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Airway Scope® for Emergency Intubations: Usefulness of a New Video-laryngoscope

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ABSTRACT

The Airway Scope® (AWS-S100, Pentax, Tokyo, Japan) is a new video-laryngoscope, which has a specially designed blade and a portable, battery-powered, 2.4-inch built-in liquid crystal device (LCD) full-color video screen at the top of the handle. In this study, we tested the usefulness of the AWS for tracheal intubation in acute, urgent situations. Patients admitted to the Advanced Emergency and Critical Care Center at Hiroshima University Hospital and who required orotracheal intubations were prospectively enrolled. Tracheal intubations were performed using the AWS by residents (the novice group) or staff physicians (the experienced group), who received a brief instruction in the AWS. We enrolled 38 patients (23 males, 15 females; age, 60 ± 19 years). Intubations were attempted by 22 intubators (11 residents and 11 experienced personnel). The durations from inserting the blade via the oral cavity until observing the glottis (T1), inserting the tube into the trachea (T2), and confirming the chest rise (T3) were 22 ± 15, 34 ± 21 and 49 ± 27 sec, respectively. When the results were classified into t experienced and novice groups, T1, T2 and T3 were 17 ± 10 vs. 26 ± 17, 32 ± 23 vs. 36 ± 20, and 45 ± 25 vs. 53 ± 27 sec, respectively (the experienced vs. the novice group, n.s.). These results suggested that the AWS may be a suitable device particularly for less experienced personnel, such as novice Advanced Life Support providers.

Key words: *Tracheal intubation, Video-laryngoscope, Emergency*

Attempted tracheal intubation by unskilled personnel can lead to serious complications such as severe tissue injury to the oropharynx and larynx, interruption of ventilatory support for unacceptably long periods, and hypoxemia due to prolonged intubation attempts or failure to recognize tube misplacement. Therefore, adequate initial training and frequent experience or retraining are prerequisites for those who perform tracheal intubation [7].

Various types of laryngoscopes have been recently developed to facilitate tracheal intubation [4,5,8], and it has been suggested that one of these new laryngoscopes is a superior device in terms of enabling novice personnel to acquire the skills of tracheal intubation [6].

The Airway Scope® (AWS-S100, Pentax, Tokyo, Japan) is a new video-laryngoscope that has been available in Japan since July 2006 [3]. This device has unique features that are not found in regular-type laryngoscopes. The AWS is equipped with a portable and waterproof video screen located at the top of the handle. The 2.4-inch full-color screen consists of a battery-powered, built-in liquid crystal display (LCD). The blade is a specially designed disposable curved blade (Fig. 1) with an L-shaped structure. This design enables imaging of the larynx without requiring alignment of the oral, pharyngeal, and tracheal axes (Fig. 2). The blade consists of three channels that have the following functions: housing for the placement and insertion of the tracheal tube; an image channel with a CCD camera at its tip; and a suction port. The image channel provides a wide and clear image of the pharyngeal and laryngeal structures on the full-color screen located on its handle.

It has been demonstrated that the AWS is easy to use and an effective intubation device for difficult intubation in the operating room (OR) [1] and for intubation by novice personnel [2]. However, no study has investigated its usefulness in the emergency setting. In the present study, therefore, we tested the usefulness of the AWS for tracheal intubation in acute, urgent situations.

MATERIALS AND METHODS

This study was approved by the IRB of Hiroshima University Hospital. Intubators consisted of first- or second-year residents (Novice group) and staff physicians (Experienced group). The novice personnel had either no prior intubation training in the OR, or no clinical experience in tracheal intubation using the Macintosh laryngoscope. The experienced personnel had clinical experience in emergency airway management including tracheal intubation. Niether groups had any clinical experience of the AWS prior to this study. They received brief instruction regarding the use of the AWS and the study design.

Patients admitted to the Advanced Emergency and Critical Care Center at Hiroshima University Hospital and who required oro-tracheal intubation were prospectively enrolled in the study. Standard maneuvers were used prior to attempting intubation in the emergency setting: all patients were connected to standard monitoring devices, preoxygenated, and received an intravenous infusion with or without induction agents and/or vasopressors, as required. The patient's background, diagnosis on admission, and application of C-spine

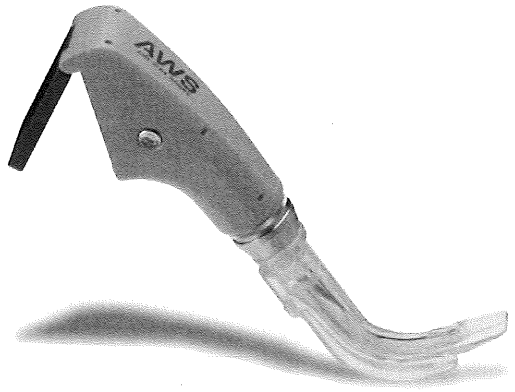

Fig. 1. Airway Scope®

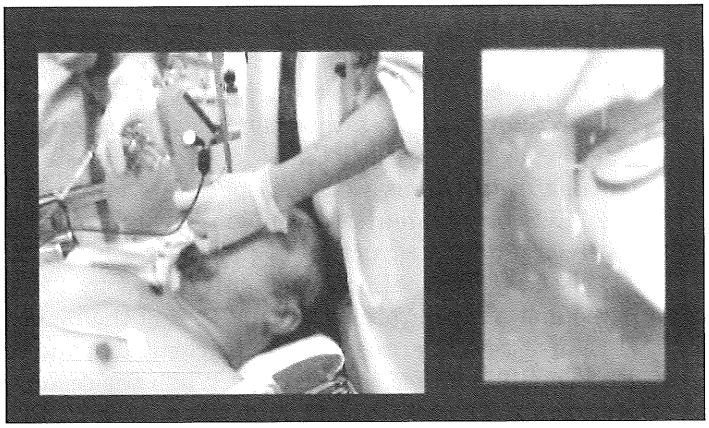

Fig. 2. Images during intubation using the AWS
Left: the head and neck position during the intubation attempt
Right: the monitor screen showing the glottis and tube being advanced

Table 1. Baseline characteristics of study patients

	total	Novice group	Experienced group
Number of patients	38	20	18
Sex (male/female)	23/15	14/6	9/9
Age (yr)	61 ± 19	60 ± 21	60 ± 18
Diagnosis/conditions on admission			
cardiac arrest	11	6	5
trauma	10	4	6
acute respiratory failure	6	5	1
stroke	3	2	1
other	8	3	5
GCS on admission	10 ± 5	10 ± 5	11 ± 4
Induction agents for intubation attempt			
sedatives + analgesics	4	1	3
sedatives	2	1	1
analgesics	1	0	1
sedatives + NMB	9	6	3
analgesics + NMB	7	3	4
NMB	2	1	1
non	13	8	5

GCS, Glasgow Coma Scale; NMB, neuromuscular blockade

immobilization were recorded. Intubation was performed by either novice or experienced personnel. We measured the time intervals (seconds) from the time the blade entered the oral cavity until the glottis opening was observed (T1), until the tube passed through the vocal cords (T2), and until chest rise was confirmed (T3). If more than one attempt was required, the patient received bag-valve-mask oxygenation between attempts. We recorded drugs given for induction, hemodynamic parameters (mean arterial pressure (MAP) and heart rate (HR)), SpO2, and complications such as bleeding, lacerations, and dental injuries.

Data are shown as mean ± S.D. Statistical analysis was performed using SPSS (11.0J for Windows, SPSS Inc., Chicago, IL, USA); significance was defined as a p value of $\leqq 0.05$. Comparisons between groups were made using chi-square statistics and the unpaired Student's t-test, as appropriate.

RESULTS

We enrolled 38 patients (23 males, 15 females; age, 60 ± 19 years) in the study, between August 2006 and May 2007. Patient backgrounds included cardiac arrest, major trauma, acute respiratory failure, and stroke (Table 1). Intubations were attempted by 22 intubators (11 novice and 11 experienced personnel).

Drugs used for intubation included sedatives (midazolam or propofol) and analgesics (buprenorphine or fentanyl), sedatives only, analgesics only, sedatives and neuromuscular blocking agents (vecuronium or succinylcholine), analgesics and neuromuscular blocking agents, and neuromuscular blocking agents only. No drugs were used in 11 patients (cardiac arrest, severe burns, stroke).

The vocal cords were fully visualized and intubations were successfully performed using the AWS, except in one patient with trauma. In this case, intubation was attempted by a resident but was eventually aborted following rapid desaturation events during the attempt. Intubation was accomplished by staff physicians using the Macintosh laryngoscope.

Of 37 successful intubations, 28 cases were intubated on the first attempt, 8 cases required 2 attempts, and 1 case was intubated on the third attempt (Table 2). Esophageal intubation was encountered in one attempt performed by a resident. In this case, successful intubation was accomplished on the second attempt. The reasons for more than 2 attempts included poor visibility due to the presence of blood or vomit in the oropharyngeal space, condensation on the tip of the CCD camera, and a loss of anatomical orientation during the attempt.

T1, T2, and T3 were 22 ± 15, 34 ± 21, and 49 ± 27 sec, respectively (Fig. 3). To determine the effect of clinical experience on the use of the AWS, the results were classified into experienced and novice groups; T1, T2 and T3 were 17 ± 10 vs. 26 ± 17, 32 ± 23 vs. 36 ± 20, and 45 ± 25 vs. 53 ± 27 sec (the experienced vs. the novice group), respectively. No significant differences were observed between groups (Figs. 4, 5, 6).

The pre- and post-intubation MAPs of patients with a pulse were 93 ± 26 and 94 ± 25 mmHg, respectively; HRs were 98 ± 31 and 98 ± 29 bpm, and SpO2 values were 95 ± 7 and 90 ± 13 %, respectively (Table 3). No major complications were encountered.

Table 2. Number of attempts for successful intubation using the AWS

Number of attempt	Total n=37	Novice group	Experienced group
1st	28	15	13
2nd	8	3	5
3rd	1	1	

DISCUSSION

Tracheal intubation is the gold standard in airway management in the emergency setting. It enables protection against aspiration of blood or vomit, unlimited administration of analgesics and sedatives, use of transport ventilators with high oxygen concentrations, use of positive end expiratory pressure, and tracheal suctioning. However, repeated safe and effective placement of the tracheal tube over the wide range of patient and environmental conditions encountered in resuscitation requires considerable skill and experience. The difficulty in acquiring tracheal intubation skills permits this life-saving maneuver to be performed only by those who have received sufficient initial training, ongoing practice, and experience [7].

The AWS is a novel airway apparatus that facilitates tracheal intubation. Studies in the OR suggest that this device is useful in difficult intubation and for use by novice personnel [1,2]. Our study demonstrated that the AWS was also a useful device in difficult situations such as emergency settings, and that tracheal intubations were successfully accomplished despite only brief instruction on the AWS prior to use by residents and staff physicians. This result is in agreement with other studies that report that the AWS requires less operator skill in comparison with the Macintosh laryngoscope (8).

The time duration required for intubation attempts using the AWS might be longer than those required with the Macintosh laryngoscope.

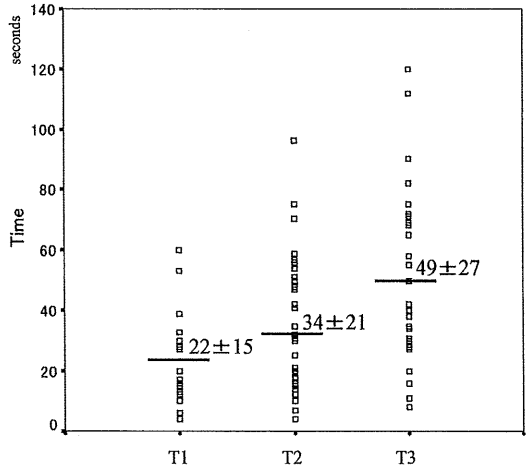

Fig. 3. Time required for intubation
T1, the time intervals from the time the blade entered the oral cavity until the glottis opening was observed; T2, the time intervals until the tube passed through the vocal cords (T2); T3, the time intervals until chest rise was confirmed

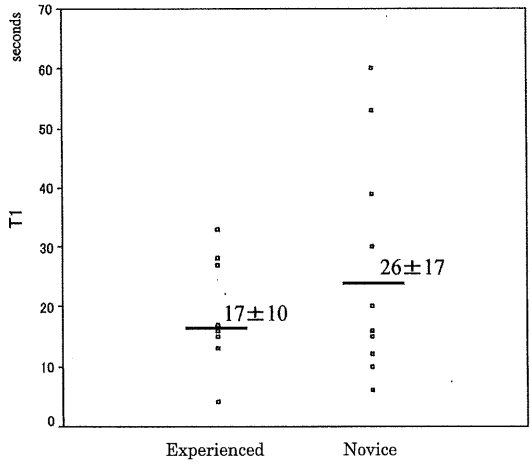

Fig. 4. Comparison of T1
T1, the time intervals from the time the blade entered the oral cavity until the glottis opening was observed

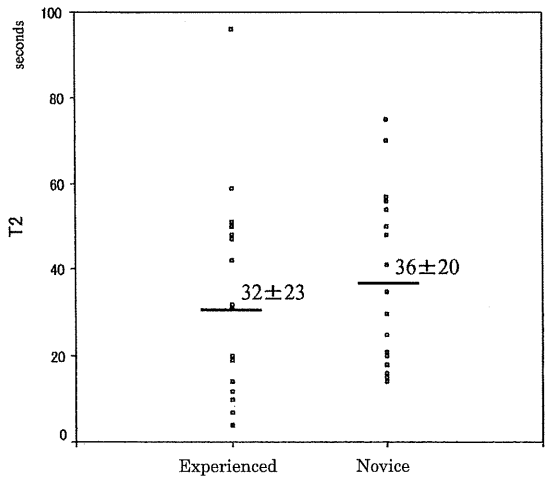

Fig. 5. Comparison of T2
T2, the time intervals from the time the blade entered the oral cavity until the tube passed through the vocal cords

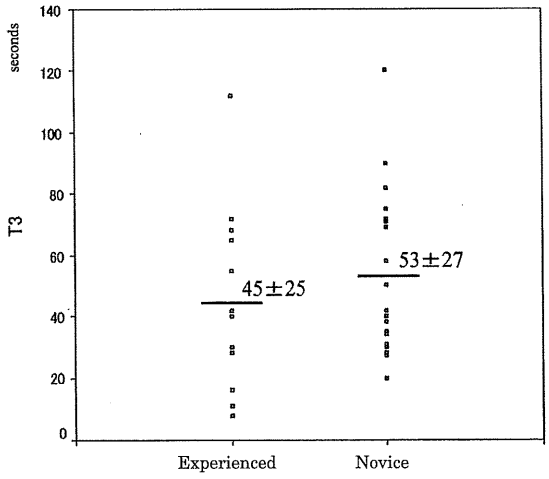

Fig. 6. Comparison of T3
T3, the time intervals from the time the blade entered the oral cavity until chest rise was confirmed

In addition, the time required for intubation was longer in the novice group; this was clearly due to the fact that the intubators in the novice group had no clinical experience in airway management prior to the present study. The operators in both groups had no previous clinical experience of the AWS and received brief instruction on using this device before the study. This indicates that proficiency could be acquired rapidly with additional training and experience, thus reducing the time required for intubation.

Two major advantages of the AWS contributed to these results. First, the AWS has a unique L-shaped blade that does not require alignment of the oral, pharyngeal, and tracheal axes; therefore, less force needs to be applied during laryngoscopy. The structure of the blade is different from the Macintosh blade and appears similar to that of the Airtraq blade [6]. This unique blade structure is advantageous over other types of conventional blades. The tracheal tube fits into one of the channels of the blade. The operator inserts the blade into the mouth in the midline, over the base of the tongue, with the tip positioned over the epiglottis. The glottic opening can be visualized with less force applied to the blade and handle in compari-

Table 3. Hemodynamic parameters

		total	Novice group	Experienced group
MAP (mmHg)	pre-intubation	93 ± 26	86 ± 22	100 ± 28
	post-intubation	94 ± 25	89 ± 23	98 ± 28
HR (bpm)	pre-intubation	98 ± 31	101 ± 30	95 ± 33
	post-intubation	98 ± 29	100 ± 31	97 ± 31
SpO2 (%)	pre-intubation	95 ± 7	95 ± 7	95 ± 9
	post-intubation	90 ± 13	91 ± 12	90 ± 14

MAP, mean arterial pressure; HR, heart rate

son with the Macintosh laryngoscope.

Second, the full-color video screen provides very bright, clear, and wide images of the laryngeal anatomy. The screen has a cross mark located near the upper right corner that indicates the correct direction for advancing the tube. The laryngeal views on the screen can be shared by assistants or teaching staff, and advice can be given as required. Unlike the GlideScope, which has a separate video monitor [8], the monitor screen of the AWS is built into the handle, making it suitable for emergency situations. This feature of the AWS also differentiates it from the Airtraq laryngoscope, which does not have a video-monitor device [5,6]. In comparison with Airtraq laryngoscope, the monitor screen attached to the handle of the AWS provides much brighter, clearer, and wider images of the glottic opening and surrounding structures. In addition, the AWS has a video outlet via which the image can be transmitted to other monitor screens. This function can be used to transmit the image via mobile phone to other mobile devices or to a remote computer.

We found several disadvantages of using the AWS. Copious secretions, vomit, or blood affected visualization of the pharyngeal and laryngeal anatomy. In these cases, frequent suctioning was required prior to using the AWS. Condensation on the tip of the CCD camera was another problem. Despite applying an anti-mist substance, as advised by the manufacturer, the tip of the CCD camera occasionally became foggy when the patient breathed spontaneously. We encountered one case in which the blade was too short to reach the epiglottis, resulting in extra time spent to visualize the glottic opening. Currently, only one blade size is available for the AWS.

Several types of newly developed laryngoscope have been introduced, and their usefulness has been reported; however, most of these studies were performed either using mannequins [4-6] or in controlled clinical situations such as the Operating Room [2,3,8]. To evaluate the usefulness of the AWS in urgent situations, we performed this study in the emergency setting. However, our study still suffered from several limitations: the study population was small, and no comparison was made with the Macintosh laryngoscope and/or other devices. Therefore, further clinical studies are required to compare and determine the usefulness of different intubation devices in emergency situations.

In conclusion, tracheal intubations in emergency settings were successfully achieved with use of the AWS either by residents or staff personnel, and no serious complications were encountered. This indicates that the AWS may be a suitable device particularly for less experienced personnel, such as novice Advanced Life Support providers.

CONFLICT OF INTEREST

The authors have no conflict of interest in regard to the Airway Scope® device.

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