

A New Curved Laryngoscope Blade for Routine and Difficult Tracheal Intubation

Koji Nishikawa, MD, PhD*

Koki Yamada, MD, PhD*

Atsuhiko Sakamoto, MD, PhD†

We have designed a new curved laryngoscope blade based on a new concept of reversing the peardrop phenomenon to facilitate a view of the larynx sufficient for intubation in a greater variety of patients than the current Macintosh blade affords. The new design has a bifid tip and S-shaped spatula to exert more effective pressure in the vallecula area, elevate the epiglottis and change directions of the forces on the tongue to prevent posteroinferior displacement of the compressed tongue in the submandibular space during laryngoscopy. A radiograph laryngoscopy technique was used to guide the new blade curvature design and compare the performance of the new blade with the Macintosh blade in patients with or without a difficult airway. Our results confirm that the new blade provides a laryngeal view sufficient to accomplish intubation by compressing the root of the tongue in an anterocephalad direction in the submandibular space and elevating the epiglottis effectively in patients with or without unanticipated difficult airway. The new curved blade can also effectively move the U-shaped epiglottis out of the laryngeal view to facilitate intubation in pediatric patients aged 2 mo–13 yr.

Anesth Analg 2008;107:1248–52

Unanticipated difficult laryngoscopy and/or difficult intubation is an important problem as management may be complicated by the lack of preparation of alternate intubation techniques.

In an editorial, Hung and Morris emphasized that a clear understanding of the dynamic anatomy of the upper airway during laryngoscopy is required to develop new strategies to manage the unanticipated difficult airway.¹ The peardrop phenomenon, noted by Horton et al. with radiograph laryngoscopy,² is caused by posteroinferior displacement of the compressed tongue in the submandibular space, which impairs a direct view of the airway due to the inability to elevate the epiglottis during laryngoscopy with the Macintosh blade.

The submandibular space has a flexible wall and is the main space for the displacement of the tongue during laryngoscopy. We hypothesize that reduced compliance of the submandibular space may limit its potential anterior space and compress the root of the tongue backward into a peardrop shape. The peardrop-shaped tongue can then press the less curved distal portion of the Macintosh blade³ to fold the epiglottis down toward or against the posterior pharyngeal wall,

which may obscure the view of the vocal cords and be associated with difficult intubation.

Although the reasons for encountering the unanticipated difficult airway are not fully understood, we speculate that the mechanism of the unanticipated difficult airway may be principally related to the peardrop phenomenon in patients with reduced submandibular compliance. Current methods for preoperative airway assessment would not predict reduced submandibular compliance. A possible way to reverse the peardrop phenomenon is to modify the laryngoscope blade curvature with the goal of modifying the forces on the tongue and preventing posteroinferior displacement of the compressed tongue into the submandibular space (Fig. 1).

Furthermore, the bifid tip of the laryngoscope blade, designed by Bowen and Jackson was confirmed to be more effective than the Macintosh blade for elevating the epiglottis by increasing the pressure in the vallecula.⁴ We used cervical magnetic resonance imaging or computed tomography scans of normal individuals to guide a redesign of the bifid tip to improve the performance of the new blade tip.

Based on the new concept of reversing the peardrop phenomenon, we have developed an alternate design to the Macintosh blade with a streamlined bifid tip and S-shaped spatula. This blade design is intended to provide an adequate view of the larynx for intubation in more patients than the current Macintosh blade and to reduce the risk of unanticipated difficult airway. The performance of the new blade was objectively evaluated with the radiograph laryngoscopy technique in patients with or without a difficult airway.

From the *Department of Anesthesiology, Nippon Medical School Tama Nagayama Hospital, Tokyo, Japan; and †Department of Anesthesiology, Nippon Medical School Hospital, Tokyo, Japan.

Accepted for publication June 19, 2008.

Address correspondence and reprint requests to Dr. Koji Nishikawa, Department of Anesthesiology, Nippon Medical School Tama Nagayama Hospital, Nagayama 1-7-1, Tama-shi, Tokyo 206-8512, Japan. Address e-mail to nagayamamasui60@yahoo.co.jp.

Copyright © 2008 International Anesthesia Research Society
DOI: 10.1213/ane.0b013e318185000b