

ADVISORY

Title:

Secondary Confirmation of ETT

Effective Date:

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Replaces/Supercedes:

Purpose

To promote the use of adjuncts for secondary confirmation and monitoring of endotracheal tube placement in adult and pediatric patients.

Background

Endotracheal intubation in adult and pediatric patients with severe respiratory failure or arrest can be a vital intervention for the prehospital advanced life support provider. However, since **failure to detect improper placement of an endotracheal tube can be fatal**, utmost care must be taken to ensure proper placement. Advanced life support providers should use both *primary* and *secondary* confirmation of endotracheal tube placement to reduce the chance of unrecognized misplacement or dislodgement. Use of a secondary confirmation device is particularly important in the prehospital setting and ambulance environment where movement of the patient at the scene and during transport increase the potential for unrecognized dislodgement.

Primary confirmation techniques for verifying correct intratracheal placement of the endotracheal tube include direct visualization of the endotracheal tube passing through the vocal cords, visual inspection of the chest for **presence** of symmetric chest rise, auscultation at the epigastrium for **absence** of gurgling sounds and auscultation at the anterior and lateral chest walls for **presence** of equal bilateral breath sounds.

Secondary confirmation techniques for verifying correct intratracheal placement of the endotracheal tube are used both following initial intubation and subsequently throughout transport. Secondary confirmation devices include *exhaled carbon dioxide (CO₂) detector devices* and *esophageal detector devices*. Both qualitative and quantitative exhaled carbon dioxide (CO₂) detector devices can be used for secondary confirmation and continuous monitoring. Qualitative devices indicate the presence of exhaled carbon dioxide (CO₂) by change in color. Quantitative devices use digital numeric read outs or waveforms to document presence of exhaled carbon dioxide (CO₂). Secondary confirmation devices are **not a substitute** for primary confirmation techniques that rely upon direct visualization and auscultation, but serve as **an additional method** of documenting proper endotracheal tube placement.

Implementation

General Considerations

For *secondary* confirmation of proper endotracheal tube placement, the prehospital care provider should use an exhaled carbon dioxide (CO₂) detector device. Options for secondary confirmation include:

- qualitative capnometry (colorimetric),
- quantitative capnometry (digital readout), or
- quantitative capnography (continuous waveforms)

When using exhaled carbon dioxide (CO₂) detector devices, assessment should be made after six ventilations to clear any retained carbon dioxide that may be present after bag mask ventilation.

Because levels of carbon dioxide may be too low to register on exhaled carbon dioxide (CO₂) detector devices in patients who are in cardiac arrest (or have severe airway obstruction or pulmonary edema), use of an esophageal detector device may be helpful. Esophageal detector devices (EDDs), both syringe and bulb types, suggest proper tube placement by noting easy aspiration of the syringe or rapid re-expansion of the bulb.

Pediatric Considerations

When using a colorimetric device in children, a pediatric sized device is recommended for pediatric patients under 15 kg. If an adult sized device must be used in a pediatric patient due to the non-availability of a pediatric device, it should be removed from the breathing circuit immediately after proper endotracheal tube placement has been confirmed. This is due to the larger amount of dead space within the adult sized device, which will interfere with proper ventilation of patients under 15 kg (approximately 2 ½ years of age).

When using a capnographic device, the adapters should be consistent with manufacturer's recommendations for age or size of patients.

At present, esophageal detector devices are marketed for use in children 5 years of age and above by one manufacturer. The American Heart Association *Emergency Cardiovascular Care Guidelines 2000* notes that while the EDD has been used successfully in children, it appears unreliable for children below 1 year of age, and there are insufficient data in emergency intubations in infants and children to recommend their routine use.

Limitations

Adjuncts for secondary confirmation of proper endotracheal tube placement may not be reliable under certain circumstances. As with many devices, there are limitations and special considerations that can affect results and interpretation. However, when interpreted along with primary confirmation, secondary confirmation provides further verification of successful intubation and helps to eliminate unrecognized esophageal intubation and dislodgement.

Exhaled Carbon Dioxide (CO₂) Detector Devices

- **Exhaled carbon dioxide (CO₂) detector devices** may detect residual CO₂ in the stomach from previous bag-valve-mask ventilations, mouth-to-mouth ventilations, or carbonated beverages. This might lead an advanced life support provider to think the tube is in the trachea when in actuality the device is detecting CO₂ from the stomach. Therefore, it is always recommended to administer six ventilations to clear any residual CO₂ from the trachea before performing the exhaled CO₂ measurement.
- **Exhaled colormetric carbon dioxide (CO₂) detector devices** that become contaminated with gastric acid or acidic drugs, such as epinephrine or lidocaine, may not be reliable. A color change that will be consistent with exhaled CO₂ may result but it will not change with ventilation. The EMS provider may think the tube is properly placed but it could be either in the esophagus or the trachea.
- **Exhaled carbon dioxide (CO₂) detector devices** may not register CO₂ in circumstances where not enough CO₂ is delivered to the lungs or exhaled because of conditions such as cardiac arrest, status asthmaticus, and pulmonary edema. In such circumstances, there is insufficient CO₂ production to produce a color change (colorimetric device) or register a digital reading (capnometry), although carbon dioxide waveform (capnographic) devices register even very low concentrations of carbon dioxide. Therefore, in cardiac arrest, it is recommended that when the exhaled carbon dioxide (CO₂) detector device does not register CO₂, an EDD device also be used, especially if signs of primary confirmation are present.

- **Pediatric exhaled carbon dioxide (CO₂) detector devices** should be employed as per manufacturer recommendations to assure use of the appropriate size for infants and children. Note that in children less than 2 kg (approximately 4½ lb), CO₂ monitors may not register CO₂ even if the tube is in the trachea. With very small infants, the smaller volumes of CO₂ exhaled are insufficient to produce a color change (colorimetric device), a digital readout, or the characteristic waveform (capnographic devices).

Esophageal Detector Devices

- **Esophageal detector devices** may give **misleading results** when there is **excessive gas in the stomach due to CPR** and there is easy pull back of the syringe or rapid expansion of the bulb. In this situation, the EMS provider may believe the endotracheal tube is properly placed in the trachea but it could be in the esophagus.
- **Esophageal detector devices** may **meet resistance to air pull** when the tube is actually in the trachea in situations such as: **clogging of the tube** with thick secretions, **morbid obesity**, or **COPD**. In these situations, the advanced life support provider might think that the tube is in the esophagus when it could be in the trachea.

Application

To confirm proper placement of an endotracheal tube, advanced life support providers should use both primary and secondary confirmation:

Primary confirmation includes:

- Direct visualization of the endotracheal tube passing through the vocal cords,
- Observation of chest rise with positive pressure ventilation,
- Auscultation of the epigastric region for absence of gurgling, and
- Auscultation of the anterior and lateral chest walls for presence of breath sounds.

Secondary confirmation includes:

- Exhaled carbon dioxide (CO₂) detection, using colorimetric device, capnometry or capnography.
- If the CO₂ detector does not register CO₂ and a pulse is present, rely on the CO₂ device.

- 👤 If the CO₂ detector does not register CO₂ and the patient is in cardiac arrest, test with the esophageal detector device.
- 👤 When in doubt about proper tube placement, visualize correct placement of the tube between the cords or remove the tube.

Prehospital providers must continue to confirm proper tube placement with clinical signs of adequate ventilation and end tidal CO₂ detector devices throughout treatment and transport. This is particularly important because the potential for dislodgement of the tube during patient movement and patient transport is high.

As with any adjunct, it is important to have proper training in its use, to follow the manufacturer's recommendations, know the device's indications and limitations, and to follow medical protocols.

QA/QI

The SEMAC will develop a process to monitor the success rate of endotracheal intubation by prehospital providers, to be implemented by the REMACs. This will include at least the following:

1. Develop and implement a process to track use of secondary confirmation devices by type in adult and pediatric patients being intubated.
2. Develop and implement a process to record physician verification of proper tube placement on arrival at the emergency department.
3. Develop and implement a process to provide continuing education and appropriate remediation based on the results of 1 and 2 above.

References

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