The Eschmann Tracheal Tube Introducer

(Gum Elastic Bougie)

Susheela Viswanathan, MD,* Carol Campbell, MD,* David G. Wood, MD,* James M. Riopelle, MD,* and M. Naraghi, MD*

Unexpected difficult intubation is one of the most challenging situations faced by anesthesiologists. To date, no technique or device has been found that permits successful endotracheal intubation in all patients. For more than 40 years, British anesthesiologists have found the Eschmann Tracheal Tube Introducer to be a valuable tool in the management of difficult intubation occurring as a result of a number of different anatomic and pathologic problems.[1-6] One recent survey revealed that more British anesthesiologists choose this tracheal tube introducer than the malleable stylet to facilitate difficult intubation if downward tracheal pressure fails to result in clear visualization of the glottis.[1] Recently, reports describing the usefulness of the Eschmann introducer in facilitating tracheal intubation in both anesthetized[7] and awake[8] patients have appeared in the American literature. A recent review article[9] and two recent books[10,11] on the subject of difficult intubation have also described the tracheal tube introducer. Considering its popularity abroad, its ease of use, and its relatively low cost, the Eschmann tracheal tube introducer is a device that warrants the serious attention of all anesthesiologists.

History of the Eschmann Introducer

In 1949, Dr Robert R. Macintosh, Professor of Anesthetics at the Nuffield Department of Anesthetics at Oxford University, reported that insertion of a "gum elastic" urinary catheter through a tracheal tube so that the catheter tip protruded beyond the tube's end facilitated tracheal intubation. He found this introducer to be particularly useful in overcoming three relatively common difficulties that are encountered during the performance of the procedure: (1) a large tracheal tube obstructing the laryngoscopist's view of the glottic orifice (insertion of the introducer's much smaller tip did not block the view); (2) prominent teeth forcing the tube to follow a tortuous path from the mouth to the glottic orifice (the thin catheter could be guided along such a course with greater ease); and (3) incomplete glottic visualization (the catheter could be curved so that it was possible to guide its tip into the trachea).[12]

Following Dr Macintosh's description of his new technique of using a urinary catheter to facilitate tracheal intubation, the British firm of Eschmann Brothers & Walsh began manufacturing a device designed specifically for this purpose. Most often referred to in the British literature as a "gum elastic bougie" (despite the fact that it is not gum, elastic, or a bougie), the Eschmann tracheal tube introducer gained popularity in the mid-1960s and is now considered by many British anesthesiologists to be an essential airway management tool.

*Drs Viswanathan, Campbell, Wood, Riopelle, and Naraghi are with the Department of Anesthesiology, Louisiana State University Medical Center, New Orleans, Louisiana.

Design and Construction

The Eschmann introducer is 60 cm in length. Because it has an external diameter of 5 mm, it is suitable for use with tracheal tubes with internal diameters ≥6.0 mm. The device is straight except for a 35°-angle kink approximately 2.5 cm from the end that is inserted into the airway. This kink is the device's most unique and important feature. Because of its presence, rotating the introducer's shaft during insertion permits the tip to be "steered" around obstacles (eg, prominent teeth, an enlarged tonsil, the epiglottis, an airway mass) and through the laryngeal aperture. If the base of the tongue partly or completely obscures visualization of the glottic inlet (anterior larynx), the introducer's tip can nevertheless usually be maneuvered "blindly" into the tracheal lumen because of its kink.[2]

The Eschmann tracheal tube introducer is the only device of its kind currently marketed. In the United States, it is marketed by Concord/Portex and SIMS Surgical (both in Keene, New Hampshire). The device is composed of two layers—a hollow core that consists of a tube woven from Dacron polyester threads and an outer resin layer that provides stiffness, flexibility, and a slippery, water-impervious surface that makes washing, chemical sterilization, and reuse feasible (Figures 1 and 2).

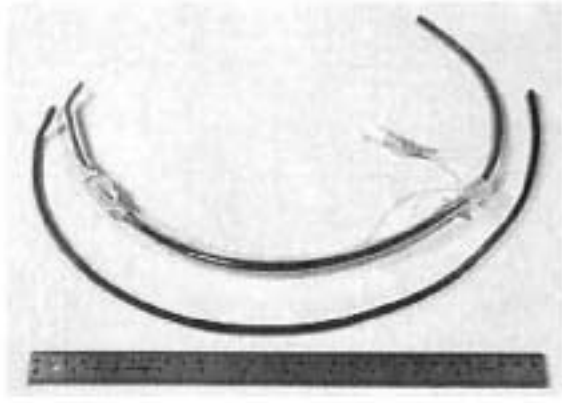

Figure 1. Eschmann tracheal tube introducer below a second introducer inserted through an endotracheal tube.

Figure 2. Cutaway (upper) and cross-sectional (lower) views of an Eschmann tracheal tube introducer. A = braided Dacron core.

Technique of Using the Device

Although the tracheal tube introducer can be used for routine intubation, it is normally employed only to facilitate difficult intubation, especially when caused by the presence of an anterior larynx. In patients with this anatomic variation, elevation of the head into the sniffing position and application of cricoid pressure fail to align the oral, pharyngeal, and laryngeal axes, and the glottic orifice remains anterior to the laryngoscopist's line of vision. Provided that at least the tip of the patient's epiglottis can be visualized (Cormack and Lehane grade 3 or better[2]) (Figure 3), intubation of the trachea using the introducer can be accomplished as follows.

Using proper laryngoscopic technique, the anesthesiologist first obtains the best possible view of the laryngeal orifice. The kinked end of the tracheal tube introducer is then inserted into the patient's mouth until its tip contacts

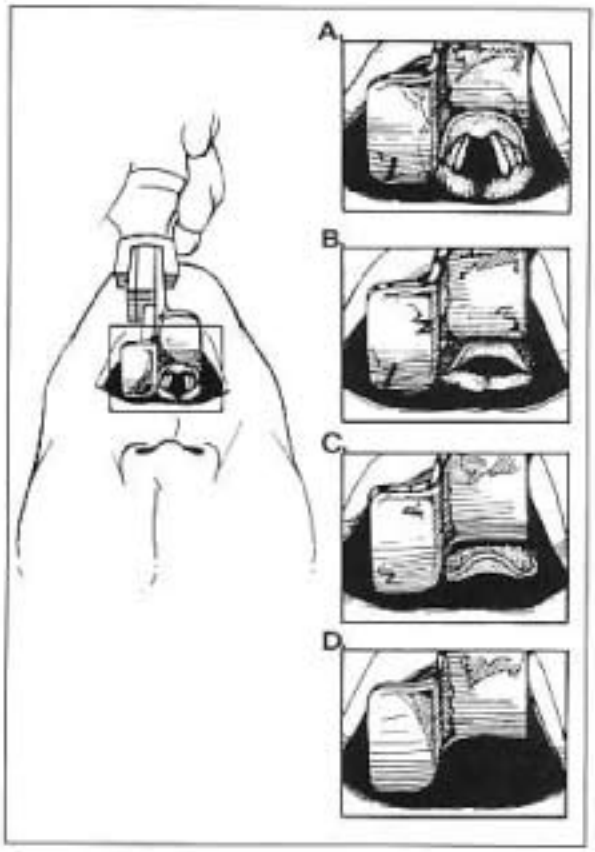

Figure 3. Cormack and Lehane[2] classification of glottic exposure by direct laryngoscopy: (A) visualization of the entire glottis; (B) visualization of the posterior portion of the glottis; (C) no visualization of the glottis, but epiglottis seen; (D) no visualization of the glottis or epiglottis.

the posterior surface of the epiglottis. The introducer is then advanced, its tip remaining in contact with the posterior surface of the epiglottis until it has traversed the glottis. (Occasionally if the curvature of the airway is particularly extreme, the tip can be directed even more anteriorly by lifting it with Magill forceps.[6]) The first sign that the introducer's tip is traversing the larynx is that the assistant holding cricoid pressure usually feels a faint upward pressure as the tip passes beneath his fingers. The second sign of tracheal placement, present in 90% of cases,[5] is the distinctive "clicking" sensation that is felt by the person advancing the introducer as the tip bumps along the corrugated anterior inner surface of the trachea.[13] The introducer should be inserted far enough that its tip lies in the middle or distal trachea. Some investigators have recommended, as a third sign of tracheal placement, advancement of the introducer until resistance is met (Cheney's sign). This resistance is a reliable indicator that the tip has lodged in a bronchus (since if the introducer has entered the esophagus, no resistance is encountered during insertion of its entire length).[5,13] Care must be taken if this sign is sought, however, to avoid advancing the introducer with a force sufficient to produce bronchial injury (and pneumothorax or pneumomediastinum once mechanical ventilation is instituted).

After the introducer has been inserted into the patient's trachea, the tracheal tube, its lumen already lubricated with a water-soluble gel, is slipped over the introducer in a manner analogous to central-venous or arterial-catheter insertion over a guide wire (Seldinger technique[14]). Sometimes when one attempts to slip the tracheal tube over a correctly positioned introducer, the beveled tip of the tracheal tube "catches" or "hangs up" on the right arytenoid[9,15-17] or aryepiglottic fold (Figure 4), the right vocal cord,[4,9] or the epiglottis.[18] This problem can usually be overcome by withdrawing the tracheal tube a few centimeters, twisting it 90° counterclockwise,[4,6,9,15,16] and then again advancing it over the introducer. This twisting and reinserting process is even more successful if performed by an assistant while the laryngoscopist maintains upward traction on the tongue.[6] If resistance is encountered and the tracheal tube cannot be slid into the trachea despite counterclockwise rotation, the assistant should remove the tracheal tube, leaving the introducer in position (black line at the lips), and repeat the process using a tube of smaller diameter.

A second technique of employing the Eschmann introducer consists of preinserting it into the tracheal tube so that its tip protrudes approximately 5 cm beyond that of the tube (Figure 1). After laryngoscopy has been performed and the best possible view of the glottis has

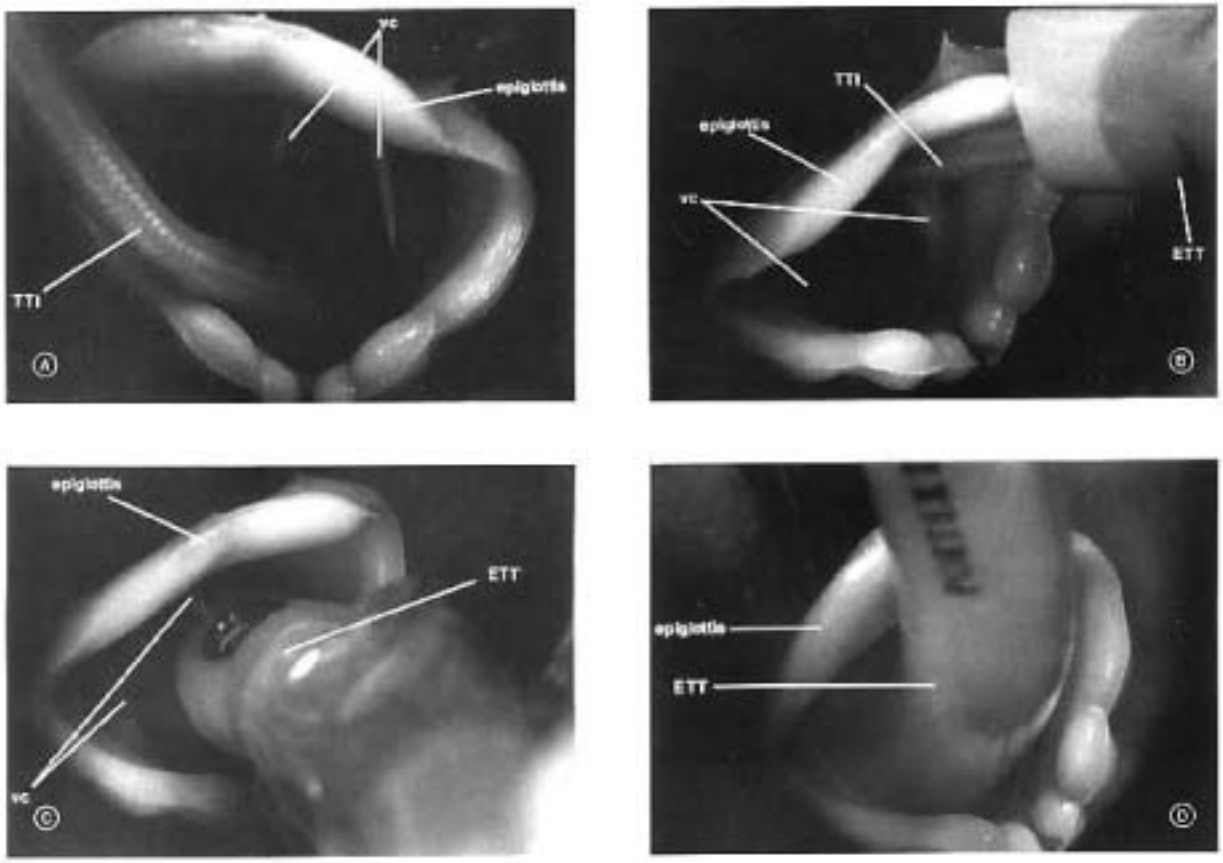

Figure 4. Steps in tracheal intubation using an Eschmann tracheal tube introducer, as demonstrated in a manikin. (A) The introducer (TTI) entering the glottis. (B) The tip of the TTI has passed through the glottic aperture; however, the endotracheal tube (ETT) is "catching" on the right aryepiglottic fold. (C) The ETT has been withdrawn a short distance and its shaft rotated 90° counterclockwise. The tip of the ETT (Murphy eye anterior) will now enter the glottis when the tube is inserted. (D) The ETT is correctly positioned within the trachea. VC = vocal cords.

been obtained, the introducer and tube are then inserted into the trachea with a single movement. This technique can save a few seconds if the problem is an anterior larynx. Steering the introducer tip to the left or right may be made more difficult, however, because the introducer can twist within a large-diameter tracheal tube.

Gaining Practice Using the Device

It is preferable to practice using a tracheal tube introducer on a training manikin and in patients with a normal airway before using the device to facilitate difficult tracheal intubation. Some investigators have also recommended practicing with the device in patients in whom one simulates the presence of an anterior larynx by intentionally exposing only the tip of the epiglottis with the laryngoscope.[2,6] Concerns about patient safety during the performance of such drills have recently been expressed, however.[19]

Complications Using the Introducer

We have found no reports of patient injuries caused by using the tracheal tube introducer for its intended purpose of facilitating orotracheal intubation.

Although pharyngeal structures could conceivably be injured by a tracheal tube introducer, this device is considerably more flexible than a tracheal tube reinforced with a standard malleable stylet. Nevertheless, concerns

Figure 5. An Eschmann tracheal tube introducer coiled for easy transport in a scrub-suit pocket.

about the introducer entering the retropharyngeal space have deterred us from employing the introducer as an aid to blind nasotracheal intubation.

Forceful insertion of an excessive length of the introducer can result in bronchial rupture. We are aware of two instances of right-sided pneumothorax and one of mediastinal emphysema that developed shortly after use of a tracheal tube introducer. In all three instances, however, the device was used to change a tracheal tube rather than first insert one. The manufacturer discourages use of the introducer for this purpose because other devices designed specifically for tracheal tube exchange are available.

Finally, it is important for the user to realize that although the tracheal tube introducer frequently permits tracheal intubation in patients whose glottic orifices cannot be visualized during laryngoscopy, esophageal intubation is certainly possible despite use of this device. Therefore, once the tracheal tube has been inserted over the introducer and its cuff inflated, all appropriate techniques for verifying that the tube does indeed lie within the trachea (including capnometry) must be performed without delay.

Storage of the Introducer

Although the tracheal tube introducer can be stored in the drawer of an anesthesia cart in its original long, narrow package, staff anesthesiologists and residents at our hospital prefer to loop their introducers (Figure 5) so that they can be kept in a scrub suit pocket ready for use during a difficult intubation anywhere in the hospital. Arranging the introducer into loops should be performed slowly while the device is submerged in hot water so that the resinous outer layer bends rather than fractures.

Customization of the Introducer

Some anesthesiologists have modified the Eschmann tracheal tube introducer to suit their own purposes. One reported customization consists of cutting a few millimeters off each end of the device to form a hollow kinked tube to which can be attached a pressurized oxygen source to permit oxygen insufflation[20] or jet ventilation or a side-stream capnometer to permit tracheal gas sampling.[21] Such modification probably prevents effective sterilization, however, and devices so altered should be discarded after use.

Similar Devices

Several brands of malleable stylets are available, including at least one that incorporates a light at the end to serve as a tracheal transilluminator (eg, Illuminated Stylet [Mercury Medical, Clearwater, Florida] available in three sizes). Rusch (Waiblinger, Germany; distributed in the United States by Pilling, Fort Washington, Pennsylvania) now markets a series of malleable stylets of varying diameters, each of which has a soft plastic sheath slightly longer than its aluminum core that is designed to protrude slightly beyond the tube's tracheal orifice. A laryngotracheal (topical) anesthesia kit (LTA 360 Kit [Abbott Laboratories, North Chicago, Illinois]), if inserted through the tube's Murphy

eye prior to use, can also serve as an intubation guide.[22] Tracheal tube exchange devices, eg, the Sheridan TTX (Sheridan, Argyle, New York) or the JEM tube changer (Instrumentation Industries, Bethel Park, Pennsylvania) can be used as tracheal tube introducers but, because they lack a kink, are not ordinarily useful in facilitating difficult intubation. Finally, the more invasive technique of "retrograde intubation" includes use of a wire (and dilator) or a plastic catheter to guide a tracheal tube into correct position.[23]

Conclusions

The technique of tracheal intubation using an introducer, introduced by Dr Robert Macintosh in 1949, is today highly favored by British anesthesiologists to facilitate difficult unexpected tracheal intubation. The Eschmann tracheal tube introducer, like Dr Macintosh's original gum elastic catheter, is especially useful in patients with an anterior larynx. For these reasons and because of its ease of use, portability, and relatively low cost, this device deserves evaluation by anesthesiologists and others who perform endotracheal intubation.

Acknowledgments

The photographs in this report were produced by the Louisiana State University Medical Center Department of Learning Resources. The writers wish to thank Richard H. Myer and John Forster for providing information on the history of the Eschmann tracheal tube introducer and to Martin L. Norton, MD, for sharing with us his technique of adapting a commercial tracheal tube exchanger for use as a tracheal tube introducer.

References

1. Latto IP, Rosen M. *Difficulties in Tracheal Intubation.* London, England: Balliere Tindall; 1984:111.
2. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. *Anaesthesia.* 1984;39:1105–1111.
3. Tomlinson AA. Difficult tracheal intubation. *Anaesthesia.* 1985;40:496–497. Letter.
4. Cossham PS. Difficult intubation. *Br J Anaesth.* 1985;57:239. Letter.
5. Kidd JF, Dyson A, Latto IP. Successful difficult intubation: use of the gum elastic bougie. *Anaesthesia.* 1988;43:437–438.
6. Dogra S, Falconer R, Latto IP. Successful difficult intubation: tracheal tube placement over a gum-elastic bougie. *Anaesthesia.* 1990;45:774–776.
7. McCarroll SM, Lamont BJ, Buckland MR, Yates APB. The gum-elastic bougie: old but still useful. *Anesthesiology.* 1988;68:643–644. Letter.
8. Benson PF. The gum-elastic bougie: a life saver. *Anesth Analg.* 1992;74:318. Letter.
9. Benumof JL. Management of the difficult adult airway with special emphasis on awake tracheal intubation. *Anesthesiology.* 1991;75:1087–1110.
10. Finucaine BT, Santora AH. *Principles of Airway Management.* Philadelphia, Pa: FA Davis; 1988.
11. Norton ML, Brown ACD, eds. *Atlas of the Difficult Airway: A Source Book.* St. Louis, Mo: CV Mosby; 1991.
12. Macintosh RR. An aid to oral intubation. *Br Med J.* 1949;1:28.
13. Sellers WFS, Jones GW. Difficult tracheal intubation. *Anaesthesia.* 1986;41:93. Letter.
14. Seldinger SI. Catheter replacement of the needle in percutaneous arteriography: a new technique. *Acta Radiol.* 1953;39:368–376.
15. Schwartz D, Johnson C, Roberts J. A maneuver to facilitate flexible fiberoptic intubation. *Anesthesiology.* 1989;71:470–471. Letter.
16. Dellinger RP. Fiberoptic bronchoscopy in adult airway management. *Crit Care Med.* 1990;8:882–887.
17. Katsnelson T, Frost EAM, Farcon E, Goldiner PL. When the endotracheal tube will not pass over the flexible fiberoptic bronchoscope. *Anesthesiology.* 1992;76:151–152.
18. Ovaspassian A, Yelich SJ, Dykes MHM, Brunner EE. Fiberoptic nasotracheal intubation—incidence and causes of failure. *Anesth Analg.* 1983;62:692–695.
19. Goldberg JS, Bernard AC, Marks RJ, Sladen RN. Simulation technique for difficult intubation: teaching tool or new hazard? *J Clin Anesth.* 1990;2:21–26.
20. Arndt GA, Ghani GA. A modification of an Eschmann endotracheal tube changer for insufflation. *Anesthesiology.* 1988;69:282–283. Letter.
21. Artu AA, Schultz AB, Bonneau JJ. Modification of an Eschmann introducer to permit measurement of end-tidal carbon dioxide. *Anesth Analg.* 1989;69:129–131.
22. Cahen CR. An aid in cases of difficult tracheal intubation. *Anesthesiology.* 1991;74:197. Letter.
23. Lieu JC, Forrier M, Forrier C, Pottecher T. L'intubation orotracheale par voie retrograde. *Ann Fr Anesth Reanim.* 1989;8:632–635.