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## REVIEW ARTICLE

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### AIRTRAQ OPTICAL LARYNGOSCOPE: ADVANTAGES AND DISADVANTAGES

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#### Abstract

Difficult or unsuccessful tracheal intubation is one of the important causes for morbidity and mortality in susceptible patients. Almost 30% of the anesthesia-related deaths are induced by the complications of difficult airway management and more than 85% of all respiratory related complications cause brain injury or death. Nowadays, due to the advances in technology, new videolaryngoscopic devices became available. Airtraq is a novel single-use laryngoscope which provides glottis display without any deviation in the normal position of the oral, pharyngeal or the tracheal axes. With the help of the display lens glottis and the surrounding structures are visualised and under direct view of its tip the tracheal tube is introduced between the vocal cords. In patients having restricted neck motion or limited mouth opening (provided that it is greater than 3 cm) Airtraq offers the advantage of a better display. Moreover the video image can be transferred to an external monitor thus an experienced specialist can provide assistance and an educational course can be conducted simultaneously. On the other hand the Airtraq videolaryngoscopic devices possess certain disadvantages including the need of experience and the time demand for the operator to learn how to use them properly, the rapid deterioration of their display in the presence of a swelling or a secretion and the fact that they are rather complicated and expensive devices. The Airtraq device has already documented benefits in the management of difficult airways, however serial utilization obviously necessitates experience.

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**Key words:** airtraq, airway management, videolaryngoscope.

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## Introduction

Difficult or unsuccessful tracheal intubation is one of the important causes for morbidity and mortality in susceptible patients<sup>1</sup>. Cormack and Lehane laryngoscopic view grade 3 or 4 difficult intubation occur in between 0.3-20% of laryngoscopies. Almost 30% of the anesthesia-related deaths are induced by the complications of difficult airway management and more than 85% of all respiratory related complications cause brain injury or death<sup>2</sup>. The incidence of difficult intubation is 1.15-3.8%, on the other side the incidence for failed intubation is 0.13-0.3% in the general population<sup>3</sup>. Furthermore failed intubations using Macintosh laryngoscopes were reported in up to 30% intubations by paramedics<sup>4</sup>.

In addition to the operating theatre, the need for emergent endotracheal intubation is also high in intensive care unit, emergency intervention room and emergency ward; thus this subject obviously is of particular concern to many physicians of various specialties. Trauma to the airways, esophageal intubation, pulmonary aspiration, systemic complications secondary to hypoxia and undesired hemodynamic changes are some of the unwanted conditions which could accompany emergent endotracheal intubation<sup>5</sup>. Nowadays, due to the advances in technology, new videolaryngoscopic devices became available. Optical systems with adjustable position capability and modified blades with LED lights, rechargeable batteries, accelerated the developmental progress of these devices<sup>6</sup>, which include Airtraq, Glide scope<sup>7</sup>, LMA C Trach<sup>8</sup>, Airway scope<sup>9</sup>, Storz V-Mac<sup>10</sup>, lightwand<sup>11</sup>, Mc-Grath video laryngoscope<sup>12</sup> or True-view laryngoscope<sup>13</sup>. These devices are originally designed to handle difficult intubation, and with time they become regular for management of the normal airways, as well.

### Airtraq Optical Laryngoscope

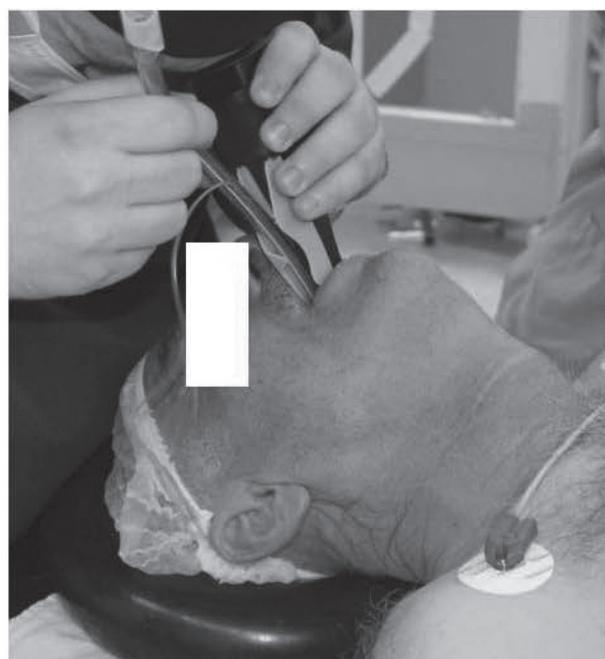
The standard direct laryngoscopy procedure requires the proper alignment of the oral, pharyngeal and laryngeal axes in order to provide the necessary display of the vocal cords. Airtraq is a novel single-use laryngoscope which provides glottis display

without any deviation in the normal position of the oral, pharyngeal or the tracheal axes. The Airtraq blade is composed of two channels running parallel to each other. The more externally positioned channel serves as a conduit for the introduction of the tracheal tube<sup>14</sup> (Figure 1). The exaggerated curvature of the blade and the combination of the lens with the prism ensure the transmission of the image to the proximal field. A battery-powered light source is located on the edge of the blade. The purpose of this configuration is to enable intubation with minimal movement of the cervical spine<sup>15</sup> (Figure 2). With the help of the display lens, the glottis and the surrounding structures are visualised and under direct view of its tip the tracheal tube is introduced between the vocal cords.

*Fig. 1*



*Fig. 2*



## Advantages

In patients having restricted neck motion or limited mouth opening (provided that it is greater than 3 cm) Airtraq offers the advantage of a better display. Moreover the video image can be transferred to an external monitor thus an experienced specialist can provide assistance and an educational course can be conducted simultaneously<sup>16</sup>. Alignment of the airway with the eye of the operator is deemed unnecessary. Compared to Macintosh laryngoscope, Airtraq requires less operator skills thus it constitutes an advantage to the emergency service staff and the ambulance personnel who have limited or no intubation experience. Nowadays it is a prerequisite for the medical and paramedical health professionals to know these instruments as much as possible. Shorter duration of intubation, fewer complications during procedure and lower intubation difficulty scores were reported using Airtraq<sup>17</sup>.

Macintosh laryngoscope being the gold standard device for tracheal intubation has been utilized for many years. Despite all of the developed videolaryngoscopic devices, it is still the most frequently used intubation device<sup>18</sup>. Previous studies have demonstrated that the learning process of intubation with Macintosh laryngoscope is quite difficult and necessitates a long period of time<sup>19,20</sup>. However Airtraq laryngoscope is a novel intubation device which has been introduced to the clinical practice in recent years during the videolaryngoscopic revolution and its utilization is rapidly becoming more and more widespread. Airtraq was previously used in normal and difficult airways to compare with both Macintosh laryngoscope and other videolaryngoscopic devices<sup>21,22</sup>. One of the greatest advantages of this device is the provision of intubation conditions with the least amount of cervical spine movement, due to the lens and prism configuration. In comparison to Macintosh laryngoscope, the reduction of the cervical spine mobility to a minimum level during Airtraq utilization was also demonstrated fluoroscopically<sup>23</sup>. It was observed that all of the Cormack and Lehane grade 4 appearances were reduced to grade 1<sup>24</sup>. Additionally, Airtraq can shorten the duration of intubation in difficult airways as well as normal airways<sup>25</sup>. It was demonstrated that Airtraq influenced the hemodynamic changes to a lower

extent than Macintosh laryngoscope and thus it was emphasized that Airtraq could be safely utilized in patients with coronary artery disease or arrhythmia<sup>26</sup>. Airtraq was also successfully applied in awake intubation<sup>27</sup>; before the procedure a lidocaine injection was performed through the Airtraq channel and thus successful intubations were achieved<sup>28</sup>. Moreover, Airtraq was also utilized for transesophageal echocardiography probe placement<sup>29</sup>, bronchial blocker placement<sup>30</sup> and biluminal tube insertion<sup>31</sup>.

In one study 40 medical students with no previous intubation experience have performed intubations easier with Airtraq compared to Macintosh laryngoscope<sup>32</sup>; in another study the dental trauma incidence was found to be lower with Airtraq<sup>16</sup>. Arslan et al.<sup>25</sup> comparing Airtraq with Macintosh laryngoscope, concluded that the duration of intubation was shorter and the severity of mucosal damage was found to be lower with Airtraq. Compared to Macintosh laryngoscope, the success rate of the first intubation attempt in experienced as well as unexperienced staff was found to be significantly higher with Airtraq<sup>33</sup>. In this study the rate of esophageal intubation was reported to be 65% with Macintosh blade and 13% with Airtraq. A comparative study of Airtraq with Lightwand revealed no significant difference for the hemodynamic changes<sup>34</sup>. The disposable nature of the device decreases the risk of a possible prion contamination and thus the occurrence of Creutzfeldt Jacob Disease<sup>35</sup>.

Savoldelli GL, et al.<sup>36</sup> concluded that time taken to position the endotracheal tube was shorter for the Airtraq when compared with the McGrath and Glidescope. The Airtraq had the most favourable learning curve in this study. In another study which is conducted in 318 morbidly obese patients, the duration tracheal intubation has been found shorter with the Airtraq laryngoscope than with the LMA CTrach<sup>37</sup>. The evaluation of ease of intubation in patients immobilised with cervical collar proved that Airtraq improves the ease of intubation when compared to laryngoscopy with Mc Coy blade<sup>38</sup>. Airtraq aided intubation without requiring the removal of the collar. Airtraq has also been shown to reduce the Intubation Difficulty Scale score and the need for optimization manoeuvres, improving the Cormack and Lehane glottic view when compared with the C-MAC<sup>®39</sup>. In another comparative

study of endotracheal intubation with Airtraq versus Storz videolaryngoscope in children younger than two years, the Airtraq has been found significantly faster in all measured procedural elements of intubation<sup>40</sup>.

## Disadvantages

On the other hand Airtraq videolaryngoscopic devices possess certain disadvantages including the need of experience and the time demand for the operator to learn how to use them properly, the rapid deterioration of their display in the presence of a swelling or a secretion and the fact that they are rather complicated and expensive devices<sup>16</sup>.

The disposability of the device necessitates the provision of backups, which increases the expenditures and represents a disadvantage for its utilization. That's why it inevitably directs us into the search of a reusable videolaryngoscope among the equipments for the management of difficult airways.

In the literature there are previous studies comparing Airtraq with videolaryngoscopic devices such as airway scope<sup>41</sup> and True-view<sup>42</sup>, in addition to the comparative studies of Airtraq with Macintosh laryngoscope. In a study comparing Airtraq, Macintosh laryngoscope and airway scope blades the duration of intubation as well as the success rate of the intubation attempts were compared in resuscitation cases which underwent chest compression<sup>43</sup>. Both of these parameters were found to be significantly more favorable for airway scope. One of the reasons for the increase in duration of intubation with Airtraq is the fact that during the procedure the eye needs to be fully approximated to the laryngoscope and even a small movement of the head can compromise the visibility of larynx. However with increasing experience on how to use the device, the proper application of optimisation maneuvers are learned and the problems can be solved.

Airtraq device also requires some time for set-up. Upon activation of Airtraq approximately 30-60 seconds of time is needed to warm-up the lens and to prevent fogging<sup>23</sup>. That is a disadvantage of the Airtraq device during emergency situations. There are reports of tonsillar injury in children during the intubation attempts with Airtraq<sup>44</sup>. Certain factors, including the blurred vision provided by the Airtraq

laryngoscope, the accidental extubation of a patient upon the retraction of the device following a successful intubation and the inability to place Airtraq into the oral cavity of a patient with a rather limited mouth opening can contribute to the failure of intubation by even some of the experienced anesthesiologists<sup>45</sup>.

In a study conducted on morbidly obese patients, although Airtraq was found to be a faster and safer way of intubation compared to Macintosh laryngoscope, the patients were preoperatively warned about the risk of tissue trauma<sup>10</sup>.

Airtraq is a device with 1.8 cm thickness and 2.8 cm width<sup>46</sup>. It is not possible to use it in patients with restricted mouth opening. Airtraq provides a better laryngoscopic view but this does not always mean that the intubation will be easier. Even in cases with excellent visibility additional manipulations might be necessary and the duration of intubation could be longer. In fact, during a case Cormack and Lahen Grade 3 difficult intubation was detected with Macintosh laryngoscope, followed by several intubation attempts with Airtraq, which has yielded an excellent display, and upon the failure of these attempts a fiberoptic bronchoscope was introduced through the Airtraq device and the intubation was completed under its guidance<sup>47</sup>.

The insertion of Airtraq can damage the mucosal tissue because of its 2.8 cm width. Moreover the pressure exerted by the device through the oropharyngeal region may result in postoperative emergence of sore throat. Holst et al. [48] reported a 2 cm long vertical laceration due to the utilization of Airtraq in oropharyngeal airway areas. The exaggerated curvature and the large anteroposterior diameter of the Airtraq blade might lead to difficulties during its intraoral insertion. Moreover the tip of the blade does not have a rounded vallecular ending like the Macintosh blade thus the risk of trauma increases during the placement of the Airtraq blade behind the tongue. Ndoko SK et al.<sup>49</sup> have reported that the standard Airtraq insertion technique might cause bleeding and the reverse maneuver could be utilized to decrease the complication rates in morbidly obese patients.

Especially for patients with restricted mouth opening Airtraq is not the best choice in every circumstances. Compared to Airtraq, the Glidescope,

Trueview or Storz videolaryngoscope seem to be better choices for patients having limited mouth opening<sup>50</sup>. It should always be kept in mind that a successful intubation could never be guaranteed for each and every case despite the good visualisation of glottis obtained by Airtraq.

## **Conclusion**

The Airtraq device has already documented benefits in the management of difficult airways, however serial utilization obviously necessitates experience.

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