

DIAGNOSTIC CHALLENGE

Answer

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The most appropriate next step in the management of this patient is to attempt video laryngoscopy again (i.e., answer D).

Despite what the end-tidal CO₂ detector indicated, the endotracheal (ET) tube was above the vocal cords. When the GlideScope® video laryngoscope (Saturn Biomedical Systems Inc., Burnaby, BC) was reinserted, it was apparent that the tip of the ET tube was lodged in the hypopharynx and had bent into the shape of a U (Fig. 1). End-tidal CO₂ was detected because oropharyngeal edema created a seal around the ET tube.

The cuff was deflated, the tube was removed, and the patient was effectively ventilated with a bag–valve–mask unit, during which oxygen saturation did not fall below 92%. Orotracheal intubation was then again attempted using the GlideScope, and this time the tip of the tube was seen to pass through the vocal cords.

Although a portable chest x-ray would definitely help in confirmation of ET tube placement, the management delay would be inappropriate. Changing the end-tidal CO₂ monitor and aggressive ventilation would be futile, since the ET tube was not in the trachea.

Proceeding directly to tracheostomy is a reasonable option after failed difficult intubation. Given the fact that oxygen saturations were maintained and considering the anticipated early resolution of airway angioedema, however, we opted for one more try at orotracheal intubation.

Commentary

Colorimetric end-tidal CO₂ detectors provide continuous semiquantitative measurement of end-tidal CO₂ using a

pH-sensitive chemical strip that changes colour upon exposure to the gas. The colour ranges for the Portex® device (Smiths Medical ASD, Keene, NH) are blue, green, green-yellow, and yellow, which correspond to levels of 0–1, 1–2, 2–5, and >5% CO₂, respectively. Normally, end-tidal CO₂ is > 4%.^{1,2}

In hemodynamically stable patients, colorimetric capnometry can discriminate between tracheal and esophageal

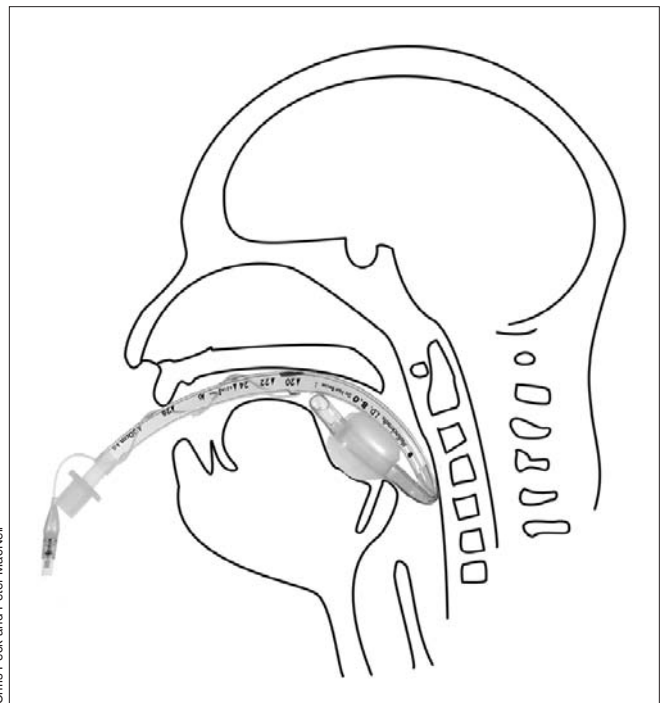


Fig. 1. One possible representation of flexed ET tube causing a partial seal in the glottis sufficient to detect end-tidal CO₂ synchronous with respiration.

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intubation with almost 100% sensitivity and 100% specificity provided that the ET tube cuff is inflated.¹ Colorimetric detectors can also detect inadvertent tracheal placement of feeding tubes.³ Falsely positive CO₂ levels can occur with esophageal intubation during cardiac arrest,¹ contamination of the detector with lidocaine or gastric acid, and when there are carbonated beverages in the stomach.^{4,5} To our knowledge, falsely positive colorimetric CO₂ detection due to ET tube distortion has not been reported.

In this patient the end-tidal CO₂ detector was accurately indicating abundant carbon dioxide from cellular respiration, yet clinical signs indicated that the tube had not passed through the vocal cords. In retrospect, supraglottic airway distortion had prevented passage of the ET tube, and it bent during advancement; consequently, passage of the fiberoptic bronchoscope was impossible. Tongue and palatal edema provided a partial seal, so that expired CO₂ flowed out through the proximal connection of the ET tube leading to an appropriate colorimetric change in the detector.

This case should remind emergency physicians that no one method to confirm proper ET tube placement is bullet-proof. Clinical signs can still help us make the right choice in emergency airway management.

Competing interests: None declared.

Key words: coliremetric capnography; difficult intubation; end-tidal CO₂; GlideScope

References

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For the Challenge, see page 436.

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