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Review Article

Anaesthesia Section

Comparative Preference of Airtraq Laryngoscope Over Macintosh Laryngoscope- A Review

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ABSTRACT

Tracheal intubation using a Macintosh laryngoscope can save lives. However, because intubation is a difficult procedure to master, failures can have disastrous results. A more recent intubation tool than the Macintosh is the Airtraq optical laryngoscope, which offers glottic plane visualisation without requiring correct tracheal, pharyngeal and oral axes alignment. Airtraq can improve the incidence of failed first intubations and the time required to manage an airway, especially in patients who have had cervical spine trauma which requires manual stabilisation of the cervical spine. With no differences in haemodynamics or intubation duration, the Airtraq laryngoscope offered patients a better laryngeal vision than the Macintosh laryngoscope by providing shorter laryngoscopy and intubation time, and easier intubation. The aim of this literature review was to compare these two laryngoscopes with respect to endotracheal intubation. This review article was put together after a comprehensive study of the literature using the electronic databases PubMed, Medline, Embase and Google. Airtraq laryngoscope was found to be superior to Macintosh laryngoscope as it provides a better view of the glottic region with more ease and less intubation time than the conventional Macintosh laryngoscope.

Keywords: Airway, Anaesthesia, Endotracheal intubation, Laryngeal view, Novel

INTRODUCTION

Local and regional anaesthesia is used for a variety of surgical procedures. Although many surgical procedures can be carried out with supraglottic devices, many surgical operations still necessitate general anaesthesia and endotracheal intubation to preserve the airway [1]. The fundamental tasks of an anaesthesiologist include managing the airway, ensuring good patient breathing, and performing endotracheal intubations in particular [2]. Unfortunately, endotracheal intubation can be challenging in some situations and impossible in others [3,4]. Numerous measures can be used to evaluate the patient's airway and predict the likelihood of complications during endotracheal intubation. These measures are based on the input of trained medical professionals and aid in selecting the most appropriate approach, manufacturing the required equipment, and considering alternative options. The potential for fatal accidents is one of the numerous issues that might result from inadequate airway management. It is important for emergency room airway treatments and for saving lives in dire situations. If oesophageal intubation goes undetected, the patient could die [3].

Airway management, and specifically endotracheal intubation, can be evaluated by looking at factors like the duration of time it takes to perform the procedure, the number of times intubation is attempted, and the percentage of intubations that are successful on the first try (while also taking into account the use of cervical spine immobilisation). Anaesthesiologists routinely perform intubation, but maintaining the airway during surgery remains a concern [5].

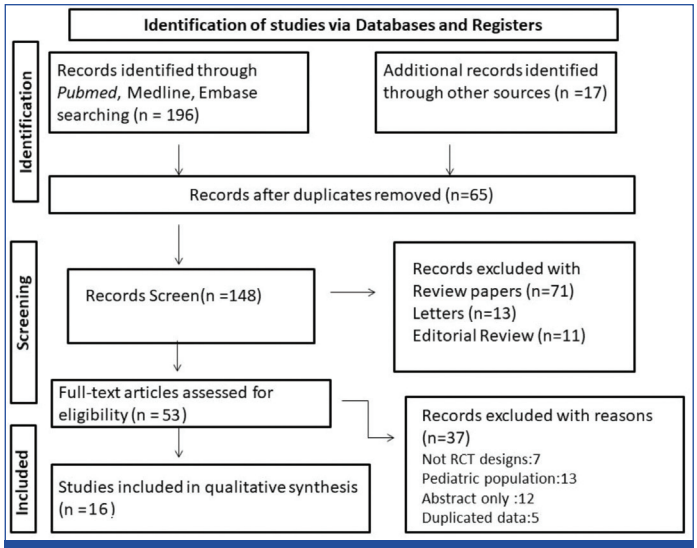
Intubation failure by inexperienced personnel is still a major source of death and morbidity in anaesthesia and emergencies [6]. Though there have been many advancements in the technology of laryngoscopes and other airway devices, the "Macintosh laryngoscope" is still the most commonly used tool for performing endotracheal intubation [7]. Other airway devices are measured against endotracheal intubation as a standard. Unanticipated difficult airways are not detected before anaesthesia induction since they are dependent on several situations [8]. The latest video laryngoscope, the Airtraq, helps doctors to intubate subjects with easy or problematic (difficult airways) air routes. It is possible to view the glottic field with minimal movement of the tracheal, pharyngeal, and oral axis due to the curved design of the Airtraq blade and the meticulous inner arrangement of the optical components. This is made possible by the fact that the Airtraq blade is curved [9]. Indirect laryngeal exposure is achieved with less cervical spine movement than with traditional Macintosh laryngoscopes [10]. The Airtraq rotor has two streams, one on each side. The other uses optics to project a wide-angle image from the lighted apex, through the glottis, and onto the trachea and adjacent laryngeal structures. There is a high-quality endotracheal tube insertion option (ETT). Airtraq is compatible with standard ETTs since its design mimics the human body [11]. This article compares efficacy of Airtraq over Macintosh laryngoscope for endotracheal intubation, focusing on its efficacy and safety.

SEARCH METHODOLOGY

A literature search in English was conducted using the electronic databases PubMed, Medline, Embase, and Google. The search terms were Airtraq OR Macintosh OR Laryngoscope OR Endotracheal Intubation OR General Anaesthesia. The archiving of relevant papers was supported by the writers' personal knowledge and experience in the field. Manuscripts on laryngoscopes and endotracheal intubation were included, [Table/Fig-1].

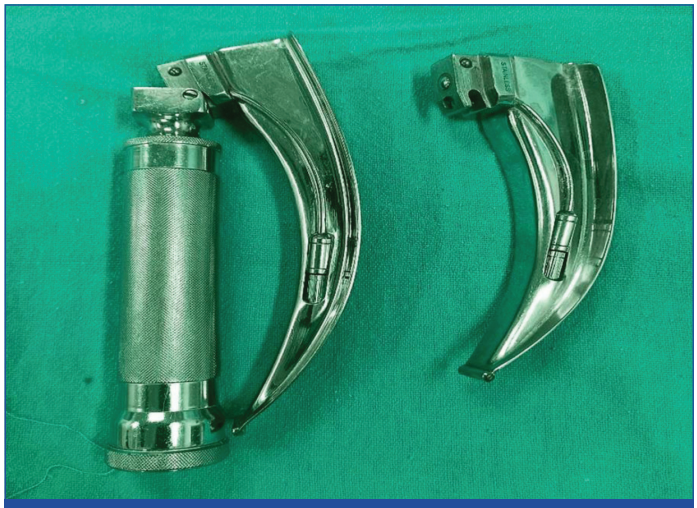
Macintosh Laryngoscope

Before the development of muscle relaxants, "Professor Sir Robert Macintosh" described endotracheal intubation as a "tour de force." A New Zealander who helped establish a private anaesthetic practice in London's West End in the 1930s, famously declared that "the hallmark of a successful anaesthesiologist was the ability to insert an endotracheal tube under vision. The Macintosh laryngoscope continues to be the benchmark by which other devices are compared, even though its broad use sometimes seems to compromise adequate laryngeal vision [12]. Five distinct components make-up the Macintosh laryngoscope blade: The blade tip is a section of the rod that has been shaped at the ends and slotted along its length to fit onto the tip of the blade, pressing



[Table/Fig-1]: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart of included studies.
RCT: Randomised clinical trials

to present a rounded, atraumatic end; the lamp holder is made of rod and is internally threaded. The blade pressing is formed from sheet metal in a strong press. The blade block is made from bar material by turning and milling, [Table/Fig-2].



[Table/Fig-2]: Macintosh laryngoscope with its different blade attachments.
Image Credits: Dr. Yatharth Bhardwaj

Airtraq Laryngoscope

In patients with healthy or difficult airways, tracheal intubation can be performed with the use of a laryngoscope called the Airtraq, which is an optical laryngoscope designed for single use (Prodol Ltd, Vizcaya, Spain). It comes equipped with a light source, a path for the tracheal tube to follow, and a heater to keep the viewfinder from being fogged over with condensation. Viewing of the glottic can be accomplished with the Airtraq without the need to align the 3 axes [13]. This is made possible by the unique structure of the optical components and the curve of the stiff blade. Direct laryngoscopy often involves positioning the patient so that their oral, pharyngeal, and laryngeal axes are all in the correct positions so that the vocal cords can be seen. Airtraq, a novel single-use laryngoscope, reveals the glottis without shifting the tracheal, pharyngeal, and oral axes.

The Airtraq blade is made up of two channels that travel in opposite directions. The tracheal tube is placed through the more externally located channel. Lens contact with the prism and the increased curvature of the blades transmit the picture to the near field. At the very tip of the blade is a battery-powered light. The intubation process is made less stressful by reducing the potential for cervical spine movement with this design [14]. The glottis and its surrounding structures can be observed by placing the display lens over the mouth and nose and inserting the head of a tracheal tube between the vocal cords. Airtraq provides a more legible display for patients who have trouble opening their mouths or moving their necks (assuming it is greater than 3 cm). Transmitting the video footage to an external monitor also allows for real-time guidance from an instructor [14], [Table/Fig-3].

[Table/Fig-3]: Airtraq laryngoscope with phone adapter.
Image credits: Dr. Yatharth Bhardwaj
[Table/Fig-4]: Airtraq laryngoscope showing its anatomical curvature.
Image credits: Dr. Yatharth Bhardwaj. (Images from left to right)

Advantages: Airtraq is advantageous because of its superior presentation. The video feed can also be broadcast to a second screen so that a professional can provide guidance and training at the same time. With Airtraq, intubation times were shorter, problems were reduced, and intubation difficulty scores were lowered [Table/Fig-4]. The lens and prism design of this device allow for intubation conditions to be created with minimal movement of the cervical spine, which is one of its primary advantages [14]. As is needed for instructional and training airway management, the ergonomics of Airtraq laryngoscopes have been modified, including the operator's orientation and a shared view of the airway. The technique could well be monitored, captured on film, exported, and documented.

The direction of passage of the endotracheal tube as it emerges from the guide channel is indicated by the target mark on the monitor, which is positioned in line with the glottic aperture. Airtraq increases protection for healthcare personnel by enabling tracheal intubation while the operator is farther away from potentially contagious fluids. When inserting an endotracheal tube is challenging, Airtraq facilitates the employment of procedures, adjuvants, and assistance. Reports of the Airtraq's success in aiding tracheal intubation in patients with traumatic asphyxia provide more evidence for the device's usefulness in clinical situations likely to involve difficult airways.

Disadvantages: The display of an Airtraq video laryngoscope quickly degenerates in the presence of a bulge or secretion, and the gadget is difficult and expensive to use [14]. As described by Holst B et al., [15], Airtraq use in oropharyngeal airway sites was associated with a 2 cm long vertical laceration. The device's short lifespan necessitates keeping spares on hand, which raises costs and reduces its utility [16]. To get the most out of the Airtraq system, practioners should plan on allocating some intervals for arrangement. Airtraq requires 30-60 sec. of on time to warm-up the lens and eliminate fogging [17]. Because of this, the Airtraq equipment can be less useful in a crisis. The width of Airtraq i.e. 2.8 cm, increases the risk of mucosal tissue injury during insertion [18]. Sore throat may develope after surgery due to the device's effect on the oropharynx [Table/Fig-5] [11,17,19-23].

Serial number	Macintosh laryngoscope	Airtraq laryngoscope
1.	Macintosh was found to have in comparison more intubation attempts, problems during intubation, with higher intubation difficulty scores [19].	Airtraq was found to result in shorter intubation times, fewer problems during the process, and lower intubation difficulty scores [19].
2.	Gold standard and highly used intubation device still [20].	A novel videolaryngoscopicdevice, not widely used [20].
3.	More time consuming and challenging intubations are observed with macintoshlaryngoscope [21,22].	With airtraq intubations are less time consuming [22].
4.	Macintosh laryngoscope poses more challenges during difficult airways [23].	Airtraq use is rapidly expanding for both easy and difficult airway [11,23].
5.	There is always a challenge for patients with cervical spine trauma/pathology [17].	The lens and prism configuration of this device allows for minimal movement of cervical spine [17].

[Table/Fig-5]: Macintosh laryngoscope vs Airtraq laryngoscope [11,17,19-23].

DISCUSSION

Medical students, naïve to intubation, also find Airtraq to be easier to use than a Macintosh laryngoscope [24,25]. The Airtraq laryngoscope was found to have less severe mucosal irritation and shorter intubation duration when compared to the Macintosh laryngoscope [26]. Successful first intubation was more common with the Airtraq than with a Macintosh laryngoscope among both experienced and untrained doctors [27]. This study found that the Macintosh blade was used for oesophageal intubation 69% of the time, while the Airtraq was only used 13% of the time. Similar haemodynamic changes were observed between Airtraq and Lightwand in a head-to-head comparison [28]. As a one-time use item, Airtraq reduces the likelihood of prior contamination and subsequent cases of Creutzfeldt-Jacob disease [29].

Savoldelli GL et al., [30] found that the Airtraq required less time to implant the endotracheal tube than the McGrath and Glidescope. Based on this analysis, Airtraq has the easiest learning curve. One study including 318 morbidly obese individuals found that the Airtraq laryngoscope reduced the time it took to intubate the trachea by about a minute compared to the Laryngeal Mask Airways (LMA) CTrach [31]. Using the "Airtraq," "Macintosh laryngoscope," and "airway scope," researchers looked at the achievement rate of intubation attempts and the time it took to complete them [32]. When combined, these two elements were found to increase visibility throughout the airway by a large margin. Airtraq intubation takes longer than other methods because the eye must be completely opposed to the laryngoscope. Das B et al., concluded that for endotracheal intubation, patients with elevated intraocular pressure, Airtraq optical laryngoscope would be a superior substitute for the Macintosh. With the Airtraq, there is also less risk of haemodynamic pressure response and airway injury [33]. According to Castillo-Monzón CG et al., Airtraq laryngoscope enhanced the glottic (modified Cormack-Lehane classification), decreased the need for additional tracheal intubation maneuvers, and also decreased the sympathetic stimulus indicated by a slight increase in heart rate following tracheal intubation [34].

Since the Airtraq laryngoscope offered better laryngoscopic views, quicker laryngoscopy and intubation, easier intubation, with noticeably minimal increase in heart rate and systolic blood pressure than Macintosh laryngoscope [35]. Ndoko SK et al., had shown that the Airtraq laryngoscope allows for the quick and secure tracheal intubation of individuals who are morbidly obese than the typical Macintosh laryngoscope [36]. In comparison to the Macintosh laryngoscope, Hoshijima H et al., find that the Airtraq attenuates the haemodynamic response at 60 s following tracheal intubation [37].

CONCLUSION(S)

The Airtraq gadget is easy to learn and use, even in difficult airway situations. Although Airtaq has been shown to decrease the number of unsuccessful initial intubations and the time needed to manage an airway, this benefit is limited to individuals who had cervical spine trauma which requires manual stabilisation of the cervical spine. With nominal differences in haemodynamics, the Airtraq laryngoscope offered patients a better laryngeal view than the Macintosh laryngoscope. More research is required to ascertain whether two or more devices have significantly different serious adverse effects.

REFERENCES

[1] Apfelbaum JL, Hagberg CA, Connis RT, Abdelmalak BB, Agarkar M, Richard P, et al. 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway. Anesthesiology. 2022;136:31-81. Doi: https://doi.org/10.1097/ALN.0000000000004002.

[2] Saasouh W, Laffey K, Turan A. Degree of obesity is not associated with more than one intubation attempt: A large centre experience. Br J Anaesth. 2018;120:1110-16. Doi: 10.1016/j.bja.2018.01.019.

[3] Higgs A, McGrath BA, Goddard C. Difficult airway society, intensive care society, faculty of intensive care medicine, royal college of anaesthetists. Guidelines for the management of tracheal intubation in critically ill adults. Braz J Anesthesiol. 2018;120:323-52. Doi: 10.1016/j.bja.2017.10.021.

[4] Szarpak L. Laryngoscopes for difficult airway scenarios: A comparison of the available devices. Expert Rev Med Devices. 2018;15:631-43. Doi: 10.1080/17434440.2018.1511423.

[5] Haliem AM, Ashrey EM. Comparative study between C-MAC, Air Traq laryngoscope, and Air Q in adult patients. The Scientific Journal of Al-Azhar Medical Faculty, Girls. 2020;4(1):22. Doi: 10.4103/sjamf.sjamf_106_19.

[6] Abdelgalel EF, Mowafy MS. Comparison between glidescope, airtraq and macintosh laryngoscopy for emergency endotracheal intubation in intensive care unit: Randomised controlled trial Egyptian. J Anaesth. 2018;34:123-28. Doi: 10.1016/j.egja.2018.06.002.

[7] Gupta N, Singh S, Shouche S. Tracheal intubation using the airtraq video laryngoscope vs. Macintosh laryngoscope in patients with anticipated difficult intubation. Med J. Armed Forces India. 2020;78:0377-37. Doi: 10.1016/j.mjafi.2020.02.005.

[8] Ahmad I, El-Boghdadly K, Bhagrath R, Hodzovic I, McNarry AF, Mir F, et al. Difficult airway society guidelines for awake tracheal intubation (ATI) in adults. Anaesthesia. 2020;75:509-28. Doi: 10.1111/anae.14904.

[9] Zhao H, Feng Y, Zhou Y. Teaching tracheal intubation: Airtraq is superior to Macintosh laryngoscope. BMC Med Edu. 2014;14:01-05. Doi: 10.1186/1472-6920-14-144.

[10] McElwain J, Laffey JG. Comparison of the C-MAC®, Airtraq®, and Macintosh laryngoscopes in patients undergoing tracheal intubation with cervical spine immobilization. Braz J Anaesthesiol. 2011;107:258-64. Doi: 10.1093/bja/aer099.

[11] Maharaj CH, O'croinin D, Curley G. A comparison of tracheal intubation using the Airtraq® or the Macintosh laryngoscope in routine airway management: A randomised, controlled clinical trial. Anaesthesia. 2006;61:1093-99. 10.1111/j.1365-2044.2006.04819.x.

[12] Scott J, Baker PA. How did the Macintosh laryngoscope become so popular? Pediatr Anaesthesia. 2009;19:24-29. Doi: 10.1111/j.1460-9592.2009.03026.x.

[13] Lu Y, Jiang H, Zhu YS. Airtraq laryngoscope versus conventional Macintosh laryngoscope: A systematic review and meta-analysis. Anaesthesia. 2011;66:1160-67. Doi: 10.1111/j.1365-2044.2011.06871.x.

[14] Saracoglu KT, Eti Z, Gogus FY. Airtraq optical laryngoscope: Advantages and disadvantages. Middle East J Anaesthesiol. 2013;22(2):135-41.

[15] Holst B, Hodzovic I, Francis V. Airway trauma caused by the Airtraq® laryngoscope. Anaesthesia. 2008;63:889-90. https://doi.org/10.1111/j.1365-2044.2008.05620.x.

[16] Iglesias González JL, Gómez-Ríosbcd MA, Poveda Marinae JL, Calvo-Vecinoa JM. Evaluación del videolaringoscopio Airtraq como dispositivo de rescate tras laringoscopia directa difícilEvaluation of the Airtraq video laryngoscope as a rescue device after difficult direct laryngoscopy. 2018;65(10):552-57. Doi: 10.1016/j.redar.2018.06.010.

[17] Turkstra TP, Pelz DM, Jones PM. Cervical spine motion: A fluoroscopic Comparison of the airtraq laryngoscope versus the Macintosh laryngoscope. Anesthesiology. 2009;111:97-01. Doi: https://doi.org/10.1097/ALN.0b013e3181a8649f.

[18] Çardaközü T, Arslan Zİ, Cesur S, Aksu B. Comparison of hemodynamic response to tracheal intubation with two different videolaryngoscopes: A randomised clinical trial. Braz J Anesthesiol (English Edition). 2021. ISSN 0104-0014; Doi: 10.1016/j.bjane.2021.07.017.

[19] Maharaj CH, Higgins BD, Harte BH. Evaluation of intubation using the airtraq or Macintosh laryngoscope by anaesthetists in easy and simulated difficult laryngoscopy-a manikin study. Anaesthesia. 2006;61:469-77. Doi: 10.1111/j.1365-2044.2006.04547.x.

[20] Campos-Cortés AC, Cordero-Escobar I, Mora-Díaz I. Ventajas del laringoscopio óptico Airtraq® en el abordaje de la vía respiratoria anatómicamente difícil. Rev Mex Anest. 2018;41(1):18-23.

[21] Wang HE, Seitz SR, Hostler D. Defining the learning curve for paramedic student endotracheal intubation. Prehospital Emerg Care. 2005;9:156-62. Doi: 10.1080/10903120590924645.

[22] Garza AG, Gratton MC, Coontz D. Effect of paramedic experience on orotracheal intubation success rates. J Emerg Med. 2003;25:251-56. Doi: 10.1016/s0736-4679(03)00198-7.
[23] Maharaj CH, Costello JF, Harte BH. Evaluation of the airtraq and Macintosh laryngoscopes in patients at increased risk for difficult tracheal intubation. Anaesthesia. 2008;63:182-88. Doi: 10.1111/j.1365-2044.2007.05316.x.
[24] Woollard M, Mannion W, Lighton D. Use of the airtraq laryngoscope in a model of difficult intubation by prehospital providers not previously trained in laryngoscopy. Anaesthesia. 2007;62:1061-65. Doi: 10.1111/j.1365-2044.2007.05215.x.
[25] Maharaj CH, Costello JF, Higgins BD. Learning and performance of tracheal intubation by novice personnel: A comparison of the airtraqamd Macintosh laryngoscope. Anaesthesia. 2006;61:671-77. Doi: 10.1111/j.1365-2044.2006.04653.x.
[26] Arslan ZI, Yildiz T, Baykara ZN. Tracheal intubation in patients with rigid collar immobilisation of the cervical spine: A comparison of Airtraq and LMA CTrach devices. Anaesthesia. 2009;64:1332-36. Doi: 10.1111/j.1365-2044.2009.06053.x.
[27] Woollard M, Lighton D, Mannion W, Watt J, McCrea C, Johns I, et al. Airtraq vs standart laryngoscopy by student paramedics and experienced prehospital laryngoscopes managing a model of difficult intubation. Anaesthesia. 2008;63:26-31. https://doi.org/10.1111/j.1365-2044.2007.05263.x.
[28] Park EY, Kim JY, Lee JS. Tracheal intubation using the airtraq: A comparison with the lightwand. Anaesthesia. 2010;65:729-32. Doi: 10.1111/j.1365-2044.2010.06376.x.
[29] Lowe PR, Engelhardt T. Anaesthesia. 2001;56:485. Doi: 10.1046/j.1365-2044.2001.02047.x.
[30] Savoldelli GL, Schiffer E, Abegg C. Learning curves of the glidescope, the McGrath and the airtraq laryngoscopes: A manikin study. Eur J Anaesthesiol. 2009;26:554-58. Doi: 10.1097/eja.0b013e3283269ff4.
[31] Dhonneur G, Abdi W, Ndoko SK. Video-assisted versus conventional tracheal intubation in morbidly obese patients. Obes Surg. 2009;19:1096-1101. Doi: 10.1007/s11695-008-9719-0.
[32] Koyama J, Iwashita T, Okamoto K. Comparison of three types of laryngoscope for tracheal intubation during rhythmic chest compressions: A manikin study. Resuscitation. 2010;81:1172-74. Doi: 10.1016/j.resuscitation.2010.05.020.
[33] Das B, Samal RK, Ghosh A. A randomised comparative study of the effect of airtraq optical laryngoscope vs. Macintosh laryngoscope on intraocular pressure in non-ophthalmic surgery. Braz J Anesthesiol. 2016;66:19-23. Doi: 10.1016/j.bjane.2014.07.004.
[34] Castillo-Monzón CG, Marroquín-Valz, Fernández-Villacañas-Marín M, Moreno-Cascales M. Comparison of the macintosh and airtraq laryngoscopes in morbidly obese patients: A randomised and prospective study. J Clin Anesth. 2017;36:136-41. Doi: 10.1016/j.jclinane.2016.10.023.
[35] Samal RK, Kundu R, Ghosh M. A comparative study of tracheal intubation characteristics using Macintosh and airtraq Laryngoscpe. J Med Dent Sci. 2014;3:460. Doi: 10.19056/ijmdsjssmes/2014/v3i2/81292.
[36] Ndoko SK, Amathieu R, Tual L. Tracheal intubation of morbidly obese patients: A randomised trial comparing performance of Macintosh and airtraq laryngoscopes. Br J Anaesth. 2008;100:263-68. Doi: 10.1093/bja/aem346.
[37] Hoshijima H, Maruyama K, Mihara T. Airtraq® reduces the hemodynamic response to tracheal intubation using single-lumen tubes in adults compared with the Macintosh laryngoscope: A systematic review and meta-analysis of randomised control trials. J Clin Anesth. 2018;47:86-94. Doi: 10.1016/j.jclinane.2018.03.022.

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