J Anesth (2010) 24:124–127
DOI 10.1007/s00540-009-0826-4

CLINICAL REPORT

Displacement of the epiglottis during intubation with the Pentax-AWS Airway Scope

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Received: 7 May 2009 / Accepted: 31 July 2009 / Published online: 29 December 2009

Abstract The Pentax-AWS system is a rigid indirect video laryngoscope with integrated tube guidance. Complications associated with this device are not well understood. We report two cases of epiglottis malposition during intubation with the Pentax-AWS. The standard technique of using the Pentax-AWS system involves direct elevation of the epiglottis for exposure of the vocal cords. The blade tip should be passed posterior to the epiglottis for laryngeal exposure, but pressure on the anterior surface of the epiglottis by the tip can rarely happen even during the correct maneuver. Although the Pentax-AWS provides clear images of the airway structures, it is sometimes difficult to observe the epiglottis continuously because the camera is located beneath the blade tip. Consequently, the view of the epiglottis from the camera may be impeded by the blade tip and may result in undiagnosed epiglottis malposition. The AWS's structural feature and its approach to the larynx can be associated with increased chance of unexpected epiglottis folding. It is particularly important to confirm normal position of the epiglottis during withdrawal of the device to prevent this complication.

Keywords Pentax-AWS · Airway Scope · Folding epiglottis · Epiglottis displacement

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Introduction

The Pentax-AWS Airway Scope system (AWS, Hoya, Tokyo, Japan) is a new indirect rigid video laryngoscope with integrated tube guidance which does not require the laryngoscopist to achieve a line of sight during laryngoscopy and tracheal intubation [1]. The AWS can be used for both normal and difficult airways [2]. During intubation, the glottis is visualized on the 2.4-in. built-in color-LCD monitor through the CCD camera positioned 1-in. from the tip of the blade. Thus, intubation can be performed safely under vision. The technique recommended by the manufacturer is that the tip of the AWS should be passed posterior to the epiglottis, which is elevated directly to expose the glottis, as with other straight laryngoscopes. However, because the camera is positioned beneath the tip of the blade, it is difficult to watch the epiglottis after laryngeal exposure and during the intubation procedure. We have experienced two cases of posterior displacement of the epiglottis which prolapsed into the trachea beside the tracheal tube during intubation with the AWS.

Case presentations

Case 1

A 77-year-old woman (weighing 57 kg, height 153 cm) was admitted to our hospital for lumbar spine laminectomy under general endotracheal anesthesia. She had no significant medical problems and assessment of the airway gave no indication of potential problems. Anesthesia was induced with propofol (100 mg iv) and fentanyl (0.1 mg iv) and neuromuscular blocking with vecuronium (6 mg iv). After complete paralysis occurred, confirmed with the

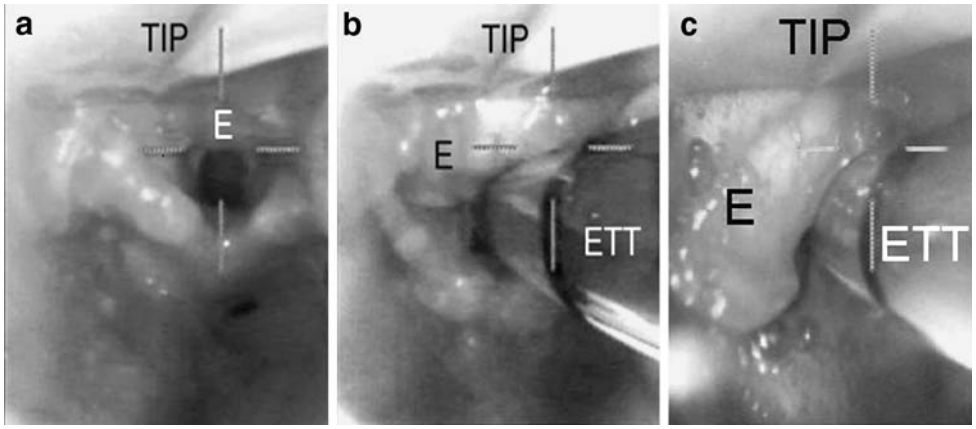

Fig. 1 Laryngeal views obtained with the Pentax-AWS. **a** Best laryngeal view achieved with the Pentax-AWS. It is difficult to recognize but the epiglottis was folded into the trachea. **b** View of the larynx after tracheal tube passage. Now it is easier to recognize that the epiglottis was pushed into the laryngeal inlet along with the tracheal tube. **c** In the other case, the epiglottis was partially folded into the trachea, which was also recognized during withdrawal of the blade tip. *TIP* tip of the AWS blade, *ETT* endotracheal tube, *E* folding epiglottis

peripheral nerve stimulator, we performed intubation using the AWS connected to an external video-recorder. We inserted the AWS in the midline with the 7.0 mm I.D. endotracheal tube (ETT) set in the channel. As we directed the blade into the oropharynx, the epiglottis was visualized. The laryngoscopist required a few attempts, including advance and withdrawal maneuvers of the AWS, to place the tip in the correct position posterior to the epiglottis. The laryngoscopist eventually achieved visualization of the patient's vocal cords. The percentage of glottic opening (POGO) score was 80% (Fig. 1a), and he passed the ETT into the patient's trachea.

Immediately after ETT placement, the supervising anesthesiologist, who also watched the procedure on the integrated LCD monitor of the AWS, suggested that the laryngoscopist might have displaced the epiglottis into the trachea along with the ETT. We reviewed the videotaped procedure and confirmed this suggestion was correct (Fig. 1b).

The laryngoscopist again inserted the AWS into the patient mouth, and could not see the epiglottis in its normal position. During careful withdrawal of the ETT under vision, the epiglottis reappeared in view and retuned to its normal position. No edema or bleeding was observed on the surface of the epiglottis and so we performed the 4-h operation. After surgery, we observed the epiglottis with the AWS again, but there was no significant abnormality. We withdrew the tube without any serious airway trouble. The patient complained of brief hoarseness and slight sore throat, but the symptoms disappeared within 24 h.

Case 2

A 56-year-old woman (weighing 63 kg, height 160 cm) without any complication was scheduled for breast cancer surgery. The anesthetic regimen was similar to Case 1. After insertion of the AWS, we observed the epiglottis on the monitor. The laryngoscopist manipulated the blade a few times to try to insert the tip posterior to the epiglottis. Finally he obtained the best laryngeal view, followed by ETT placement into the trachea. The supervising anesthesiologist watched the procedure through the built-in monitor and suspected the laryngoscopist had displaced the tip of the epiglottis into the trachea. He therefore asked the laryngoscopist to carefully withdraw the blade tip in order to confirm the position of the epiglottis. This maneuver revealed that the tip of the epiglottis was partially inserted into the trachea (Fig. 1c). The laryngoscopist carefully withdrew the ETT under vision, and the epiglottis returned to its normal position. We observed no abnormality on the surface of the epiglottis and the laryngoscopist again inserted the ETT to its optimum depth. In this case, also, no airway morbidity was noted after surgery.

Discussion

The AWS has been used in clinical practice since 2006 in Japan and since 2007 in other countries. Few complications associated with this new device have been described.

Epiglottis downfolding (posterior displacement of the epiglottis) is thought to be a rare complication but has been described with several airway techniques. The epiglottis lies within the bowl of the LMA in 60% of uses [3]. When this "downfolding" occurs, the epiglottis can become ischemic and edematous [4] which may result in complete airway obstruction [5, 6].

Chance discovery by nasendoscopy of prolapse of the epiglottis into the larynx after intubation with an

illuminated stylet led the authors to conduct a prospective study in which they found a 10% incidence of brief epiglottis prolapse into the larynx with the illuminated stylet despite use of careful technique [7]. There was no significant damage in these cases, in which the prolapse was rapidly relieved.

Prolapse of the epiglottis into the larynx has occurred with the classic [6] and intubating laryngeal mask [5, 8]. In the latter case the prolapse was a chance finding during fiberoptic examination at the end of anesthesia and the epiglottis was edematous. Therefore, anesthesiologists should be cautious, particularly when using these airway devices (for example LMA, illuminated stylet) that involve "blind" technique.

However, even with the Macintosh laryngoscope, prolapse of the epiglottis has been described after tracheal intubation in an adult. In this case, the event was discovered during diagnostic laryngoscopy by the ENT surgeon [4].

Posterior displacement, leading in some cases to prolapse of the epiglottis into the larynx, is a consequence of pressure on the anterior surface of the epiglottis. It probably occurs much more frequently than is realized. It should not occur during techniques such as those with the straight laryngoscope and the Bullard and AWS devices in which the epiglottis is elevated directly.

The AWS is a new device which requires direct elevation of the epiglottis for laryngeal exposure. During glottic expose with the AWS, the blade tip should be inserted posterior to the epiglottis, which is then elevated directly out of the line of sight of the glottis. In order to facilitate the passage of the tip posterior to the epiglottis, the AWS blade should be passed along the posterior route through the airway, against the palate and posterior pharyngeal wall, as with the laryngeal mask airway insertion technique.

In the cases presented, novice laryngoscopists might have inserted the AWS along the anterior route. The blade tip was passed along the oral surface and then the base of the tongue, so that it passed anterior to the epiglottis and into the vallecula. This route is used for the conventional Macintosh laryngoscope. Once the blade tip is positioned in the vallecula, further pressure from the blade tip may displace the epiglottis posteriorly, as in the cases presented. However, pressure on the anterior surface of the epiglottis by the AWS tip can not be always prevented, particularly in the event of a floppy epiglottis or a narrow pharyngeal space. In this sense, users should be cautious in difficult airway cases such as small mandible or retrognathia.

In both cases the displacement was recognized immediately by the supervising anesthesiologist who was observing the built-in monitor. The ability to record and review the views is a diagnostic and teaching asset of the AWS.

The blade configuration may contribute to this complication. As in other rigid indirect laryngoscopes, the camera of the AWS is located beneath the blade tip in order to achieve a view of the glottis. Although direct elevation of the epiglottis used by the AWS is more reliable than the indirect Macintosh technique [9], it is sometimes difficult to see the epiglottis through the translucent blade tip from the AWS camera. In addition, blade configuration not allow laryngoscopist to observe the epiglottis directly through the oropharyngeal space.

We recommend the following maneuvers to reduce the risk of displacement of the epiglottis:

1. choose the posterior route for AWS insertion;
2. the shape and position of the epiglottis should be observed throughout manipulation of the blade tip;
3. the normal position of the epiglottis should be confirmed during withdrawal of the AWS;
4. more than one person should observe the intubation process, particularly when performed by novice personnel; and
5. jaw thrust should be applied when it is difficult to pass the tip posterior to the epiglottis.

The intubation procedure for the AWS is explained in four stages—insertion, rotation, elevation, and intubation [10]. We propose fifth stage, "confirmation" of the anatomical structure, for safe intubation with this device. We have experienced three cases of epiglottis displacement during 1000 intubations with the AWS, all of which were performed by trainees under supervision. The built-in monitor and ability to record and playback video images are features of the AWS which were useful for detecting the event.

References

1. Koyama J, Aoyama T, Kusano Y, Seguchi T, Kawagishi K, Iwashita T, et al. Description and first clinical application of AirWay Scope for tracheal intubation. J Neurosurg Anesthesiol. 2006;18:247–50.
2. Suzuki A, Toyama Y, Katsumi N, Kunisawa T, Sasaki R, Hirota K, et al. The Pentax AWS rigid indirect video laryngoscope: clinical assessment of performance in 320 cases. Anaesthesia. 2008;63:641–7.
3. Brimacombe JR. Anatomy. In: Laryngeal mask anesthesia principles and practice, 2nd ed. Philadelphia, Saunders; 2005. p. 73–104.
4. Lin TS, Chen CH, Yang MW. Folding of the epiglottis an unusual complication to be recognized after laryngoscopic endotracheal intubation. J Clin Anesth. 2004;16:469–71.
5. Murashima K, Fukutome T. Jaw thrust manoeuvre for repositioning the epiglottis down folded by the ILM. Anaesthesia. 2000;55:921–2.
6. Ramachandran K, Bhishma R. Unexpected difficult airway. Anaesthesia. 2003;58:392–3.

7. Aoyama K, Takenaka I, Nagaoka E, Kadoya T, Sata T, Shigematsu A. Potential damage to the larynx associated with light-guided intubation: a case and series of fiberoptic examinations. Anesthesiology. 2001;94:165–7.
8. Takenaka I, Aoyama K, Nagaoka E, Seto A, Niijima K, Kadoya T. Malposition of the epiglottis after tracheal intubation via the intubating laryngeal mask. Br J Anaesth. 1999;83:962–3.
9. Henderson JJ. Questions about the Macintosh laryngoscope and technique of laryngoscopy. Eur J Anaesth. 2000;17:2–5.
10. Suzuki A, Terao M, Fujita S, Henderson JJ. Tips for intubation with the Pentax-AWS rigid indirect laryngoscope in morbidly obese patients. Anaesthesia. 2008;63:442–4.