Comparison of video-laryngoscope and conventional Macintosh laryngoscope for simulated emergency tracheal intubation by pre-hospital emergency care providers in cases with copious vomiting or bleeding in oral cavity

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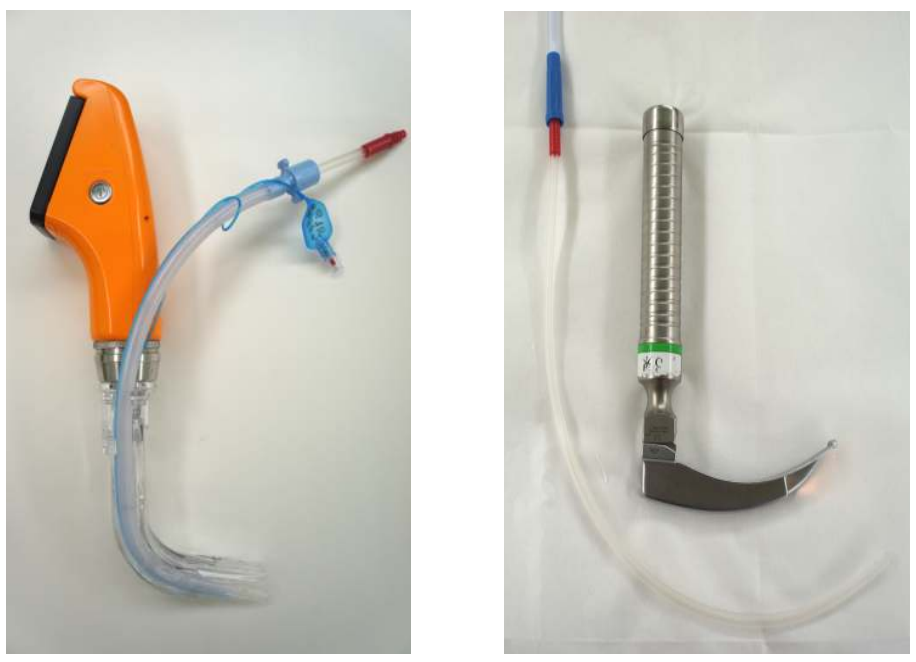
Background and Goal of Study: Greater incidences of difficult and failed tracheal intubation (TI) procedures in emergency settings as compared to an operating room environment have been reported.[1] Notably, when there is copious salivation or vomiting, or bleeding in the oral cavity, the fluid makes glottis identification difficult, complicating TI.[2] The PENTAX-AWS (AWS, HOYA, Japan) is a video-laryngoscope developed to facilitate TI under various conditions, including emergency settings. We compared the AWS to a conventional Macintosh laryngoscope (ML) for simulated TI in cases with vomiting or bleeding in the oral cavity in regard to success rate, intubation time, and difficulty.

Materials and Methods: Fifty-one ambulance crews certified for TI were tested under two scenarios; vomiting and hematemesis. Using a manikin with a clumped bronchus and esophagus, we simulated those scenarios by pouring rice gruel or simulant blood material, respectively, into the oral cavity, then compared the following procedures. A. Laryngoscopy with the AWS, with suctioning using an 18-Fr suction catheter inserted via the tracheal tube (TT) set into the tube-guiding groove of the blade and subsequent TT advancement. B. Standard laryngoscopy with an ML with conventional suctioning using the same size catheter and subsequent TT advancement (Figure 1). Intubations with each device were randomly performed. Success rates and times required from device insertion to glottis visualization (T1) and tube passage through the vocal cords (T2) were noted. The subjects scored the difficulty of the TI attempts using a visual analog scale (0-100 mm, very easy to very difficult). Data are shown as the median (IQR), with Mann-Whitney's U test used for analysis.



A. PENTAX-AWS + 18-Fr suction catheter inserted via tracheal tube

B. ML + 18-Fr suction catheter

Figure 1. Two methods of tracheal intubation and suctioning used in present study.

Results: We enrolled 26 ambulance crews for the vomiting and 25 for the hematemesis scenarios. The success rate with each device was 100%. The time required for TI with the AWS was significantly shorter than with the ML for both the vomiting [T1: 27 (19-34) vs. 41 (28-49) sec, p=0.001, T2: 31 (26-42) vs. 45 (35-56) sec, p=0.001] (Figure 2) and hematemesis [T1: 17 (10-21) vs. 22 (15-34) sec, p=0.008, T2: 21 (16-28) vs. 28 (23-44) sec, p=0.001] scenarios (Figure 3). The difficulty score for the AWS as compared to the ML under hematemesis was significantly lower [13 (6-28) vs. 38 (18-56) mm, p=0.007] (Figure 5), while there was no significant difference under vomiting [36 (20-52) vs. 46 (24-53) mm, p=0.510] (Figure 4).

Vomiting scenario

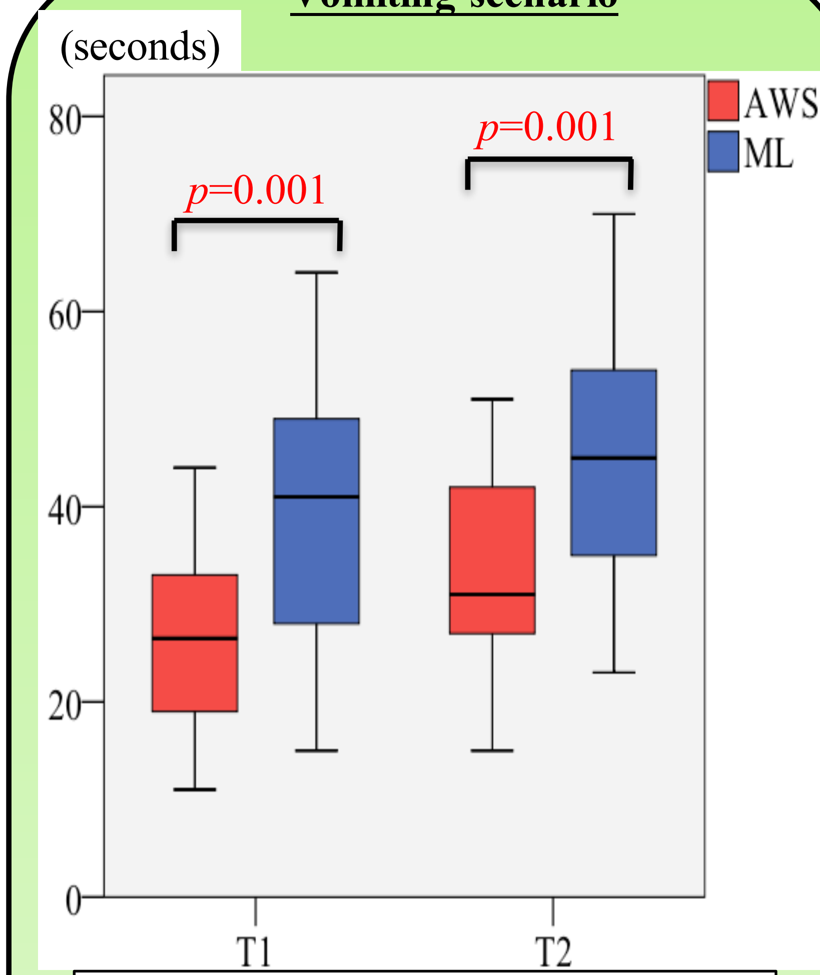


Figure 2.Time to intubation, vomiting.

Hematemesis scenario

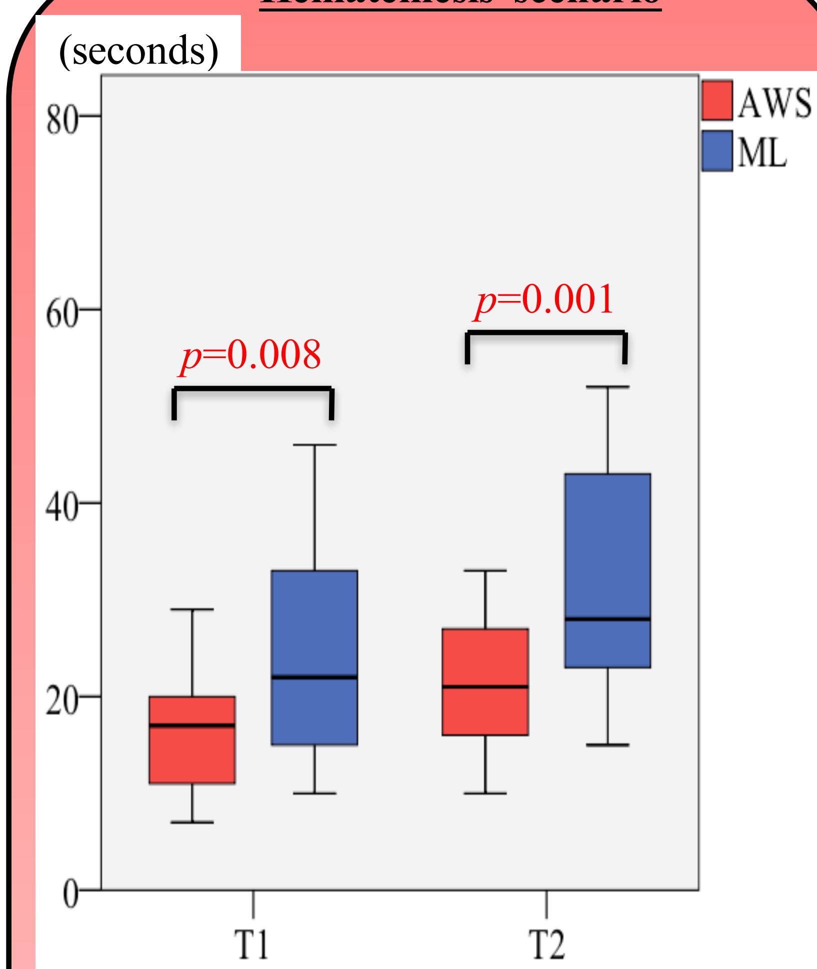


Figure 3. Time to intubation, hematemesis.

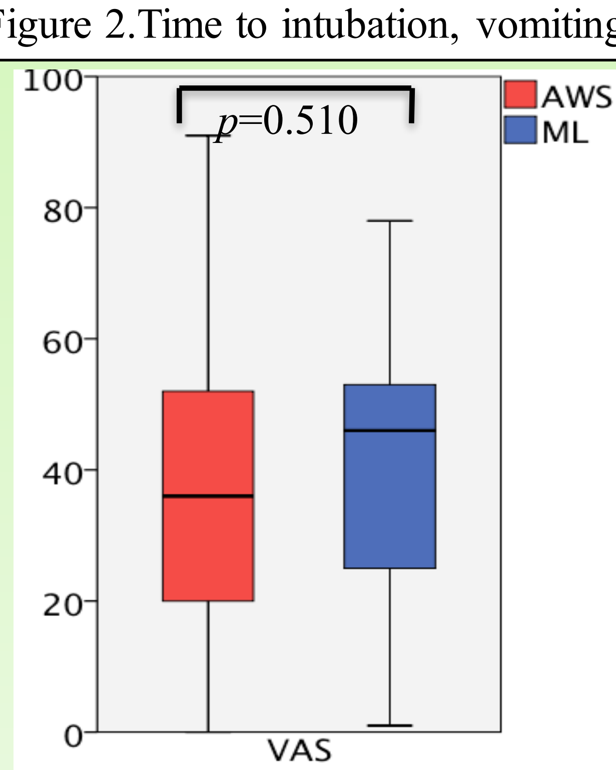
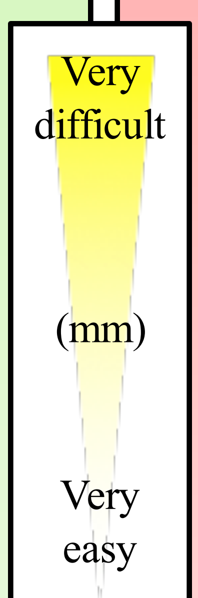


Figure 4. Difficulty score, vomiting.



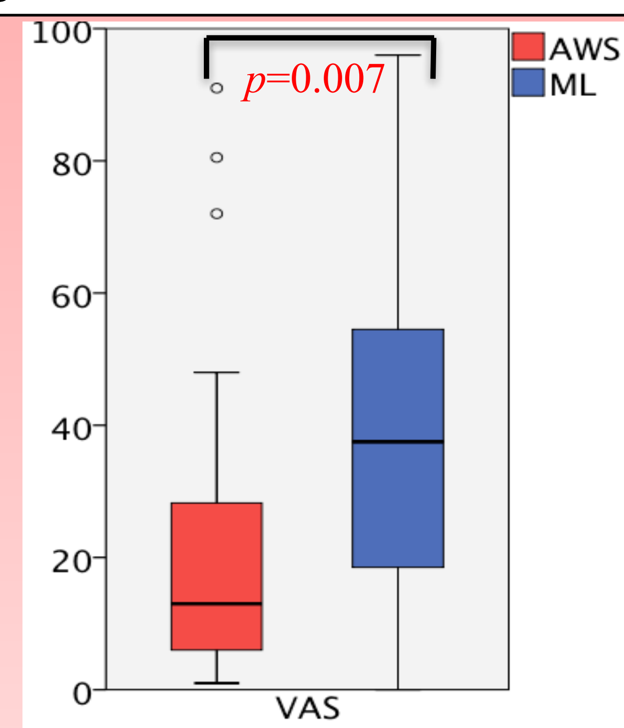


Figure 5. Difficulty score, hematemesis.

Discussion: With both scenarios, the AWS required less time to visualize the glottis and also complete the intubation procedure than the ML. Meanwhile, the difficulty score for the AWS was significantly lower under the hematemesis scenario. The AWS is an indirect laryngoscope equipped with a full-color LCD monitor and blade molded to fit the oropharyngeal anatomy, thus enabling even less experienced operators to obtain an optimal view for TI without requiring alignment of the airway axes.[3] In addition, suctioning using a catheter inserted via the TT set into the tube-guiding groove of the AWS blade enables focused decontamination around the glottis. These features of the AWS may explain the results of this study. Although why there was no difference in difficulty score between the devices for the vomiting scenario was undetermined from the results of our study, the higher viscosity of the rice gruel may have had an influence.

Conclusion: With the AWS, more prompt glottis visualization and TI were achieved under simulated vomiting and hematemesis scenarios.

References:

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2. Gaither JB, et al. J Emerg Med. 2014;47:294-300.
3. Koyama J, et al. J Neurosurg Anesthesiol. 2006;18:247-50

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