COMPARISON OF THE AIRTRAQ™, AIRWAY SCOPE™, AND DISPOSABLE MACINTOSH LARYNGOSCOPE BLADE

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Abstract

Background: The present study was performed to 1. compare usefulness of the Airtraq™ (ATQ) and the Airway Scope™ (AWS) with the Macintosh laryngoscope (MAC), 2. compare usefulness of the ATQ with the AWS, 3. compare usefulness of the AWS with the tip of the blade under the epiglottis as recommended by the manufacturer (AWS-Miller) and the AWS with the tip of the blade in the vallecula as the MAC (AWS-MAC), in tracheal intubation by expert anesthesiologists.

Methods: One hundred and twenty patients were divided into the ATQ, AWS-Miller, AWS-MAC, and the MAC groups of 30 patients each. Intubation was performed by expert anesthesiologists. How many attempts were necessary (number of the attempts), and the time required for successful tracheal intubation (intubation time) were compared among the four groups.

Results: In patients with Cormack and Lehane classification 1 and 2, the number of attempts was significantly larger in the AWS-Miller group than MAC and ATQ groups, and intubation time in the AWS-Miller group was significantly longer than those in the ATQ and MAC groups. In patients with Cormack and Lehane classification 3, intubation time was significantly shorter in the ATQ group than that in the MAC group.

Conclusions: The MAC and ATQ were better than the AWS-Miller for patients with easy intubation, while the ATQ was better than the MAC for difficult intubation when the expert anesthesiologists did the intubation.

Introduction

Recently, many devices for intubation have been developed, especially those that can observe the glottis using camera or some other methods. In those devices, the Airtraq™ (ATQ, Prodol Meditec S.A., Vizcaya, Spain) and the Airway Scope™ (AWS, Pentax, Tokyo, Japan) have similar design which provide a view of the glottis without the alignment of the oral, pharyngeal and tracheal axes in one line to visualize the glottis directly unlike the Macintosh laryngoscope (MAC)[1,2]. Many studies have been performed to compare ATQ or AWS with the conventional reusable MAC[3-7]. However, only one study of comparison between ATQ and AWS was performed[8].

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In addition, one of the important characteristics of these devices is that the ATQ and the blade of the AWS (INTLOCK™) are disposable (single use), reducing the risk of infection. It is difficult to remove all proteinaceous material from reusable laryngoscope blades during cleaning and sterilization[9]. Therefore, the guidelines of the Association of Anaesthetists of Great Britain and Ireland state that single use intubation aids should be used wherever possible[10], especially in emergency cases. However, certain single use laryngoscope blades provide inferior intubating conditions compared to reusable blades[11]. Therefore, the ATQ and AWS should be compared with single use MAC blades, not with the reusable metal blades, while all the comparative studies used a metal reusable blade to compare it with ATQ or AWS[3-7].

A lot of studies have focussed on how easily the beginners can intubate with these new devices[4-6]. However, in emergence cases, usually not the beginners but the specialists who are already familiar with MAC, intubate patients. Therefore, to replace for the MAC, these devices must be useful even for the specialists.

The ATQ is designed to use as a MAC blade (with the tip of the blade in the vallecula), and the AWS is designed to use as a Miller blade (with the tip of the blade under the epiglottis), while the AWS is also available as a MAC blade.

The present study was performed to 1.compare the ATQ and the AWS with the MAC, 2. compare the ATQ with the AWS, 3. compare the AWS with the tip of the blade under the epiglottis as recommended by the manufacturer and the AWS with the tip of the blade in the vallecula as the ATQ or MAC, with regard to the success rate of and time required for intubation by expert anesthesiologists.

Patients and Methods

After the approval of the ethics committee of the hospital and informed consent from patients, 120 patients with ASA physical status I or II scheduled for general anesthesia aged 30 to 70 years were enrolled in the present study. Those who had a history of surgery or any other diseases of neck and face were excluded. Patients were randomly divided into the ATQ group (30 patients), the AWS with the tip of the blade under the epiglottis group (AWS-Miller, 30 patients), the AWS with the tip of the blade in the vallecula group (AWS-MAC, 30 patients), and the disposable MAC (Penlon Crystal polycarbonate clear plastic laryngoscope No.3, Penlon, Abingdon, UK) group (30 patients) by a sealed envelop method.

Without any premedication, when patients came into the operating room, Mallampati classification was performed. Anesthesia was induced with midazolam, propofol and fentanyl. Vecuronium was used as a muscle relaxant. At first, using the reusable conventional metal MAC (Penlon standard Mac 3, Penlon, Abingdon, UK), Cormack and Lehane classification was checked and 4 % lidocaine 2 to 4 mL was sprayed into the trachea. One minute later, tracheal intubation was performed with one of the devices. Clear endotracheal tube (Portex soft-seal cuff clear tracheal tube, Smiths Medical, Kent, UK) was intubated. The study was performed by expert anesthesiologists who are familiar with MAC and learned how to use ATQ and AWS with some clinical experiences for these devices.

How many attempts were necessary (number of the attempts), and the time required for successful tracheal intubation (intubation time) were compared among the four groups. The intubation time was defined as the time from opening the mouth to confirm the location of the tube after connecting the tracheal tube to the anesthesia circuit and inflating the cuff. When the attempts failed, the reason was checked. If the fourth attempts failed, it is judged as failed and changed to another method. Patients in each group were further divided into subgroups by the Cormack and Lehane classification. The patients with the Cormack and Lehane classification 4 were excluded from the study.

Data were expressed as number of the patients, number of attempts, mean ± SD, or median and range. Statistical analysis was performed with the factorial analysis of variance (ANOVA) followed by Student Newman Keuls test as a post-hoc analysis for age, body weight, and height, chi-square test for gender and the reason of the repeated attempts of intubation, and Kruskall Wallis test followed by the Mann-Whitney U test for intubation time, Mallampati, and Cormack and Lehane classifications, and number of the attempts. A p value less than 0.05 was considered to be statistically significant.

Results

No differences were observed in the backgrounds, Mallampati, and Cormack and Lehane classification, number of attempts and intubation time among the four groups (Table 1). In patients with Cormack and Lehane classification 1 and 2, the number of attempts was significantly larger in the AWS-Miller group than MAC and ATQ groups (Table 2), and intubation time in the AWS-Miller group was significantly longer than those in the ATQ and MAC groups (Table 2). In patients with Cormack and Lehane classification 3, the number of attempts was not different among the groups (Table 2), and intubation time was significantly shorter in the ATQ group than that in the MAC group (Table 2). The reasons for repeated attempts were bad views by secretions, and failure to advance the tube into the trachea by directing the tube to the arytenoids cartilages or some other wrong places. No differences were found in the reason of repeated attempts among the groups in Cormack and Lehane classification 1 and 2, but the bad views by secretions were significantly larger in the ATQ group than in the MAC group in Cormack and Lehane classification 3 (Table 3).

Discussion

The results of the present study indicate that when expert anesthesiologists performed intubation, 1. In the patients with Cormack and Lehane classification 1 or 2, MAC and ATQ were better than the AWS-Miller. 2. In the patients with Cormack and Lehane classification 3, the ATQ was better than the MAC. The AWS-Miller and AWS-MAC had no statistically significant differences.

One of the weak points of this study is that this is not a blind study, but it is impossible to perform this kind of the study as a blind one. The patients with Cormack and Lehane classification 4 were excluded from the study because for those patients intubation with MAC and bring the blade of the ATQ or AWS to the appropriate position were quite difficult. One more is that the anesthesiologists had significantly fewer experiences with the ATQ and AWS than with the MAC. This is, however, inevitable when testing new devices, and MAC could be interchanged to new devices only when specialists can use these devices better than the MAC with only a few practices.

The ATQ is reported to require less operator

Table 1
Demographic data

		ATQ	AWS-MAC	AWS-Miller	MAC
Cormack 1	Male/Female	10/8	8/8	9/10	12/8
	Age (years)	57 ± 10	55 ± 9	52 ± 8	54 ± 9
	Body weight (kg)	63 ± 9	60 ± 8	61 ± 8	62 ± 7
	Height (cm)	164 ± 9	162 ± 6	161 ± 7	162 ± 6
Cormack 2	Male/Female	6/6	7/5	5/4	5/6
	Age (years)	60 ± 10	57 ± 8	53 ± 9	54 ± 8
	Body weight (kg)	64 ± 8	59 ± 9	60 ± 10	61 ± 10
	Height (cm)	165 ± 10	161 ± 9	162 ± 8	161 ± 9
Cormack 3	Male/Female	4/2	3/3	5/3	2/2
	Age (years)	57 ± 11	54 ± 9	54 ± 11	57 ± 9
	Body weight (kg)	65 ± 9	61 ± 8	59 ± 9	57 ± 9
	Height (cm)	165 ± 10	161 ± 8	161 ± 6	161 ± 7

Number of the patients or mean ± SD is shown. ATQ, Airtraq; AWS-MAC, Air way scope with the tip of the blade in the vallecula; AWS-Miller, Air way scope with the tip of the blade under the epiglottis; MAC, disposable Macintosh laryngoscope blade. No significant differences were observed among the four groups in each Cormack grade.

Table 3
Reason of repeated attempts of intubation

	ATQ	AWS-MAC	AWS-Miller	MAC
Cormack 1				
Bad view by secretions	0	1	3	0
Failure to advance tube	1	3	8	0
Cormack 2				
Bad view by secretions	1	3	3	0
Failure to advance tube	1	4	3	0
Cormack 3				
Bad view by secretions	3*	3	1	0
Failure to advance tube	2	5	3	6

Number of the patients is shown. ATQ, Airtraq; AWS-MAC, Air way scope with the tip of the blade in the vallecula; AWS-Miller, Air way scope with the tip of the blade under the epiglottis; MAC, disposable Macintosh laryngoscope blade; *: $P < 0.05$ vs. MAC.

skill, and may therefore be a superior device for teaching the skills of tracheal intubation compared to conventional direct laryngoscopes[4]. In the study using medical student with 6 months interval, tracheal intubation skills declined markedly with both ATQ and MAC[5]. However, the ATQ continued to provide better intubating conditions, resulting in greater success of intubation, with fewer optimization maneuvers required, and reduced potential for dental trauma, particularly in the difficult laryngoscope scenarios than the MAC[5]. The AWS was also compared with the MAC by nurses without experience of tracheal intubation; the AWS was more useful than the MAC as it provided quicker and easier tracheal intubation[6]. Therefore, both the AWS and ATQ are easier to learn than the conventional intubation by the MAC for the

Table 2
The number of attempts and intubation time

	Attempts number	ATQ	AWS-MAC	AWS-Miller	MAC
Cormack 1	1	17	12	11*	20
	2	1	3	6	0
	3	0	1	2	0
	4	0	0	0	0
Intubation time	(sec)	38 ± 12	45 ± 18	59 ± 21*,+	30 ± 10
Cormack 2	1	10	7	4*	11
	2	2	3	4	0
	3	0	2	1	0
	4	0	0	0	0
Intubation time	(sec)	38 ± 14	49 ± 14	58 ± 17*,+	35 ± 11
Cormack 3	1	2	1	5	0
	2	3	2	2	2
	3	1	3	1	1
	4	0	0	0	1
Intubation time	(sec)	49 ± 19*	62 ± 30	51 ± 19	73 ± 28

Number of the patients or mean ±SD is shown. ATQ, Airtraq; AWS-MAC, Air way scope with the tip of the blade in the vallecula; AWS-Miller, Air way scope with the tip of the blade under the epiglottis; MAC, disposable Macintosh laryngoscope blade; *: $P < 0.05$ vs. MAC; +: $P < 0.05$ vs. ATQ.

beginners, while those studies used manikin, which is different from clinical practice where secretions may have some effects on intubation condition as shown in the present study. The present study showed that when secretions existed, the view of the ATQ and AWS was interfered with, while the direct view with the MAC was less disturbed. For the specialists, MAC and ATQ were better than the AWS-Miller in the Cormack and Lehane 1 and 2 patients, which was different from other studies tested by beginners where the MAC was the most difficult[4-6].

The present study showed some differences between the intubation condition with the ATQ and that with the AWS. In patients with Cormack and Lehane classification 1 or 2, our study shows that intubation with ATQ was easier than with AWS-Miller. One of the reasons might be that with the AWS the tube should be directed to the marker at the right upper field of the view screen, while with the ATQ the tube could be directed to the center of the view. We, anesthesiologists, usually advance the tube in the center of our eye field, which makes it difficult to advance the tube into the right upper field. In the study by Suzuki et al., tracheal tube impingement onto the arytenoids cartilages during intubation was observed in 4% with the AWS but was easily managed by adjusting the blade direction[12]. That might be the reason why AWS took longer time for intubation. In addition, we anesthesiologists are familiar with the MAC but not with the Miller blade. Therefore, using the AWS-Miller made the intubation time longer.

In the patients with Cormack and Lehane classification 3, the ATQ was better than the MAC. Therefore, for difficult intubation, the ATQ is useful.

The AWS had CCD camera at 2.5 cm from the tip, but the lens of the ATQ was at 4 cm from the tip. Therefore, the ATQ can give a wider view than the AWS. That might be one of the reasons of the superiority of the ATQ than the AWS in the present study. However, the screen is fixed on the top of the ATQ while it is movable in the AWS. Therefore, with the ATQ the view is obtained only after insertion of the blade under the tongue, while with the AWS the view is obtained from the start of insertion of the blade. For some patients with difficult orientation of the epiglottis, the AWS may be better to find it out. The width of the blade was 18 mm in both AWS and ATQ used in the present study. In patients with small mouth, it is difficult to insert the blade into the mouth[13], while we did not have such patients. This is one of the problems for both devices especially in emergency cases intubated without any anesthetics and muscle relaxants, while the ATQ has small blade with the width 16 mm[8].

There appears to be less potential for trauma to the teeth and upper airway with the ATQ[3], while no trauma was observed in the present study with any devices. Compared with the MAC, the AWS produced less movement of upper C spine for intubation in patients with a normal C-spine[14]. The ATQ resulted in less stimulation of heart rate following tracheal intubation in comparison with the MAC[15]. These findings probably reflect the fact that the ATQ and AWS provide a view of the glottis without the need to align the oral, pharyngeal and tracheal axes, and therefore requires less force to be applied during laryngoscopy[15]. The present study did not examine these points, while these are great benefits of the ATQ and AWS.

The present study showed that the MAC and ATQ were better than the AWS-Miller for patients with easy intubation, while the ATQ was better than the MAC for difficult intubation when the expert anesthesiologists intubated.

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