**Objectives**

At the completion of this course, the reader should be able to:

1. Identify the rationale for using the Combitube (TYCO Healthcare, Pleasanton, Calif) as a rescue airway.
2. Describe the physical design and operation of the Combitube.
3. List the advantages of a Combitube.
4. Describe the manner in which the Combitube is inserted and its appropriate performance ensured, including the contraindications to the use of the Combitube.
5. Understand how to convert from the Combitube to an endotracheal tube.

**Introduction**

The use of a rescue airway can prove lifesaving in the operating room, intensive care unit, emergency department, and prehospital environment. A rescue device is equipment that is used when conventional methods of intubation, such as laryngoscopes, bougies, and fiberoptic devices, fail to achieve control of the airway. The most common rescue device used in the operating room is the laryngeal mask airway (LMA). In the other venues, caregivers may not have the special skills needed to optimally use the LMA, and, in certain circumstances, another rescue device, the esophageal-tracheal double-lumen airway, is preferable. In addition, the airway manager who is called to the emergency department must be familiar with the esophageal-tracheal double-lumen airway.

The most commonly used esophageal-tracheal double-lumen airway device is the Combitube (TYCO Healthcare, Pleasanton, Calif), which will be used to illustrate insertion techniques needed in the use of esophageal-tracheal double-lumen airways. Nurse anesthetists should familiarize themselves with the function and placement of the device in case it is needed.

**Key words:** Combitube, difficult airway, esophageal-tracheal double-lumen airway, failed intubation, rescue airway device.
comings of single-lumen devices, esophageal obturator airways, introduced to paramedics to allow management of the airway in the prehospital environment. Interestingly, a reverse trend is being observed. Single-lumen airway devices such as the Laryngeal Tube LT (VBM Medizintechnik, Sulz, Germany) are being developed as alternatives to the Combitube.³

The Combitube is a 2-lumen device that provides an excellent rescue airway in the following situations:

1. The patient is in arrest, deeply comatose, or sedated and requires an artificial airway.
2. Bag-valve-mask ventilation is inadequate or aspiration concern is high.
3. Standard methods of obtaining endotracheal intubation have failed.

One of the principal advantages of the Combitube and similar devices is that insertion and use are learned and practiced on a mannequin in preparation for actual patient use. The steps required to achieve airway control and ventilation are simple, sequential, numbered, and color-coded so that judgment and variability are minimized (see Figure 1). With double-lumen devices, placement in the esophagus or the trachea allows successful ventilation with essentially normal arterial blood gases.⁴ Aspiration can occur during placement, but once the tube is in position, there is minimal chance of aspiration.²,⁴,⁶ The major complications are inability to insert the Combitube and the possibility of insertion trauma to structures of the mouth, includ-

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<th>Table. Syringe volumes</th>
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<td><strong>Volume (mL)</strong></td>
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<tr>
<td><strong>No. 1 balloon</strong></td>
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<tr>
<td>No. 2 balloon</td>
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<tr>
<td>Combitube</td>
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<tr>
<td>100</td>
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<td>15</td>
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<td>Combitube SA</td>
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ing the teeth, the oropharyngeal soft tissue, the hypopharyngeal and laryngeal structures including the vocal cords, and the esophagus. In actual practice, complications are not common: 1 series of 250 consecutive uses in the operating room had no complications. Overdistension of the esophageal balloon has been shown to relate to esophageal tears. Once inserted, the device may be left in place for up to 8 hours, permitting stabilization of the patient’s condition. Endotracheal intubation can be accomplished with the Combitube in place (discussed later).

Contraindications to the use of the Combitube include the following:
1. Height of less than 5 ft or 4 ft for the Combitube and Combitube SA, respectively
2. Inadequate sedation or the presence of airway reflexes
3. Esophageal disease or caustic substance ingestion (relative)
4. Coagulopathy (relative)
5. Facial trauma or fractures (relative)
6. Penetrating trauma to the upper airway
7. Central airway obstruction, eg, foreign body or tumor

Proper insertion does not jeopardize a potentially unstable cervical spine.

The Combitube is available in 2 sizes designated the Combitube and the Combitube SA ("small adult"). Choice of tube is according to the patient’s height, with the standard tube recommended for patients whose height is greater than 5 ft and the SA version for patients whose height is between 4 and 5.5 ft. (Note the overlap of 0.5 ft). Anecdotal information confirmed in clinical use is that the SA version performs excellently in patients between heights of 4 ft and more than 6 ft. This upper limit was shown in anesthetized human patients up to 6 ft tall. Although not an “approved indication,” it is my recommendation that the SA version be used in patients in this height range. Also, for reasons not related to clinical usefulness, neither device is approved for use in children, but I recommend its use in children when other airway devices have failed.

The 2 Combitubes have different cuff inflation volumes that are marked on the reservoir balloon injection ports. As packaged, the syringes are predrawn to the appropriate volume when the set is opened (Table).

In comparison with the LMA, the Combitube has the following advantages:
1. The likelihood of aspiration is reduced.
2. Higher ventilation pressures can be achieved.
3. It is a more stable airway that remains in place well during patient transfers.
4. It is designed to be learned on a mannequin and used in humans. (This may be true for the LMA but is not agreed on.)
5. There is less complicated selection of the appropriate size.
6. Inflation volumes are standardized, not requiring titration.
7. The Combitube can be inserted with decreased mouth opening and in the face of massive oropharyngeal or gastrointestinal hemorrhage.

In comparison with the Combitube, the LMA has the following advantages:
position in the esophagus or trachea. Ventilation is always attempted sequentially through the ambu adaptors in the same order (ie, blue, No. 1, first; white, No. 2, second).

In preparation for insertion, clear the mouth of teeth or other foreign bodies to keep them out of the airway and avoid balloon damage. The patient’s head remains in the neutral position. Checking balloons for leaks is not recommended. Open the mandible with the thumb and second and third digits, and pass the Combitube blindly through the mouth into the hypopharynx (Figure 2). This is facilitated by a manual jaw lift or by the use of a laryngoscope to elevate the mandible and tongue. When available, use of the laryngoscope may decrease the likelihood of trauma to the pharynx. At times it is difficult to “get around the corner.” This is made less likely by bending the tube between the 2 balloons (the “Lipp maneuver”)

1. It is smaller and easier to insert.
2. It is a better conduit to intubation (especially the intubating LMA).
3. It allows fiberoptic visualization and intubation.

Insertion
Figure 1 shows the Combitube and a schematic representation. The Combitube, in reality, is 2 parallel tubes or channels for delivering ventilation that are attached lengthwise, only one of which—depending on insertion—ventilates any 1 patient. There are 2 inflation ports, 2 balloons, 2 insufflation ports, and 2 ways air can escape. The distal esophageal balloon is much smaller (12-15 mL) and the proximal oropharyngeal balloon larger (85-100 mL). The balloons are always inflated sequentially in the same order (ie, blue, No. 1, first; white, No. 2, second) with the pre-loaded syringe volume of air without consideration of
and/or using the index finger to steer the Combitube downward, past the palate and back of the pharynx. The tube is passed until the black lines, Figure 3, are between the incisors or alveolar ridges. In the great majority of cases, the tube rests in the esophagus, but rarely (~5% of insertions), it is passed through the vocal cords. Next, inflate the balloons, first, blue (No. 1) and second, white (No. 2; Figure 4). The volumes for inflation depend on which tube is used (see Table). Note that the Combitube will usually move 1 to 2 cm out of the mouth with inflation of the large balloon.

Next, connect an ambu bag to port No. 1 (blue; Figure 5A), and attempt ventilation. This is successful more than 90% of the time. If ventilation does not occur, attempt it through port No. 2 (white; Figure 5B). If successful, the Combitube has passed endotracheally. If this is also not successful, the Combitube is in the esophageal position but is inserted too far for the patient. In this case, deflate both balloons and retract the tube 3 cm. Then, inflate the balloons, sequentially, again. After placement, capnography or another method of confirmation of appropriate ventilation is recommended. Deep sedation and/or endotracheal intubation or extubation becomes necessary if the patient regains consciousness and/or airway reflexes.

Special circumstances

1. If time permits, insertion can be facilitated by softening the Combitube with brief soaking in warm saline.

2. If there is air leakage, more air can be added to the appropriate balloon (more likely the oropharyngeal balloon).

3. When ventilation is successful through lumen No. 1 (>90% of the time), a supplied suction catheter can be used to decompress the stomach through port No. 2.

Orotracheal intubation after Combitube placement

In the great majority of circumstances, the Combitube is in the esophageal position. An experienced intubator can safely replace it with an endotracheal tube. The risk of aspiration is greatly reduced and a rescue airway immediately available if only the large, oropharyngeal balloon (blue, No. 1) is deflated and the esophageal balloon (white, No. 2) left inflated. Experience has shown that after the air is aspirated from the oropharyngeal balloon (blue, No. 1), it should be reaspirated after a
wait of several seconds because redistribution of air occurs in the balloon. Next, the Combitube is pushed to the left of the patient’s mouth with the intubator’s finger exerting pressure as far down the Combitube into the mouth as possible because this is the area where maximum visualization is needed before endotracheal intubation with a laryngoscope is attempted (Figure 6). If tracheal intubation fails, the oropharyngeal balloon is reinflated and ventilation reestablished with the Combitube. Preferably before beginning the process but at least before removal of the Combitube, the supplied small orogastric tube should be used for gastric decompression. When the endotracheal tube is in place, the Combitube can be removed.

In the unlikely event that the Combitube is positioned in the trachea, replacement is accomplished with a tube exchanger. First, use nasogastric or orogastric suction by passing the nasogastric tube along side the Combitube after deflation of the oropharyngeal balloon. Then, when the tube exchanger is in position, remove the Combitube and pass the endotracheal tube over the exchanger.

**Summary**
The Combitube is an excellent rescue device that can be used when an airway cannot be secured by laryngoscopic endotracheal intubation. Placement is simple, easily learned, and faster than the placement of a percutaneous or traditional surgical airway. When in place, it prevents aspiration and allows higher pressures than can generally be obtained with an LMA and achieves normal ventilation.

**REFERENCES**

**ADDITIONAL INFORMATION**

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