoeuvre during rapid sequence induction (19). Corda et al. (11) showed that there was no statistically significant difference in glottis grade (39% of glottis grade improved and 20% worsened) when using GlideScope under cricoid pressure in 100 patients. However, it significantly decreased the glottis area by forcing vocal cord apposition. According to our results, 5% improved, 30% worsened and 65% were unchanged in the GlideScope group. We thought that inserting the GlideScope video laryngoscope through the midline of the mouth and the angle of the tip are the main problem for worsening of the view of the GlideScope under cricoid pressure.

Oh et al. (20) recorded the effects of cricoid pressure on laryngeal view, using a pillow under the patients' head. We put a pillow under the patients' head in the neutral position as well. They demonstrated that cricoid pressure worsened the glottis view obtained from the Pentax-AWS. We already knew that according to the published literature, video laryngoscopes do not require extension of the head. In addition, it was shown that the sniffing position increased the difficulty in inserting and placing the tip of the video laryngoscope (21). Further investigation is needed with or without a pillow. The main problem for Pentax-AWS is inserting it through the midline of the mouth. It is probable that this problem will also be the same with Airtraq, which has a similar shape as Pentax-AWS. Another study showed that cricoid pressure impeded intubation using the WuScope system (22). The WuScope system is also inserted from the midline.

There are some limitations of our study. First, the operators were not blinded to the devices being used in this trial. Second, this study was conducted in fasted patients undergoing elective surgery; the results would be different in a real emergency procedure. Third, this study was not powered to detect differences between the success rates, haemodynamic parameters or minor complications.

Conclusion

Although all three devices were useful for normal or difficult intubation, cricoid pressure improved the Cormack-Lehane grades of Macintosh and McGrath MAC X-Blade video laryngoscopes, but statistically significantly worsened those of the GlideScope video laryngoscope.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Kocaeli Human Researchs Ethics Committee.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - Z.İ.A.; Design - Z.İ.A., M.S.; Supervision - Z.İ.A., M.S.; Resources - Z.İ.A.; Materials - Z.İ.A., M.S.; Data Collection and/or Processing - Z.İ.A.; Analysis and/or Interpretation - Z.İ.A., M.S.; Literature Search - Z.İ.A.; Writing Manuscript - Z.İ.A.; Critical Review - M.S.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

Etik Komite Onayı: Bu çalışma için etik komite onayı Kocaeli İnsan Araştırmaları Etik Kurulu'ndan alınmıştır.

Hasta Onamı: Yazılı hasta onamı bu çalışmaya katılan hastalardan alınmıştır.

Hakem Değerlendirmesi: Dış bağımsız.

Yazar Katkıları: Fikir - Z.İ.A.; Tasarım - Z.İ.A., M.S.; Denetleme - Z.İ.A., M.S.; Kaynaklar - Z.İ.A.; Malzemeler s - Z.İ.A., M.S.; Veri Toplanması ve/veya İşlemesi - Z.İ.A.; Analiz ve/veya Yorum - Z.İ.A., M.S.; Literatür Taraması - Z.İ.A.; Yazıyı Yazan - Z.İ.A.; Eleştirel İnceleme - M.S.

Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

References

1. Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG, et al. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology 2013; 118: 251-70. [CrossRef]
2. Ehrenfeld JM, Cassedy EA, Forbes VE, Mercaldo ND, Sandberg WS. Modified rapid sequence induction and intubation: a survey of United States current practice. Anesth Analg 2012; 115: 95-101. [CrossRef]
3. Graham CA, Beard D, Oglesby AJ, Thakore SB, Beale JP, Brittliff J, et al. Rapid sequence intubation in Scottish urban emergency departments. Emerg Med J 2003; 20: 3-5. [CrossRef]
4. Bailly A, Lascarrou JB, Le Thuaut A, Boisrame-Helms J, Kamel T, Mercier E, et al. McGRATH MAC videolaryngoscope versus Macintosh laryngoscope for orotracheal intubation in intensive care patients: the randomised multicentre MACMAN trial study protocol. BMJ Open 2015; 5: e009855.
5. Kim Y, Kim JE, Jeong da H, Lee J. Combined use of a McGarth MAC video laryngoscope and Frova intubating introducer in a patient with Pierre Robin syndrome: a case report. Korean J Anesthesiol 2014; 66: 310-3. [CrossRef]
6. Griesdale DE, Liu D, McKinney J, Choi PT. Glidescope video-laryngoscopy versus direct laryngoscopy for endotracheal intubation: a systematic review and meta-analysis. Can J Anaesth 2012; 59: 41-52. [CrossRef]
7. Frerk C, Mitchell VS, McNarry AF, Mendonca C, Bhagrath R, Patel A, et al. Difficult Airway Society intubation guidelines for management of unanticipated difficult intubation in adults. Br J Anaesth 2015; 115: 827-48. [CrossRef]
8. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia 1984; 39: 1105-11. [CrossRef]
9. GlideScope AVL system operations and maintenance manual. Available from: www.verathon.com/assets/0900-4200-02-60.pdf
10. The McGRATH MAC Video Laryngoscope system for routine to extreme airways. Available from: www.memed.at/download/videolaryngoskop/folder_mac_xblade.pdf
11. Corda DM, Riutort KT, Leone AJ, Qureshi MK, Heckman MG, Brull SJ. Effect of jaw thrust and cricoid pressure maneuvers on glottis visualization during Glidescope videolaryngoscopy. J Anesth 2012; 26: 362-8. [CrossRef]
12. Ellis DY, Harris T, Zideman D. Cricoid pressure in emergency department rapid sequence tracheal intubations: a risk-benefit analysis. Ann Emerg Med 2007; 50: 653-65. [CrossRef]
13. Snider DD, Clarke D, Finucane BT. The ''BURP'' maneuver worsens the glottic view when applied in combination with cricoid pressure. Can J Anaesth 2005; 52: 100-4. [CrossRef]
14. Levitan RM, Kinkle WC, Levin WJ, Everett WW. Laryngeal view during laryngoscopy: a randomized trail comparing cricoid pressure, backward-upward-rightward pressure, and bimanual laryngoscopy. Ann Emerg Med 2006; 47: 548-55. [CrossRef]
15. Noguchi T, Koga K, Shiga Y, Shigematsu A. The gum elastic bougie eases tracheal intubation while applying cricoid pressure compared to a stylet. Can J Anaesth 2003; 50: 712-7. [CrossRef]
16. Haslam N, Parker L, Duggan JE. Effect of cricoid pressure on the view at laryngoscopy. Anaesthesia 2005; 60: 41-7. [CrossRef]
17. Ho AM, Wong W, Ling E, Chung DC, Tay BA. Airway difficulties caused by improperly applied cricoid pressure. J Emerg Med 2001; 20: 29-31. [CrossRef]
18. Loughnan TE, Gunasekera E, Tan TP. Improving the C-MAC video laryngoscopic view when applying cricoid pressure by allowing access of assistant to the video screen. Anaesth Intensive Care 2012; 40: 128-30.
19. Goldmann K, Kalmus G, Steinfeldt T, Friedrich I, Wulf H. Video laryngoscopy for midified rapid sequence induction of anaesthesia: Sellick manoever with and without video laryngoscopic control. Anaesthesist 2006; 55: 407-13. [CrossRef]
20. Oh J, Lim T, Chee Y, Kang H, Cho Y, Lee J, et al. Videographic analysis of glottic view with increasing cricoid pressure. Ann Emerg Med 2013; 61: 407-13. [CrossRef]
21. Hirabayashi Y. In-line head and neck positioning facilitates tracheal intubation with the Airway Scope. Can J Anaesth 2007; 54: 774. [CrossRef]
22. Smith CE, Boyer D. Cricoid pressure decreases ease of tracheal intubation using fiberoptic laryngoscopy (WuScope SystemÔ). Can J Anaesth 2002; 49: 614-9. [CrossRef]