

ENDOTRACHEAL INTUBATION APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation in part of application Ser. No. 08/187,609 filed Jan. 26, 1994, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to devices for assisting in oral tracheal intubation or placement of an endotracheal tube through the mouth, and in particular concerns an intubation guide approximating an internal diameter of the tube, the guide having a distal tip that is articulated and manually controlled to obtain a sharp anterior deflection at the end of the tube for passing the tube through the larynx.

2. Prior Art

Endotracheal tubes are used to couple a patient's respiratory system to a breathing apparatus during surgical procedures or emergency situations. A typical endotracheal tube is made of polyvinyl chloride or the like and has an inflatable cuff several centimeters from an end of the tube that is inserted into the trachea, whereby the tube can be sealed relative to the trachea by inflating the cuff through an inflation line passing along the tube. A fitting on an opposite end of the tube couples to an artificial respirator or ventilator.

The tube is dimensioned to provide an adequate airflow for the patient, and may have an internal diameter of 2.0 to 9.5 mm, depending on the air flow required, normally varying as a function of the size of the patient. A typical internal diameter for adults is 5.5 to 8.5 mm and a typical length is about 30 cm. The tube is somewhat flexible but must be sufficiently rigid to ensure that the lumen of the tube does not pinch shut or become restricted if the tube is flexed. Therefore, the tube has a substantial wall thickness to provide necessary rigidity, e.g. 2 mm wall thickness. The tube typically is manufactured to assume a smooth arc at rest, this arc approximating the curve of the passage through the mouth to the trachea. For example, from end to end the tube can define a quadrant (90°) of a circular arc with a radius of curvature of about 20 cm.

In placing the endotracheal tube, it is necessary to guide the cuffed or distal end of the tube around an anterior bend to bring the end of the tube forward through the larynx and into the trachea, rather than rearward into the esophagus and the digestive system. There are various situations in which the tube must be placed quickly, and in every case the tube must be placed properly so as to ensure airflow. In connection with surgery under general anesthesia, for example, a typical procedure is to render the patient unconscious, e.g., using pentothal, and also to administer a neuromuscular blocking agent such as succinylcholine to block involuntary and voluntary muscular movements that may interfere with a surgical procedure. This also stops respiration by disabling all muscles of respiration. At this point, the endotracheal tube must be properly positioned in a timely fashion to avoid potentially catastrophic results from hypoxia at the brain and heart. It is obviously desirable to place the tracheal tube properly on the first attempt.

Oral rather than nasal placement of the tracheal tube is generally preferred. Various tools have been devised to assist in placing the tube, i.e., threading the cuffed end through the mouth and the pharynx, turning forward to pass the epig-

lottis and larynx, and advancing the tube several centimeters into the trachea until the inflatable cuff passes the vocal cords. Typically, a laryngoscope having a generally spoon shaped blade is used to pull the tongue and associated tissues anteriorly (i.e., upwardly for a supine patient). Often, this is sufficient to enable proper placement of the endotracheal tube. Occasionally some form of tool is used to assist in guiding the tube into place.

According to one technique, a thin malleable metal stylette is inserted into the trachea for guiding the tracheal tube into place by sliding the tube along the stylette. First the stylette is bent manually to approximate an estimated path of the tracheal tube, i.e., the stylette is curved into an arc and may be diverted or bent anteriorly at the distal end so as to point toward the larynx when inserted orally. The length and extent of the bend that is possible is limited by the need to pass the stylette along the path to the trachea. The endotracheal tube is placed on the stylette, which is inserted into the patient. The tube then is pushed axially along the stylette, and if all goes well, into the trachea. This approach requires correct estimation of the path and a certain dexterity, and sometimes requires repeated attempts as the stylette is adjusted, tried, removed and adjusted again.

The stylette has a substantially smaller diameter than the tracheal tube. Although the stylette may traverse the larynx, the end of the tube, which is wider, may encounter tissues and require repositioning to enable the tube to pass. Additionally, because the stylette is thin compared to the inside diameter of the tube, the tube does not bend to the same angle as the stylette and instead assumes a longer radius of curvature. The stylette is inexpensive, but it is a cumbersome, time consuming and inefficient means to achieve a bend at the distal tip of the endotracheal tube for guiding the tube into place.

A stylette including a mechanism for manually varying a bending arc at the distal end of the stylette, is available from Mainline Medical, Inc., Smyrna, Ga., under the name Flexguide. The stylette is made of flexible plastic, laterally slotted exclusively along one side to define a series of articulated segments over a span of several centimeters at the distal end portion of the stylette. A solid movable plunger extends axially through a central passageway and is attached or abutted against a segment at the distal end. By pulling or pushing the plunger relative to the remainder of the stylette using a finger ring, the distal end is caused to bend toward or away from the slotted side, respectively. Due to the segment structure, bending occurs evenly over the span of segments, such that it is difficult to make an abrupt bend. The stylette is also narrow compared to the internal diameter of the endotracheal tube, making it difficult or impossible to use the tool to alter the curve of a tube placed on the stylette. Instead, diversion of the end of the stylette is used to aim the end of the stylette toward the larynx, using the four or five centimeters of tissue space in the area of the pharynx and larynx. The stylette is placed in the trachea and the tube is pushed along the stylette in the same manner as with a malleable metal stylette.

Other devices are known that are intended to bend the endotracheal tube itself. In U.S. Pat. No. 4,329,983—Fletcher, a stylette is coupled to a wire to enable the distal end of the stylette to be pulled into an arc when inside the lumen of the tube. Whereas the stylette is thin compared to the tube, the stylette must be bent into a relatively sharper curve in order to form a relatively more shallow curve in the tube. In U.S. Pat. Nos. 4,589,410—Miller and 4,150,676—Jackson, pull rings at the proximal end are tied to the distal end via a wire or the like disposed in a passage on one side