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APPARATUS

The Airtraq® as a rescue airway device following failed direct laryngoscopy: a case series

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Summary

We report the successful use of the Airtraq® as a rescue device following failed direct laryngoscopy, in patients deemed at increased risk for difficult tracheal intubation. In a series of seven patients, repeated attempts at direct laryngoscopy with the Macintosh blade, and the use of manoeuvres to aid intubation, such as the gum elastic bougie placement, were unsuccessful. In contrast, with the Airtraq® device, each patient's trachea was successfully intubated on the first attempt. This report underlines the utility of the Airtraq device in these patients.

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The Airtraq® (Prodol Meditec S.A., Vizcaya, Spain) is a new, single-use, indirect laryngoscope introduced into clinical practice in 2005. It is designed to facilitate tracheal intubation in patients with both normal and difficult airways. As a result of an exaggerated blade curvature, an internal arrangement of optical lenses and a mechanism to prevent fogging of the distal lens, a high quality view of the glottis is provided without the need to align the oral, pharyngeal and tracheal axes. The blade of the Airtraq® consists of two side by side channels. One channel acts as a conduit through which an tracheal tube (ETT) can be passed, while the other channel contains a series of lenses, prisms and mirrors that transfers the image from the illuminated tip to a proximal viewfinder. A high quality wide-angle view of the glottis and surrounding structures, and the tip of the tracheal tube is provided. The Airtraq® is anatomically shaped and standard ETTs of all sizes can be used (Figure 1).

Our group has conducted a number of studies evaluating the utility of this device, for use by experienced and inexperienced personnel, in manikins and in the clinical context. Results to date have been encouraging, with clear-cut advantages over conventional laryngoscopy with the Macintosh blade when used by inexperienced users in both easy and simulated difficult laryngoscopy [1, 2], and when used by experienced anaesthetists in simulated difficult laryngoscopy [3].

In the 12 months since the Airtraq® became clinically available in our department, we have utilised it as a rescue airway device in patients predicted to be at increased risk for difficult intubation in whom attempts at direct laryngoscopic intubation subsequently prove unsuccessful. This case series details the successful use of the Airtraq® in seven such cases, all of whom were intubated on the first attempt with this new device.

Case series

Ethical committee approval was obtained, and each patient consented to the use of his or her data in this report. Four of these patients were enrolled in a prospective randomised clinical trial in patients considered to be at increased risk for difficult intubation, which is currently in progress in our department. These patients were randomised to undergo tracheal intubation by one of the authors (CM, BH, JL) using the Macintosh laryngoscope in the first instance, followed by the Airtraq®, in the event that attempts to intubate with the Macintosh proved unsuccessful. The remaining three patients were identified on pre-operative assessment by their primary anaesthetist to be at increased risk for difficult tracheal intubation, but were not enrolled in the clinical trial. In these latter cases, one of the authors (CM) was requested in advance by the primary anaesthetist to be

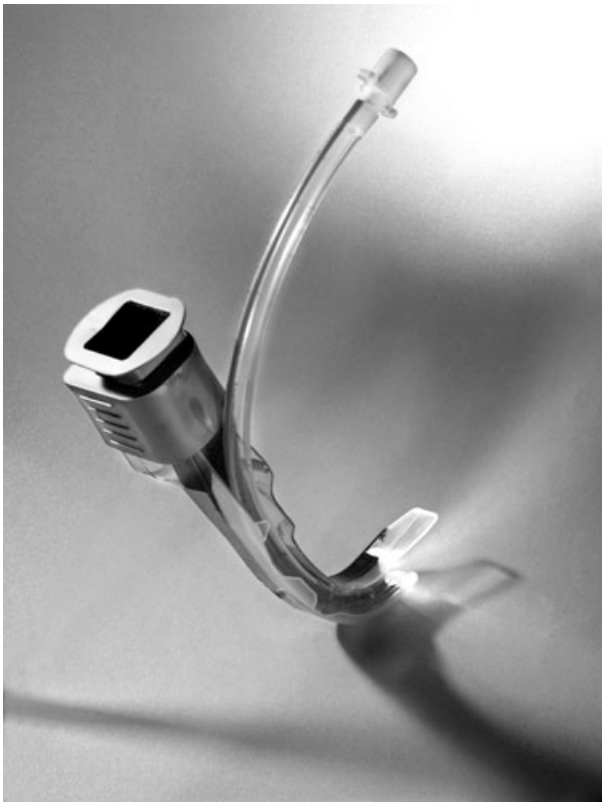

Figure 1 Photograph of the Airtraq laryngoscope with a tracheal tube in place in the side channel.

present to perform tracheal intubation with the Airtraq®, in the event that attempts to intubate with the Macintosh proved unsuccessful.

The detailed demographic and airway assessment data for each patient are given in Table 1. The mean age of these patients was 51.7 years with a female : male ratio of 2 : 5. The average body mass index was 30.1 $kg.m^{-2}$ and all patients had an ASA physical status of II–III. On pre-operative airway assessment, the mean thyromental distance was 5.2 cm (range 4.0–5.5 cm), the mean interincisor distance was 3.4 cm (range 2.5–4.5 cm), and three patients were classified as Mallampati III and four patients were classified as Mallampati IV. Three of the latter patients had a previously documented difficult tracheal intubation. All patients were scheduled for surgery that required general anaesthesia and muscle relaxation. No patient was considered at risk for aspiration.

Table 1 Patient demographics and airway assessment.

	Age; years	Gender	BMI; $kg.m^{-2}$	ASA status	TMD; cm	IID; cm	MP
Case 1	58	Male	24	III	5.5	2.5	IV
Case 2	40	Male	28	II	5.5	3.0	III
Case 3	59	Male	38	III	4.0	3.0	IV
Case 4	31	Male	41	III	7.0	3.5	III
Case 5	51	Female	28	III	5.0	3.5	IV
Case 6	63	Male	27	II	4.0	3.5	IV
Case 7	60	Female	25	II	5.5	4.5	III

BMI, body mass index; ASA, American Society of Anesthesiology; TMD, thyromental distance; IID, interincisor distance; MP, Mallampati classification.

Following placement of routine patient monitoring devices, anaesthesia was induced in all patients using propofol 2–3 $mg.kg^{-1}$ and fentanyl 1–1.5 $\mu g.kg^{-1}$. Adequacy of 'bag-mask' ventilation was established before the administration of the muscle relaxant (atracurium 0.5 $mg.kg^{-1}$). Tracheal intubation was not attempted until 3–4 min post muscle relaxant administration using a Macintosh laryngoscope.

The data regarding attempts at tracheal intubation using the Macintosh laryngoscope for each patient are given in Table 2. Direct laryngoscopy resulted in grade IV Cormack and Lehane (C-L) views, i.e. no portion of the vocal cords were visible, in all cases. Despite repeated attempts (maximum of four attempts), and the use of various airway manoeuvres including the use of the gum-elastic bougie, tracheal intubation was unsuccessful using the Macintosh blade. In each case, at least one intubation attempt lasted longer than 60 s. Oxygen saturations were maintained at > 90% in all but one case, in which the patient transiently desaturated to 81%. No other complications were noted. The intubation difficulty scale (IDS) scores [4] averaged 11, whereas the anaesthetist who performed the laryngoscopy rated the difficulty of laryngoscopy as a maximum of 10 on a visual analogue scale (VAS) in all cases.

The data regarding attempts at tracheal intubation using the Airtraq® device for each patient are given in Table 3.

Table 2 Data regarding attempts at tracheal intubation with the Macintosh laryngoscope.

	Number of intubation attempts	Number of optimisation manoeuvres	C-L view	Lowest S_aO_2; %	IDS	VAS
Case 1	3	2	IV	96	11	10
Case 2	3	3	IV	99	12	10
Case 3	4	3	IV	85	12	10
Case 4	2	2	IV	99	11	10
Case 5	3	3	IV	97	10	10
Case 6	3	2	IV	94	10	10
Case 7	3	3	IV	95	11	10

C-L, Cormack and Lehane; Manoeuvres, additional manoeuvres, e.g. bougie use, performed to optimise laryngoscopy; S_aO_2, arterial haemoglobin oxygen saturation; IDS, intubation difficulty score; VAS, visual analogue scale.

Table 3 Data regarding attempts at tracheal intubation with the Airtraq laryngoscope.

	Number of intubation attempts	Duration of attempt(s)	Number of optimisation manoeuvres	C-L view	Lowest S_aO_2; %	IDS	VAS
Case 1	1	15	0	I	100	0	2
Case 2	1	10	0	I	99	0	2
Case 3	1	7	0	I	99	0	0
Case 4	1	20	0	I	99	1	2
Case 5	1	13	0	I	98	0	0
Case 6	1	9	0	I	100	0	0
Case 7	1	22	0	I	99	1	3

C-L, Cormack and Lehane; S_aO_2, arterial haemoglobin oxygen saturation; IDS, intubation difficulty score; VAS, visual analogue scale.

All intubations using the Airtraq device were performed by experienced users (CM, BH, JL). The oral cavity was first suctioned and the blade of the Airtraq® device was inserted into the mouth in the midline, over the centre of the tongue, and the tip positioned in the vallecula. Where necessary, the epiglottis was lifted by elevating the blade into the vallecula. In each case, once the view of the glottis was optimised, the tracheal tube was successfully passed through the vocal cords on the first attempt, and the device removed. The mean duration of intubation attempts was 12.7 s. All laryngoscopic views with this device were graded as Cormack and Lehane grade I, and no additional airway manoeuvres were required to facilitate tracheal intubation. The oxygen saturation in each case remained unchanged, while the IDS score averaged 0.3 and the VAS laryngoscopic difficulty averaged 1.4. There were no complications associated with the use of this device.

Discussion

Failure to successfully intubate the trachea and secure the airway remains a leading cause of morbidity and mortality, in the operative [5–7], and emergency settings [8, 9]. Consequently, there is a requirement for novel airway devices that increase the ease of performance of tracheal intubation, particularly in settings where laryngoscopy is likely to be difficult, due to anatomical or other abnormalities.

The view obtained on laryngoscopy is a major factor in determining the difficulty of intubation [7]. In patients deemed to have a difficult airway, aligning the airway axes to obtain an adequate laryngeal view to permit tracheal intubation may be very difficult with the Macintosh blade, with excessive force being required to try to visualise airway structures. With the Airtraq®, the airway axes do not have to be aligned to visualise the vocal cords. This translates into a requirement for less upward laryngoscopic force during laryngoscopy, which should reduce the likelihood of producing oropharyngeal and/or airway trauma [1].

This is the first reported series of the Airtraq® being used as a 'rescue' airway device. In our earlier studies, we have demonstrated that the Airtraq® has advantages compared with the Macintosh laryngoscope, when used by experienced anaesthetists in simulated difficult intubation scenarios including reduced cervical spine mobility, in the manikin [3]. We have also reported that the Airtraq® performs better than the Macintosh when used by both inexperienced [1] and novice [2] users. In the clinical setting, the Airtraq® appears to reduce intubation difficulty even in patients at low risk for difficult laryngoscopy [10]. Given these findings, we have elected to utilise the Airtraq® as the preferred alternative laryngoscope, in situations where intubation with the Macintosh proves difficult.

In this present case series, all seven patients possessed risk factors for difficult direct laryngoscopy (Table 1), as determined by pre-operative assessment. In all cases the best laryngoscopic views obtained with the Macintosh blade were Cormack and Lehane grade IV, and the degree of difficulty as measured on the VAS for all cases was 10. This contrasts with our findings when we used the Airtraq® in these patients. Laryngoscopic views with the Airtraq® were all graded as Cormack and Lehane grade I. However, it should be borne in mind that the Cormack and Lehane grading system was devised for direct laryngoscopes, rather than indirect laryngoscopes such as the Airtraq®. The Cormack and Lehane grading may underestimate the difficulty of intubation with indirect laryngoscopes such as the Airtraq®.

The intubation difficulty scale (IDS) score devised by Adnet et al. [4], standardises the degree of difficulty experienced in intubating the trachea between different patients, by assigning a score to each of seven common variables associated with a difficult intubation: the number of intubation attempts, the number of supplemental operators, the number of alternative intubation techniques used, the glottic exposure obtained, the lifting force required during laryngoscopy, the necessity for external laryngeal pressure, and the position of the vocal cords at intubation. In our case series, the average IDS score was reduced from 10.5 for the Macintosh blade to 0.3 for the Airtraq® device. Finally, VAS difficulty scores for the Airtraq® were low, thus signifying the ease of use of this device in these cases where the Macintosh blade previously failed.

The recent guidelines published by the Difficult Airway Society [11] for the management of unanticipated difficult intubation advocates consideration of alternative laryngoscopes in the primary intubation plan. We

propose, based on this case series and on recent clinical and manikin studies from our group [1–3, 10, 12], that the Airtraq® be considered as part of the initial intubation plan, i.e. as an 'alternative laryngoscope', given its ease of use and its potential advantages over conventional direct laryngoscopy.

In summary, this case series demonstrates that the Airtraq® offers an alternate approach to securing the difficult airway where attempts to do so by conventional direct laryngoscopy have failed.

Acknowledgement

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