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Chapter

Airway Management in Accident and Emergency

Kemal Tolga Saracoglu, Gul Cakmak and Ayten Saracoglu

Abstract

Accidents are associated with airway complications. Tracheobronchial injury, pneumothorax, pneumomediastinum, atelectasis, and subcutaneous emphysema can be observed. Therefore airway management in emergency medicine requires skills and equipment. Rapid-sequence intubation, effective preoxygenation, apneic oxygenation, manual inline stabilization technique should be used properly. Rapid-sequence intubation consists of sedation, analgesia, and muscle paralysis components. Videolaryngoscopes, supraglottic and extraglottic airway devices, bougie and surgical airway tools are among training materials. A range of training materials have been described to improve providers' understanding and knowledge of patient safety. In conclusion providing oxygenation, minimizing the risk of complications and choosing the appropriate devices constitute the airway management's pearls.

Keywords: airway management, emergency medicine, accident

1. Introduction

Approximately 0.5-1% of patients in the emergency medicine department require tracheal intubation for various reasons [1]. Respiratory failure, diseases that cause mental state changes, and cardiac arrest are the leading causes among these reasons. Airway management requires a systematic approach (**Table 1**). This section aims to evaluate the factors such as airway providing methods in emergency conditions, the challenges encountered in the success of these methods, and the training and teamwork required to overcome them.

2. Incidence

While the frequency of difficult intubation in operating rooms is 1.15% –3.8%, this rate varies between 3.0% and 5.3% in the emergency department [2]. Difficult intubation significantly decreases the success rate of the first attempt. The risk of complications accompanies this condition. Therefore, difficult airway management preparation should be performed effectively.

Accidents can cause airway complications. Tracheobronchial injury is one of the least common injuries in blunt chest trauma, but it has a high mortality rate. Approximately 81% of the patients die at the accident site or before reaching the emergency department [3]. Pneumothorax, pneumomediastinum, atelectasis, and subcutaneous emphysema can be seen in radiological imaging. Surgical airway incidence has been reported to be 0.1–7.7% [4].

1. Patients with increasing respiratory failure should be evaluated frequently. The underlying causes of frequently accompanying acidosis should be treated.
2. Effective preoxygenation should be applied.
3. Apneic window duration should be extended with apneic oxygenation techniques
4. Since ketamine has bronchodilator effects; it should be considered in the induction of patients with obstructive pulmonary disease.
5. The presence of conditions such as hypoxemia, hypercapnia, and acidosis that increase Pulmonary Vascular Resistance should be avoided in patients with cardiac disease.
6. First of all, airway clearance should be provided and maintained with basic airway management tools. These include chin lift, jaw thrust, recovery position.
7. The oral or nasal airway should be used in an unconscious patient.
8. Suction should be used to prevent aspiration of secretions, mucus, or vomit residues.
9. RSI should be considered for tracheal intubation, while care should be taken against the risk of hemodynamic deterioration, prolonged apnea, and pulmonary aspiration.
10. Direct or indirect laryngoscopy can be applied. However, video-laryngoscopes have some advantages.
11. Tracheal intubation should be confirmed by capnography. Postintubation hypocapnia is associated with poor outcome.
12. Oxygenation with tracheal intubation, laryngeal mask, and bag valve mask should be tried before invasive techniques such as surgical airway. However, in case of failure, cricothyrotomy should not be delayed.
13. Airway management should be provided with teamwork, and critical situations should be overcome by sharing the work.
14. Recommendations for difficult airway guidelines should be transferred to clinical practice.
15. It should be ensured that the acquired knowledge and skills are made permanent by planning periodical training.

Table 1.
Pearls of airway management in the emergency room.

3. Airway providing methods

Airway management in emergency medicine requires skills and equipment. The Rapid-sequence intubation (RSI) technique is used in the rate of 99% for tracheal intubations performed under emergency conditions [5]. RSI consists of sedation, analgesia, and muscle paralysis components. For this purpose, rocuronium or succinylcholine is used as a muscle relaxant. Rocuronium is increasingly in use due to its advantages such as rapid onset effect, minimal side effects, greater availability than succinylcholine, and rapid reverse ability using sugammadex. In a retrospective study of 215 patients, West et al. [6] reported that rocuronium was chosen to provide muscle relaxation predominantly in the patient group with higher early mortality. The use of rocuronium in this study resulted in hypoxemia more often before RSI and VL. A recent large observational study reported no difference in first-pass success rate and intubation-related adverse events between the use of succinylcholine and rocuronium for RSI in the emergency department [7].

Airway management in emergency conditions is complicated due to several factors including facial and neck trauma, risk of vomiting and aspiration, cervical spinal immobilization, or chest compressions applied for resuscitation. It decreases the success of intubation. During difficult tracheal intubation, prolonged apnea results in a sudden decrease in pH, hemodynamic collapse, dysrhythmia, and bradycardia. PaO_2 decreases as oxygen are suspended from the lungs. Therefore, effective preoxygenation should be performed before the procedure, and apneic oxygenation should be considered throughout the procedure to lengthen the apneic window. Recommended preoxygenation techniques include tidal volume

ventilation for 3 min with high FiO_2, 8 min ventilation with 100% FiO_2, or oxygen inhalation until etO_2 reaches 90% and above [8]. Low flow or high flow oxygen is used for apneic oxygenation. Insufflation can also be performed through the venturi mask, nasal cannula, and oxygen cannula or catheters. However, oxygen up to 15 L/min can be given with these techniques. FiO_2 can be given in the range of 0.21-1 with 60-70 L/min flow through high flow systems. In these systems, it is possible to reach high flow rates as oxygen is given by humidifying and heating [9]. The manual inline stabilization (MILS) technique is used in patients with cervical trauma, and direct laryngoscopy worsens the vision in 50% of the cases [10]. C-spine collars and MILS limit the mouth opening. The use of videolaryngoscopes during MILS increases the first attempt success rate by increasing the viewing angle.

4. Psychological barriers

Psychological barriers complicate emergency airway management. This situation causes delays in the application of invasive techniques such as emergency cricothyroidotomy. The Vortex Approach has been defined to increase airway management's success rate applied under emergency conditions [11, 12]. It evaluates the steps of airway management in two parts as preparation and implementation. On the one hand, it is aimed to provide oxygenation successfully without the need for surgical techniques (**Figure 1**). On the other hand, invasive techniques are prepared before the patient is desaturated. Vortex provides effective teamwork. It is thought that this approach can increase the clinical applicability of difficult airway guidelines.

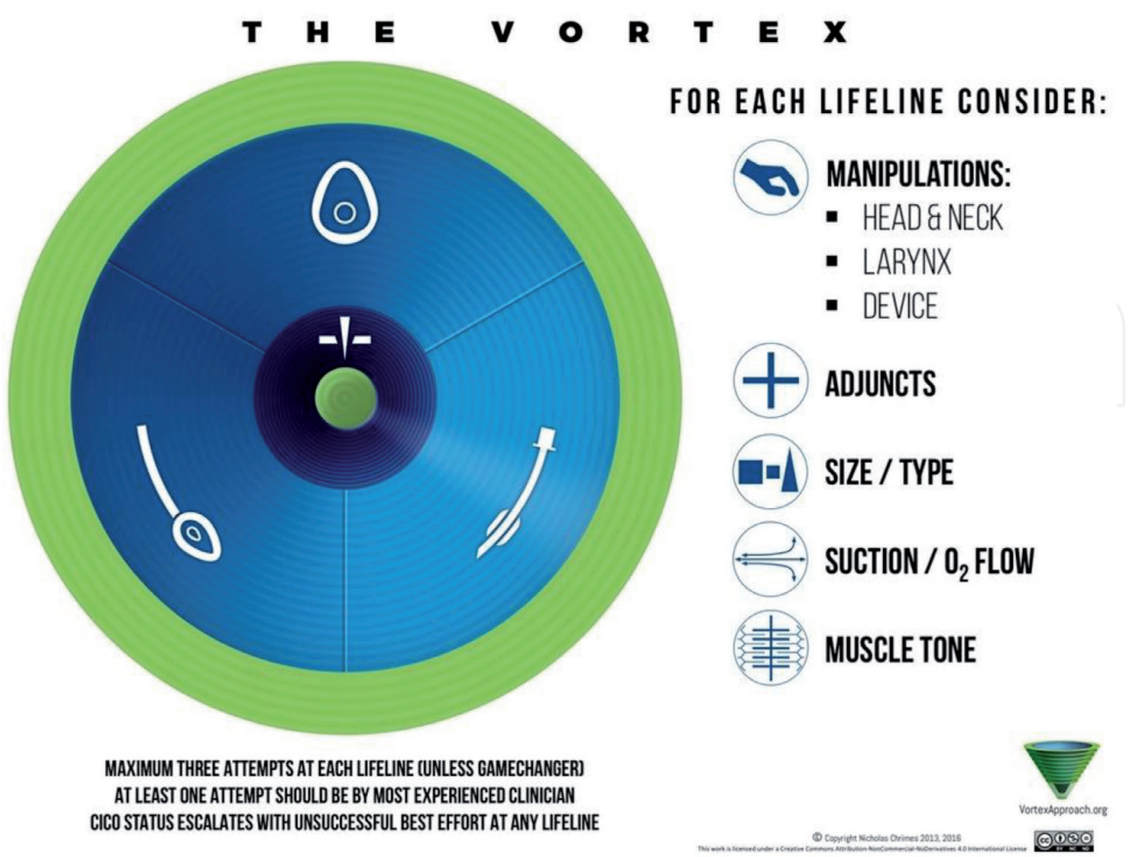

Figure 1.
The Vortex Approach action plan available from: http://vortexapproach.org.

5. Surgical airway

Surgical airway intervention is applied in case of unsuccessful tracheal intubation and cannot intubate-cannot oxygenate situation. Percutaneous cricothyrotomy is the most commonly used procedure. Laceration development in the posterior tracheal wall is a mortal complication. Life-threatening tension pneumothorax, pneumomediastinum, mediastinitis, and progressive respiratory failure can occur when the posterior membranous part of the trachea is injured. Ultrasonography reduces the developmental risk of these complications [13]. However, Siddiqui et al. reported that airway damage might develop despite ultrasound guidance. Also, ultrasound-guided cricothyrotomy takes longer than the conventional technique [14].

6. Training

On the one hand, the continuity of airway providing skills should be ensured through intermittent training, and on the other hand, knowledge about the use of newly developed devices should be obtained. Training requirements in airway

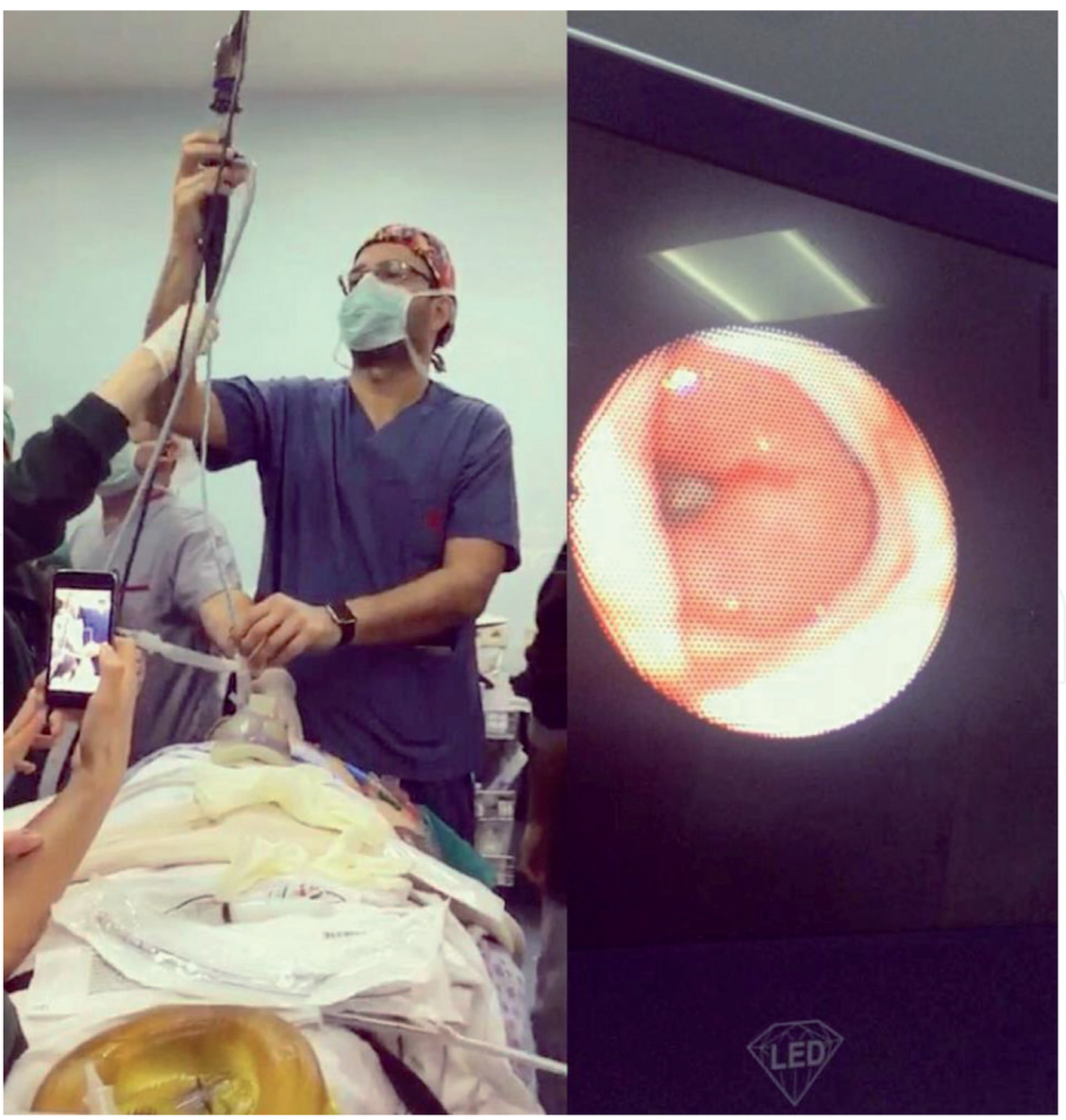

Figure 2.
Intubation through supraglottic airway devices.

management can be divided into airway evaluation, technical aspects of tracheal intubation and alternative airway techniques, and rapid sequential intubation. Fiberoptic intubation and the use of laryngeal masks are among the most common trainings (**Figure 2**) [15]. Simulation-based airway training is also widely used. Both technical and non-technical skills of the participants can be improved with simulators [16]. However, the important fact in training is the intermittent repetition of the acquired skills and permanence. Besides, the transfer of acquired knowledge and skills to the clinical environment should form the basis of training on this subject. For this purpose, different training methods were used to teach airway management to residents and novice users. It has been reported that teaching on cadavers and expression techniques such as Pecha Kucha is effective in achieving success [17].

7. Pre-hospital setting

Pre-hospital settings are often associated with airway management challenges. Although the team is well trained, the frequency of morbidity and mortality is high due to the high risk of complications. Tracheal intubation is the ideal technique [18]. Direct and indirect laryngoscopy can be used for tracheal intubation. It has been reported that the use of video-laryngoscope by emergency medical residents resulted in less esophageal intubation than direct laryngoscopy. In a study analyzing six years retrospectively, data of 2.677 patients were examined [19]. 1.530 intubations (44.7%) were performed with a direct laryngoscope, and video-laryngoscopy was used during 1.895 intubation attempts (55.3%). While esophageal intubation incidence with direct laryngoscope was 5.1%, this ratio was 1.0% with the video-laryngoscope. It has been shown that the use of a checklist in the airway management of patients with severe trauma leads to a decrease in the rate of intubation-mediated complications [20]. Many studies have been conducted in the pre-hospital setting. The success rate and risk of complications of pre-hospital tracheal intubation depend on the experience of healthcare professionals. Intubation performed by healthcare professionals who are not skilled enough to do this significantly increases mortality. A meta-analysis, including 733 studies and data of 4772 patients, reported that tracheal intubation should be performed in emergency medical services [21].

8. Video-laryngoscopes

In recent years, video-laryngoscopes have become a popular tool for the intubation of trauma patients (**Figure 3**). Many studies are comparing direct laryngoscopy and video-laryngoscopy in trauma patients. A systematic review in which nine different studies covering 1329 patients was evaluated, the first attempt success rate was significantly higher with video-laryngoscopes [22]. Besides, the use of video-laryngoscope caused a significant reduction in Cormack and Lehane grades, improving glottic vision. Mucosal trauma decreased with the use of video-laryngoscopy ($p = 0.02$). In another study, data of 150 patients who underwent RSI were analyzed [23]. Better visualization was obtained in the Emergency department through video-laryngoscope than direct laryngoscopy, but the first-attempt success rate did not increase. A recent study conducted with the GlideScope, laryngoscopic grade, and the number of intubation attempts were found to be similar, and it was concluded that intubation could be performed slightly faster [24].

On the other hand, in some studies, using a video-laryngoscope is associated with lower force application to oral structures [25, 26]. More researches are needed regarding the use of video-laryngoscopes in emergency conditions. In a study that

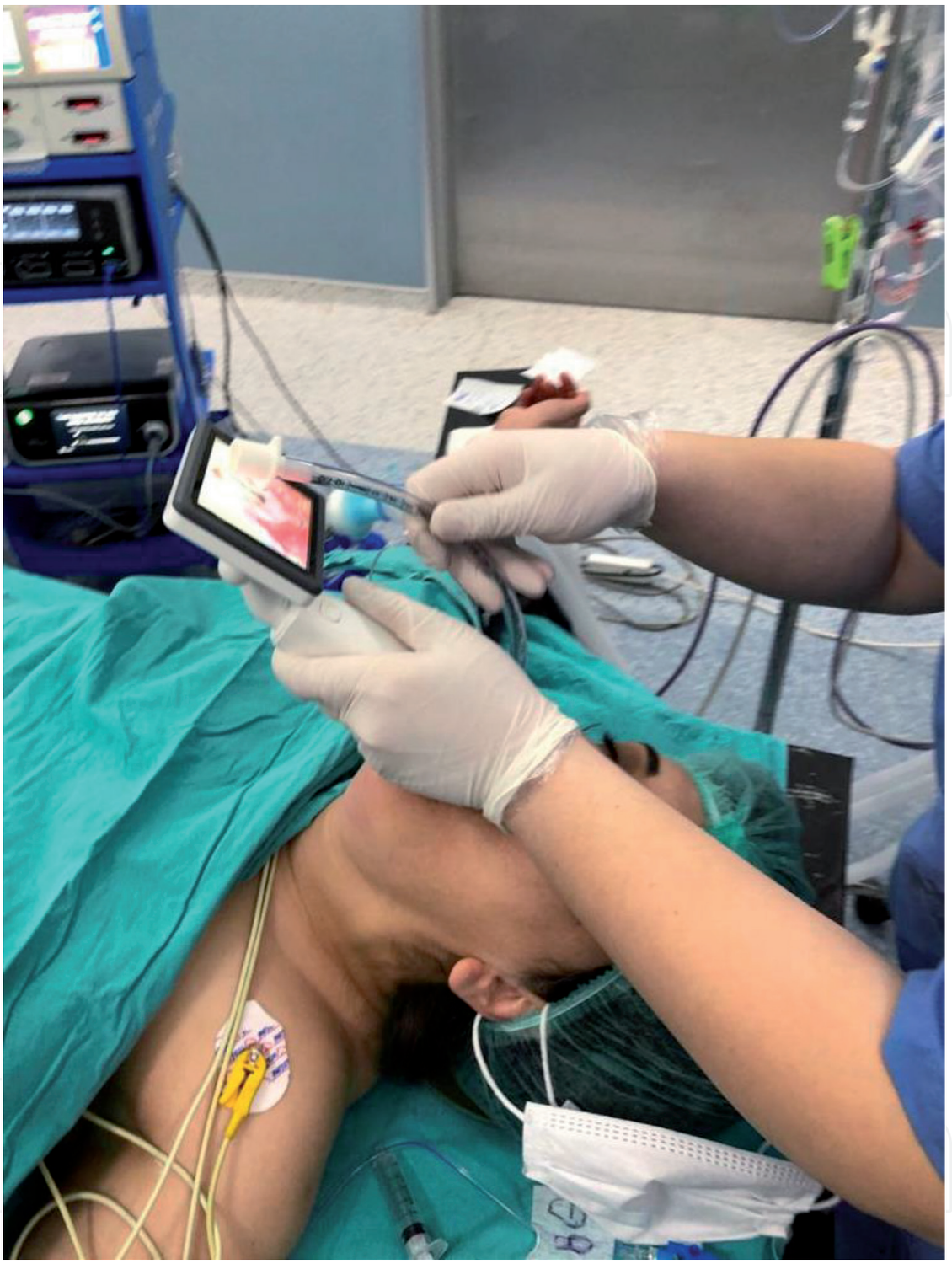

Figure 3.
Tracheal intubation using video-laryngoscopes.

included 4041 emergency room patients over three years, the GlideScope was used for tracheal intubation in 540 patients. It was reported that there was no significant difference in the success rate and unsuccessful tracheal intubation rates in the first attempt when compared with the conventional method [27].

9. Bougie

It is also known as a tracheal tube introducer. It is used to increase the success of tracheal intubation in cases with a poor laryngoscopic view. It is especially useful

when epiglottis can be seen, but vocal cords cannot be visualized. In the studies conducted recently, it has been shown that when compared with the combination of the stylet and tracheal tube, the bougie significantly increases the first pass success rate [28, 29].

10. Conclusion

Management of critical patients in need of airway management in the emergency medicine department requires experience. Providing oxygenation, minimizing the risk of complications, and choosing the appropriate devices constitute the management's pearls.

Author details

Kemal Tolga Saracoglu[1], Gul Cakmak[2] and Ayten Saracoglu[2*]

1 Department of Anesthesiology and Intensive Care, Health Sciences University Kartal, Dr. Lutfi Kirdar Training and Research Hospital, Istanbul, Turkey

2 Department of Anesthesiology and Intensive Care, Marmara University Pendik Training and Research Hospital, Istanbul, Turkey

*Address all correspondence to: anesthesiayten@gmail.com

References

[1] Goto T, Goto Y, Hagiwara Y, Okamoto H, Watase H, Hasegawa K. Advancing emergency airway management practice and research. Acute Med Surg. 2019 May 21;6(4): 336-351. doi: 10.1002/ams2.428.

[2] Clancy M, Nolan J. Airway management in the emergency department. Emerg Med J. 2002 Jan;19(1):2-3. doi: 10.1136/emj.19.1.2.

[3] Díaz C, Carvajal DF, Morales EI, Sangiovanni S, Fernández-Trujillo L. Right main bronchus rupture associated with blunt chest trauma: a case report. Int J Emerg Med. 2019 Dec 10;12(1):39. doi: 10.1186/s12245-019-0258-3.

[4] Lockey D, Crewdson K, Weaver A, Davies G. Observational study of the success rates of intubation and failed intubation airway rescue techniques in 7256 attempted intubations of trauma patients by pre-hospital physicians. Br J Anaesth. 2014 Aug;113(2):220-225. doi: 10.1093/bja/aeu227.

[5] Lentz S, Grossman A, Koyfman A, Long B. High-Risk Airway Management in the Emergency Department: Diseases and Approaches, Part II. J Emerg Med. 2020 Jun 23:S0736-4679(20)30407-8. doi: 10.1016/j.jemermed.2020.05.009.

[6] West JR, Lott C, Donner L, Kanter M, Caputo ND. Peri-intubation factors affecting emergency physician choice of paralytic agent for rapid sequence intubation of trauma patients. Am J Emerg Med. 2018 Jul;36(7):1151-1154. doi: 10.1016/j.ajem.2017.11.038.

[7] April MD, Arana A, Pallin DJ et al. Emergency department intubation success with succinylcholine versus rocuronium: a national emergency airway registry study. Ann Emerg Med 2018; 72: 645-653.

[8] Taş Z, Hoşten T, Kuş A, Cesur S, Türkyılmaz N, et al. Comparison of tidal volume and deep breath preoxygenation techniques undergoing coronary artery bypass graft surgery: Effects of hemodynamicresponse and arterial oxygenation. Turk J Med Sci 2017;47:1576-1582.

[9] Pence HH, Yilmaz M, Saracoglu KT. Apneic oxygenation and high flow. Int J Anesthetic Anesthesiol 2018, 5:081.

[10] Kovacs G, Sowers N. Airway Management in Trauma. Emerg Med Clin North Am. 2018 Feb;36(1):61-84. doi: 10.1016/j.emc.2017.08.006.

[11] Chrimes N. The Vortex: a universal 'high-acuity implementation tool' for emergency airway management. Br J Anaesth. 2016 Sep;117 Suppl 1:i20-i27. doi: 10.1093/bja/aew175.

[12] Saracoglu KT, Saracoglu A. The Vortex Approach for Difficult Airway Management. Clin Med. 2019;1(3):CIM-01-1014.

[13] Asai T. Emergency Cricothyrotomy: Toward a Safer and More Reliable Rescue Method in "Cannot Intubate, Cannot Oxygenate" Situation. Anesthesiology. 2015 Nov;123(5):995-996. doi: 10.1097/ALN.0000000000000849.

[14] Siddiqui N, Arzola C, Friedman Z, Guerina L, You-Ten KE: Ultrasound improves cricothyrotomy success in cadavers with poorly defined neck anatomy: A randomized control trial. Anesthesiolog y 2015; 123:1033-1041.

[15] Graham CA. Advanced airway management in the emergency department: what are the training and skills maintenance needs for UK emergency physicians? Emerg Med J. 2004 Jan;21(1):14-19. doi: 10.1136/emj.2003.003368.

[16] Saracoglu KT, Saracoglu A. Airway management education: an update. Acta Anaesth Belg 2017;68:175-186.

[17] Saracoglu KT, Yilmaz M, Turan AZ, Kus A, Colak T, Saracoglu A. Pecha Kucha with part task training improves the airway management in fresh frozen cadavers: case-control observational study. Med Princ Pract. 2020 Feb 19. doi: 10.1159/000506597. Epub ahead of print.

[18] Gellerfors M, Larsson A, Svensén CH, Gryth D. Use of the Airtraq® device for airway management in the pre-hospital setting--a retrospective study. Scand J Trauma Resusc Emerg Med. 2014 Feb 3;22:10. doi: 10.1186/1757-7241-22-10.

[19] Sakles JC, Javedani PP, Chase E, Garst-Orozco J, Guillen-Rodriguez JM, Stolz U. The use of a video laryngoscope by emergency medicine residents is associated with a reduction in esophageal intubations in the emergency department. Acad Emerg Med. 2015 Jun;22(6):700-707. doi: 10.1111/acem.12674.

[20] Smith KA, High K, Collins SP, Self WH. A preprocedural checklist improves the safety of emergency department intubation of trauma patients. Acad Emerg Med. 2015 Aug;22(8):989-992. doi: 10.1111/acem.12717.

[21] Bossers SM, Schwarte LA, Loer SA, Twisk JW, Boer C, Schober P. Experience in Prehospital Endotracheal Intubation Significantly Influences Mortality of Patients with Severe Traumatic Brain Injury: A Systematic Review and Meta-Analysis. PLoS One. 2015 Oct 23;10(10):e0141034. doi: 10.1371/journal.pone.0141034.

[22] Pieters BMA, Maas EHA, Knape JTA, van Zundert AAJ. Videolaryngoscopy vs. direct laryngoscopy use by experienced anaesthetists in patients with known difficult airways: a systematic review and meta-analysis. Anaesthesia. 2017 Dec;72(12):1532-1541. doi: 10.1111/anae.14057.

[23] Sulser S, Ubmann D, Schlaepfer M, Brueesch M, Goliasch G, Seifert B, Spahn DR, Ruetzler K. C-MAC videolaryngoscope compared with direct laryngoscopy for rapid sequence intubation in an emergency department: A randomised clinical trial. Eur J Anaesthesiol. 2016 Dec;33(12):943-948. doi: 10.1097/EJA.0000000000000525.

[24] Turkstra TP, Turkstra DC, Pavlosky AW, Jones PM. Simultaneous en bloc endotracheal tube insertion with GlideScope® Titanium™ video laryngoscope use: a randomized-controlled trial. Can J Anaesth. 2020 Aug 19. English. doi: 10.1007/s12630-020-01778-2. Epub ahead of print.

[25] Goto T, Koyama Y, Kondo T, Tsugawa Y, Hasegawa K. A comparison of the force applied on oral structures during intubation attempts between the Pentax-AWS airwayscope and the Macintosh laryngoscope: a high-fidelity simulatorbased study. BMJ Open 2014; 4: e006416.

[26] Nakanishi T, Shiga T, Homma Y, Koyama Y, Goto T. Comparison of the force applied on oral structures during intubation attempts by novice physicians between the Macintosh direct laryngoscope, Airway Scope and C-MAC PM: a highfidelity simulator-based study. BMJ Open 2016; 6: e011039.

[27] Choi HJ, Kim YM, Oh YM, Kang HG, Yim HW, Jeong SH; Korean Emergency Airway Management Registry (KEAMR) investigators. GlideScope video laryngoscopy versus direct laryngoscopy in the emergency department: a propensity score-matched analysis. BMJ Open. 2015 May 11;5(5):e007884. doi: 10.1136/bmjopen-2015-007884.

[28] Driver BE, Prekker ME, Klein LR et al. Effect of use of a bougie vs endotracheal tube and stylet on first-attempt intubation success among patients with difficult airways undergoing emergency intubation: a randomized clinical trial.

[29] Driver B, Dodd K, Klein LR et al. The bougie and first-pass success in the emergency department. Ann. Emerg. Med. 2017; 70: 473-8. e471.