Nasotracheal Intubation Using the Airtraq Versus Macintosh Laryngoscope: A Manikin Study

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The Airtraq laryngoscope is a new intubation device that provides a non-line-of-sight view of the glottis. We evaluated this device by comparing the ease of nasotracheal intubation on a manikin with the use of Airtraq versus the Macintosh laryngoscope with and without Magill forceps. Nasotracheal intubation on a manikin was performed by 20 anesthesiologists and 20 residents with the Airtraq or Macintosh laryngoscope. The mean ($\pm$ SD) time required for nasotracheal intubation by the residents was significantly shorter with the Airtraq laryngoscope than with the Macintosh laryngoscope (16 ± 7 sec vs 22 ± 10 sec; $P < .001$), but no difference in intubation time was observed between Airtraq (15 ± 11 sec) and Macintosh (13 ± 6 sec) laryngoscopy by the anesthesiologists. The Magill forceps was used more frequently to facilitate intubation with the Macintosh laryngoscope than with the Airtraq laryngoscope in both groups of operators ($P < .001$). The Airtraq laryngoscope scored better on the visual analog scale than did the Macintosh laryngoscope in both groups of operators ($P < .05$). The Airtraq laryngoscope offers potential advantages over standard direct laryngoscopy for nasotracheal intubation.

Key Words: Intubation; Nasotracheal; Videolaryngoscope.

Nasotracheal intubation often is required for dental and oral surgery. Direct laryngoscopy with the Macintosh laryngoscope, including the use of Magill forceps, is the most widely used method for nasotracheal intubation. However, this method is somewhat difficult to master, especially by novice personnel who do not perform nasotracheal intubation frequently.

The Airtraq laryngoscope (Prodol Meditec, Vizcaya, Spain) is a new intubation device that provides a view of the glottic opening without aligning the oral, pharyngeal, and laryngeal axes (Figure 1). This single-use plastic device consists of 2 channels. One channel has a conventional optical system and an anti-fogging system. A battery-operated light eliminating diode (LED) light provides illumination, and the image captured by a distal lens is transmitted to a proximal viewfinder through a combination of lenses and mirrors, rather

than via fiber optics (Figure 2). The other channel acts as a conduit for the placement and insertion of a tracheal tube. The Airtraq laryngoscope requires minimal head and neck manipulation compared with conventional direct laryngoscopy. Increasing evidence suggests that the Airtraq laryngoscope is useful in both routine and difficult airway management.¹⁻⁴ We undertook an evaluation of this device to test its effectiveness for nasotracheal intubation on a manikin (AirSim, TruCorp, Belfast, UK) by comparing it with conventional methods in which the Macintosh laryngoscope and the Magill forceps are used.

METHODS

This study was approved by the ethics committee at our hospital. Participants included 20 anesthesiologists and 20 residents. Clinical experience in anesthesia was longer than 4 years (median, 12 years; range, 5–33 years) for the anesthesiologists and less than 2 years (median, 3 months; range, 1–15 months) for the residents. None of the participants had prior experience with use of the Airtraq on patients or manikins.

Received September 22, 2007; accepted for publication March 20, 2008.

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Anesth Prog 55:78–81 2008

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ISSN 0003-3006/08

SSDI 0003-3006(08)

Figure 1. Lateral view of the Airtraq laryngoscope. A close proximity view of the vocal cords is transmitted to a viewfinder at the top of the scope through a conventional optical system. The device includes a battery-powered light source and an anti-fogging system.

The investigator provided a demonstration of the Airtraq laryngoscope. Each of the participants was allowed 5 or 6 practice nasotracheal intubations on a manikin with the Airtraq laryngoscope and the direct laryngoscope with Macintosh number 3 blade. If the tube could not be inserted into the glottis, the Magill

Figure 2. The image of the glottis in the AirSim manikin. The device is passed into the mouth over the tongue, and the tip of the scope is placed in the vallecula.

Table 1. Time to Complete Nasotracheal Intubation on a Manikin With Airtraq and Macintosh Laryngoscopes[†]

	Airtraq	Macintosh
Anesthesiologists (sec)	15 ± 11	13 ± 6
Residents (sec)	16 ± 7*	22 ± 10**

[†] Values are means ± SD.

* $P < .001$ vs. Macintosh.

** $P < .001$ vs. anesthesiologists.

forceps was used to grasp the tube while an assistant advanced the tube by pushing on the nasal end. Following the practice intubations, each participant performed nasotracheal intubation on the manikin with a 7 mm cuffed tracheal tube (Portex Inc, Keen, NH) and the Airtraq and Macintosh laryngoscopes. The sequence in which each participant used the Airtraq and Macintosh laryngoscopes was randomly assigned via sealed envelopes. Each operator completed the examination 3 times, and the sequence of the devices used was alternated at each examination. The duration of each nasotracheal intubation attempt was defined as the time taken from insertion of the tube into the nose until removal of the laryngoscope from between the teeth. The investigator recorded the duration of nasotracheal intubation with a stopwatch and confirmed the final position of the tube in the trachea of the manikin. At the end of the examination, participants rated the ease of use of each device on a visual analog scale (VAS; from 0 mm = extremely easy to 100 mm = extremely difficult). Results obtained from the Airtraq and Macintosh laryngoscopes were compared by means of Student's t test, and data were presented as means ± SD. A P value $< .05$ was considered statistically significant.

RESULTS

No difference in the time needed by anesthesiologists to complete nasotracheal intubation was noted with the Airtraq versus the Macintosh laryngoscope (Table 1). Nasotracheal intubation performed by residents required a significantly longer time than that performed by anesthesiologists ($P < .001$). With respect to the residents, the time for instrumentation was significantly shorter with the Airtraq laryngoscope than with the Macintosh laryngoscope ($P < .001$).

The need to use the Magill forceps was less with the Airtraq laryngoscope than with the Macintosh laryngoscope for both anesthesiologists and residents ($P < .001$; Table 2). The Magill forceps was used significantly more frequently by the residents than by the anesthesiologists ($P < .001$).

Table 2. Percentage (number) of Cases Requiring the Use of Magill Forceps

	Airtraq	Macintosh
Anesthesiologists	0%*	20% (12/60)
Residents	0%*	52% (31/60)**

* $P < .001$ vs. Macintosh.** $P < .001$ vs. anesthesiologists.

Finally, the Airtraq laryngoscope scored better on the VAS than did the Macintosh laryngoscope with both groups of operators (Table 3).

DISCUSSION

The results of the current study indicate that the Airtraq laryngoscope provides a significantly better condition, compared with the Macintosh laryngoscope, for nasotracheal intubation when used by novice personnel on a manikin. This new device performs as well as and perhaps better than the Macintosh laryngoscope when used by experienced operators on a manikin.

Direct laryngoscopy with the Macintosh laryngoscope, with or without the aid of the Magill forceps, is the most widely used method for nasotracheal intubation. Direct laryngoscopy, which requires elevation of the laryngoscope blade, moves the larynx upward and lengthens the distance between the glottic orifice and the posterior pharyngeal wall (Figures 3a and b). Under such circumstances, the Magill forceps often is used to direct the nasally introduced tube into the glottic orifice. In contrast, an anatomically shaped laryngoscope, which provides a non-line-of-sight view, often maintains the airway in its original

Table 3. Ease of Use of Devices as Reported on Visual Analog Scale[†]

	Airtraq	Macintosh
Anesthesiologists (mm)	20 ± 18*	34 ± 21
Residents (mm)	15 ± 21**	47 ± 23

[†] Values are means ± SD.* $P < .05$ vs. Macintosh.** $P < .001$ vs. Macintosh.

configuration (Figure 3c). Increasing evidence suggests that a non-line-of-sight view provides a good condition for nasotracheal intubation.^{5–8} An anatomically shaped blade involves minimum movement of the larynx from the original position and allows easy entry of the tube tip through the glottic inlet.

The time required for airway instrumentation is highly operator dependent. In the present study, experienced anesthesiologists required a relatively short time for instrumentation even with the Macintosh approach. On the other hand, residents who had less experience required more time to secure the airway through the Macintosh approach. In contrast, they preferred the better conditions provided by the Airtraq laryngoscope. An unobstructed image of the glottis is easily secured even by novice operators with the use of an anatomically shaped blade. In addition, with this new scope, the Magill forceps was not usually needed for directing the tube tip into the glottic inlet, thus lessening the chance of trauma to the cuff caused by the grasping arms of the forceps.

In conclusion, the Airtraq facilitates nasotracheal intubation on a manikin. These preliminary findings are limited by the operator's experience and the interpretation of a manikin model. Additional studies are warranted to determine the potential usefulness

Figure 3. Lateral radiographs of the manikin taken during nasotracheal intubation. ETT indicates tip of an endotracheal tube; M, tip of the Macintosh blade; A, tip of the Airtraq; and *, vocal cords. (a) The endotracheal tube was nasally advanced in the pharynx before laryngoscopy. (b) Intubation with the Macintosh laryngoscope. The Macintosh laryngoscope significantly elevates the glottis; consequently, the nasally introduced tube slides upward and then downward in sequence. To align the tube tip with the glottic inlet, the Magill forceps is often used. (c) Intubation with the Airtraq. The Airtraq laryngoscope preserves the configuration of the airway in its original position. Pushing the nasally introduced tube allows it to advance smoothly into the glottic inlet.

of the Airtraq for nasotracheal intubation in clinical settings.

ACKNOWLEDGMENTS

Support was provided solely from institutional and/or departmental sources. The author has no affiliation with any manufacturer of any devices described in this manuscript. The study was performed at Jichi Medical University Hospital.

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