A New Laryngoscope Blade to Overcome Pharyngeal Obstruction

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A new laryngoscope blade has been designed for emergency visualization of the pharynx and larynx when the pharyngeal space is restricted. The blade incorporates a 7-cm tube in the distal portion and an intraluminal light source protected from obstruction. It attaches to standard battery-powered light handles, making it practical for emergency use. The new blade has been tested on dogs and used successfully in 12 patients with edematous pharynges and in one patient with a bleeding pharyngeal tumor, where standard nontubular blades failed to produce a view of the larynx. (Key words: Anesthetic equipment: design; laryngoscopes. Complications: pharyngeal edema; upper airway obstruction.)

Acute upper airway obstruction is a life-threatening problem which demands prompt and definitive action. This problem occurs with laryngo-pharyngeal neoplasm, infectious disease, and foreign bodies in the laryngo-pharynx, and can follow neck trauma, neck surgery, and various conditions that cause swelling and edema. Under these circumstances, visualization of the larynx is very difficult, sometimes impossible, making an emergency tracheostomy or cricothyrotomy mandatory. The major problem is that the normal pharyngeal space is obliterated. Structures are displaced and may be deformed. The standard nontubular laryngoscope blade used in anesthesia fails to create sufficient viewing space under these circumstances, and edematous mucosa typically envelopes and thereby obliterates the light source attached to the blade handle. Tubular laryngoscopes (Jackson®, Holinger®, Jako®, and Dedo-Pilling® Pilling Co., Washington, PA) avoid these problems. These devices create a space for viewing structures within the pharynx and provide an intraluminal light source unobstructed by edematous mucosa. However, the long, continuous tube of ENT laryngoscopes is not ideal for the passage of an endotracheal (ET) tube. The view of the patient’s larynx is obstructed as the ET tube is inserted, and it is difficult to stabilize the tube as the laryngoscope is removed. These laryngoscopes also necessitate complex light sources which exclude their use as emergency resuscitative equipment. Consequently, there is a need for a pharyngo-laryngoscope blade which: 1) creates pharyngeal space using a tubular design; 2) modifies tubular structure to optimize the passing of ET tubes through or around the blade and into the larynx; and 3) fits existing portable light handles. I have designed and tested a laryngoscope blade with these features.

Technical Description of Blade

A drawing of the new blade is provided (fig. 1). It resembles a standard straight laryngoscope blade with one exception: the distal 7-cm section of the blade is a tube. The blade is constructed from malleable copper sheet, 2 mm thick, which was pressed around a hard wood form duplicating the inner shape of the blade. The copper edges meeting to produce the tubular portion of the blade were soldered to complete the tube. The tip of the tube was then beveled at a 60° angle to create an oval opening. This beveling permits discrete probing of the pharynx with the distal tip of the blade. A light source taken from a discarded rigid bronchoscope was inserted through the wall of the blade and fitted close to the inner wall of the tubular section, allowing enough space to insert a removable light bulb. The tip of the light source was recessed within the tubular lumen. The copper was then plated with chrome to produce a mirrored surface. The standard fitting for attaching a blade to a removable light handle was bolted to the new instrument.

When introduced into the pharynx (fig. 2), the tubular blade distends the pharynx and provides an excellent view of pharyngo-laryngeal structures. Because the light source is intraluminal, it cannot be obliterated by edematous tissue. An ET tube, size 8 or less, can be inserted through the tubular lumen without significantly obstructing vision, and can be easily stabilized while the laryngoscope is removed.

Experimental Testing

Figures 3 and 4 compare the use of the new blade with the use of the standard, nontubular Guedel® blade in a dog with an edematous pharynx. The dog was anesthetized with thiopental before placement of a cricothyrotomy tube, and with halothane and oxygen thereafter. Once anesthetized, the dog’s pharynx was made

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edematous by injecting saline into the pharyngeal submucosa and the base of the tongue. The larynx could not be visualized with the Guedel® (fig. 3) or Macintosh® blades, but was visualized with the new blade (fig. 4).

I have used the new blade in 12 patients with edema of the pharynx and in one patient with a large, friable tumor in the pyriform sinus that was actively bleeding and obstructing the view of the larynx. Standard non-tubular blades failed to provide an adequate view of pharyngeal structures in all patients, in contrast to which the new tubular blade produced views which permitted successful intubation.

Discussion

My experience has shown that three distinct features of the blade are important. First, the probing tip of the laryngoscope blade must be visible at all times to successfully probe the edematous pharynx. If the distal part of the tip were to extend as a flat, non-tubular projection, it would become lost to view within the edematous tissue. The tubular portion of the blade must, therefore, extend to the tip, to ensure that the tip remains visible. However, the need to see the distal tip necessitates that the blade be reasonably straight in its long dimension and minimally convex in its tubular portion. Second, for optimal viewing, the internal diameter (ID) of the tube should be large; an ID of 20 mm appears to be satisfactory. The smaller ID (12–14 mm) of tubes, such as those in Dedo-Pilling® ENT laryngoscopes, is not as effective in creating a viewing space, particularly when one is in great haste to identify pharyngeal structures. However, the outside diameter (OD) of the tubular portion of the blade could be reduced by using thin stainless steel instead of malleable copper. And third, the length of the tubular portion need extend only into the rostro-caudal dimension of the pharynx. Longer tubes which extend into the mouth are cumbersome.

One unexpected advantage of the design was that the mirrored surface inside the tubular portion reflected

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**Fig. 1.** Scale drawings of tubular blade.

**Fig. 2.** Top. The new tubular blade as used in a human subject. The tubular portion of the blade, seen in the cutaway, fits within the pharyngeal space. The tip of the blade elevates the epiglottis to give a view of laryngeal structures. Middle. An ET tube, without adaptor (stylet optional), is inserted through the tubular portion of the blade and advanced into the larynx. The ET tube cuff is inflated. Bottom. Syringe and stylet are removed from the ET tube. The tubular blade is now gradually removed from the mouth. The right hand of the operator stabilizes the ET tube as the blade is elevated over the proximal end of the ET tube and cuff pilot tube.
Fig. 3. *Left.* This drawing illustrates the view of the normal pharynx in the dog when the jaws are held open, and the tongue pulled forward and stretched over the lower jaw. *Top right.* This photograph shows pharyngeal walls, distended by injected saline, touching midline and obliterating the view of pharynx, epiglottis, and larynx. *Bottom right.* This photograph indicates that a Guedel® 3 blade is unable to displace edematous pharyngeal tissue. The blade is introduced midline with the handle tilted to the left to accommodate the protruding lower jaw.

and intensified the light from the source within the tubular area, and thereby enhanced viewing.

The disadvantages of the new blade are that it is bulky and feels awkward to use. To insert it, I open the patient’s mouth gently and slide the tubular section into the pharynx without attempting to view pharyngeal structures. Once the tube is within the pharynx, I elevate the patient’s tongue in the usual way for viewing. Because the visibility of the tip demands that the blade be relatively straight, the new instrument has all the difficulties intrinsic to the use of a straight blade and, consequently, may not work well for the anteriorly situated larynx.

To optimize its use, the absolute dimensions of the blade may be varied according to need. The prototype is approximately as long as the Guedel® 3, a standard straight laryngoscope blade. To be useful in larger patients, the blade could be made 3 cm longer. Similarly,

Fig. 4. *Left.* Drawing shows insertion of the tubular blade through the normal pharynx to elevate the epiglottis and give a view of the vocal cords. *Top right.* This photograph shows the tubular blade inserted through edematous pharyngeal walls to create a view of the epiglottis. *Bottom right.* This photograph shows the vocal cords after the epiglottis is elevated. Edematous pharyngeal tissue can be seen laterally.
to fit pediatric patients, the length of the blade could be shortened and the tube OD decreased. Moreover, this instrument is compatible with fiberoptic technology. A fiber light source could probably be designed to hug the inside of the tubular lumen more closely than the light source in the present model. The result would be less obstruction to view and to passage of an ET tube.

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References