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SHORT COMMUNICATION

Comparison of postoperative pharyngeal morbidity using the Macintosh laryngoscope or AirWay Scope after mastectomy

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Abstract We compared the characteristics of postoperative pharyngeal morbidity in intubation between the AirWay Scope (AWS) and Macintosh laryngoscope in 68 ASA I–II female patients aged 35–77 years in a randomized, double-blinded, controlled fashion. After induction of general anesthesia, the patient's trachea was intubated using the AWS or Macintosh laryngoscope by five anesthesiologists. Before leaving the operating room, postoperative sore throat, hoarseness, and dysphagia were assessed, and oral bleeding was evaluated by observation of the extubated tracheal tube. On the day after surgery, pharyngeal complications were evaluated again, and patients were questioned on delay of oral intake. Incidence of sore throat with the AWS (27.2%) was significantly lower than that with the Macintosh laryngoscope (52.9%) on the day of surgery. Severity of sore throat with the AWS was also significantly less compared with the Macintosh laryngoscope. Incidence of oral bleeding with the AWS (6.1%) was significantly lower than that with the Macintosh laryngoscope (23.5%). Pharyngeal morbidity on the day after surgery did not differ between groups, and no patient complained of delayed oral intake. In female patients, the AWS successfully reduced the incidence and severity of sore throat on the day of surgery in comparison with the Macintosh laryngoscope.

Keywords Airway, complications · Anesthesia, general · Complications, sore throat

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Postoperative pharyngeal morbidity, such as sore throat, hoarseness, or dysphagia, is a common complication after general anesthesia. Use of the Macintosh laryngoscope reportedly resulted in incidences of postoperative sore throat of 14–50% [1–6] and of hoarseness of 22–50% [1–3, 6, 7]. The AirWay Scope (AWS) (HOYA, Tokyo, Japan) is a video laryngoscope that allows intubation without alignment of anatomic axes, which might lead to decreased pharyngeal morbidity. The purpose of the present study was to prospectively evaluate the effect of the AWS on the incidence and severity of pharyngeal morbidity in female patients undergoing mastectomy.

After receiving institutional human study ethics committee approval and informed consent of the patients, we enrolled 68 ASA (American Society of Anesthesiologists) physical status I–II women aged 35–77 years. Mouth opening, thyromental distance, and Mallampati classification were evaluated at preanesthetic examination [8]. On the morning of surgery, patients were randomly assigned to one of two study groups by envelope method: intubation using Macintosh laryngoscope with blade size 3 (control group) or AWS (AWS group).

After standard monitoring was applied, general anesthesia was induced with propofol, fentanyl, and rocuronium. The patient's trachea was intubated without stylet with a cuffed tracheal tube (Hi-Lo; Mallinckrodt Medical, Athlone, Ireland) of 7-mm internal diameter. Each intubation was performed by one of five anesthesiologists

having combined experience of more than 400 intubations using the conventional laryngoscope and more than 40 intubations with the AWS. The time required for intubation, defined as the time elapsed from insertion of the laryngoscope until removal from the oral cavity, was measured. The laryngeal view during intubation was evaluated according to Cormack and Lehane grade [9].

After intubation, the cuff was inflated until no air leaks could be heard with peak airway pressure at 20 cm H_2O. Thereafter, anesthesia was maintained by oxygen, air, sevoflurane, and continuous infusion of remifentanil. Additional fentanyl 0.1 mg and flurbiprofen axetil 50 mg were administered intravenously at skin closure in each patient. Minimal oral and tracheal suctioning was performed to clear secretions from each patient before extubation. Approximately 20 min after extubation, interviewers blinded to the intubation device used then interviewed the patients regarding any sore throat, hoarseness, or dysphagia. At the time of this evaluation, the degree of sedation was assessed using the Modified Ramsey Sedation Score (Modified RSS: 1, patient anxious or agitated or both; 2, patient cooperative, oriented, and tranquil; 3, patient responds to commands only; 4, patient responds to a glabellar tap; 5, patient does not respond) [10]. Patients scoring a Modified RSS of 1, 4, or 5 were excluded. Symptoms of sore throat, hoarseness, and dysphagia were evaluated using 4-point verbal rating scales as follows: for sore throat, 0 = no complaints, 1 = minimal sore throat, 2 = moderate sore throat, 3 = severe sore throat; for hoarseness, 0 = no complaints, 1 = slight hoarseness, 2 = severe hoarseness, 3 = cannot speak because of hoarseness; for dysphagia, 0 = no complaints, 1 = slight dysphagia, 2 = severe dysphagia, 3 = cannot swallow because of dysphagia. Oral bleeding was identified by macroscopic bloodstains on the extubated tracheal tube. Throat complications were evaluated again on the next morning after surgery. At the same time, patients were questioned on delay of oral intake, which was defined as inability to swallow solids or liquids.

Results are expressed as either the mean ± SD or the median and range. Statistical analyses were performed with a *t* test, Mann–Whitney tests, and the chi-square test. A value of $P < 0.05$ was considered statistically significant.

One patient in the AWS group was withdrawn from analysis after extubation because of excessive sedation. Three patients in the control group and two patients in the AWS group were excluded because no blinded interviewers were available for the second evaluation. Patient characteristics are shown in Table 1. The time required for intubation was significantly longer in the AWS group than in the control group ($P < 0.01$). In comparison with the

Table 1 Patient characteristics per study group

	Control group ($n = 34$)	AirWay Scope group ($n = 34$)
Age (years)	54.6 ± 12.6	56.2 ± 11.0
Height (cm)	153.7 ± 7.2	154.4 ± 5.5
Weight (kg)	52.9 ± 10.8	54.2 ± 7.5
Mouth opening (cm)	4.5 ± 0.5	4.8 ± 0.9
Thyromental distance (cm)	9.1 ± 1.1	9.0 ± 1.1
Mallampati classification (I/II/III/IV)	15/18/1/0	16/18/0/0
Glottic view during intubation (I/II/III/IV)	25/6/3/0	34/0/0/0*
Time required for intubation (s)	15.1 ± 8.4	22.4 ± 12.0*
Number of intubation attempts (1/2)	32/2	33/1
Experience of anesthesiologists (years)	6 (3–20)	6 (3–20)
Duration of intubation (min)	143.4 ± 43.2	132.8 ± 32.8
Duration of operation (min)	113.2 ± 44.4	101.6 ± 29.1
Modified Ramsey sedation score (1/2/3/4/5)	0/27/7/0/0	0/28/5/1/0
Mean dose of remifentanil (mg)	1.0 ± 0.6	1.0 ± 0.6
Intraoperative infusion (ml)	1130.9 ± 338.9	1197.3 ± 342.7

* $P < 0.05$, compared with the control group

Values are mean ± SD for age, height, weight, mouth opening, thyromental distance, time required for intubation, number of intubation attempts, duration of intubation, duration of operation, mean dose of remifentanil, and intraoperative infusion

The Mallampati classification is graded on the basis of the structures visualized as follows: I, soft palate, fauces, uvula, pillars; II, soft palate, fauces, uvula; III, soft palate, basis of uvula; IV, soft palate not visible

Glottic view during intubation is graded as follows: grade I, glottic opening was visible; grade II, only the posterior extremity of the glottis was visible; grade III, only the epiglottis was visible; and grade IV, no recognisable structure was observed

The modified Ramsey sedation score is graded as follows: 1, patients anxious or agitated or both; 2, patient cooperative, oriented, and tranquil; 3, patient responds to commands only; 4, patient responds to a glabellar tap; 5, patient does not respond

Macintosh laryngoscope, the glottic view was significantly improved with use of the AWS ($P < 0.01$). Other patient characteristics were similar in each group. The incidence of sore throat before leaving the operating room was significantly lower in the AWS group compared with the control group (Table 2). At the same time, sore throat was rated significantly less severe in the AWS group than in the control group (Fig. 1). In contrast, the incidence of dysphagia was greater in the AWS group than in the control group, but the difference did not reach statistical significance (Table 2). Neither the incidence nor severity of hoarseness differed between the groups (Table 2; Fig. 1). On the day after surgery, the incidence and severity of pharyngeal morbidity decreased, but there was no significant difference between the groups (Table 2; Fig. 2). The incidence of oral bleeding was 23.5% (8/34 patients) in the control group and was significantly higher than that in the AWS group (6.1%, 2/33 patients) ($P = 0.04$). No patient complained of delayed oral intake as a result of throat complications.

The results of this study demonstrated that the use of the AWS decreased both the incidence and the severity of sore throat on the day of surgery while offering a better laryngeal view and significant reduction of oral bleeding compared with the Macintosh laryngoscope.

Although postoperative pharyngeal morbidity is not critical or long lasting, it could delay oral intake and prolong hospitalization. Several causal factors for these complications, such as patient's sex, large tracheal tube size, cuff design, additives contained in the lidocaine spray applied around the laryngotracheal area, and increase in intracuff pressure by nitrous oxide have been reported [1, 4, 11–16]. Teoh and colleagues [17] reported that intubation with the AWS contributed to a lower incidence of postoperative sore throat compared with the Glidescope. In their study, however, sore throat was the only postoperative pharyngeal morbidity evaluated, and the definition and evaluation methods were not clearly described. Additionally, their study compared intubation characteristics between the AWS and Glidescope and did not include the Macintosh laryngoscope. Therefore, we believe that our study is the first randomized, controlled study to systematically evaluate postoperative pharyngeal morbidity following use of the AWS.

The marked reduction in postoperative sore throat with the AWS may be the result of several factors. First, visualization of the glottis with the Macintosh laryngoscope requires alignment of oral, pharyngeal, and tracheal axes with simultaneous displacement of the tongue inferolaterally. This manipulation requires a certain degree of force, which might damage oral soft tissue. The simple insertion of the AWS into the oral cavity allows easy and smooth identification of the glottis without aligning the anatomic axes and without displacing the tongue. Actually, however, the AWS required significantly longer time for intubation than did the Macintosh laryngoscope, indicating a longer contact time between the AWS and pharyngeal mucosa. We assume, however, that the less forceful manipulation

Table 2 Incidence of postoperative sore throat, hoarseness, and dysphagia

	Control group	AWS group
Sore throat (%)		
Day of surgery	52.9 (18/34)	27.3 (9/33)*
Day after surgery	25.8 (8/31)	25.8 (8/31)
Hoarseness (%)		
Day of surgery	85.3 (29/34)	72.7 (24/33)
Day after surgery	35.5 (11/31)	22.6 (7/31)
Dysphagia (%)		
Day of surgery	14.7 (5/34)	27.3 (9/33)
Day after surgery	6.5 (2/31)	9.7 (3/31)

* $P < 0.05$, compared with the control group

Values are percentages; ratios are given in parentheses

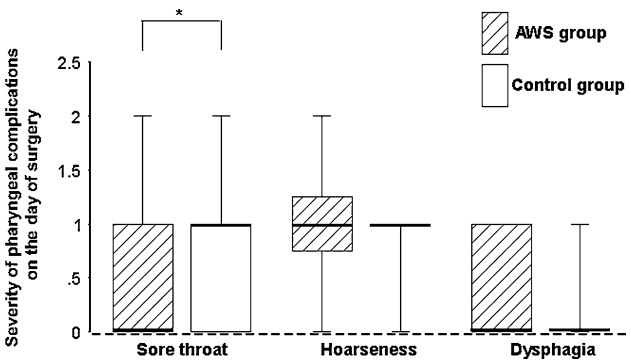

Fig. 1 Severity of postoperative sore throat, hoarseness, and dysphagia on the day of surgery. The *bold horizontal bar*, *boxes*, and *whiskers* represent the median value, interquartile range, and 10th–90th percentile range, respectively. *AWS* AirWay Scope. * $P < 0.05$ compared with the control group

Fig. 2 Severity of postoperative sore throat, hoarseness, and dysphagia on the day after surgery. The *bold horizontal bar*, *boxes*, and *whiskers* represent the median value, interquartile range, and 10th–90th percentile range, respectively. *AWS* AirWay Scope

needed with the AWS is the major factor contributing to the reduction in incidence and severity of postoperative sore throat. This assumption is supported by a study using the GlideScope, which operates on a similar concept of indirect video laryngoscopy [18]. Second, reduction of intubation-associated oral injury is another explanation for decreased incidence of sore throat with the AWS. The incidence of oral bleeding in the control group was significantly higher than that in the AWS group. The LCD screen on the AWS enables clear and magnified visualization of threading of the tracheal tube through the glottis. Such careful observation during intubation with the AWS would facilitate less traumatic intubation, possibly contributing to a reduction in postoperative sore throat. Interestingly, the incidence and severity of pharyngeal complications decreased in both groups on the day after surgery and did not differ significantly between the groups. In contrast to the marked decrease in the incidence of sore throat in the control group, from 52.9% on the day of surgery to 25.8% on the day after surgery, the decrease in sore throat in the AWS group was minimal, from 27.3% to 25.3%. The reason for these differences is not immediately obvious. However, we surmise that forceful laryngoscopy or oral injury with the Macintosh laryngoscope might contribute mainly to increased sore throat on the day of surgery. Nevertheless, these effects related to the Macintosh laryngoscope are likely not long lasting, and other common factors such as direct mucosal injury of the trachea caused by placement of the tracheal tube itself might contribute to residual sore throat on the day after surgery in both groups.

This study was limited by its small sample size. A priori power analysis indicated a sample size of 31 in each group would be adequate to detect an approximately 50% increase in sore throat severity with a power of 0.8 (alpha = 0.05). However, this number might be inappropriate, especially for detecting the incidence of dysphagia. Further studies with appropriately larger sample size are required.

In conclusion, use of the AWS decreased the frequency and severity of postoperative sore throat, presumably the consequence of less forceful laryngoscopy and less traumatic stress exerted on tissues around the glottis during intubation. More frequent use of the AWS might be beneficial in female patients to prevent unnecessary postoperative throat problems.

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