

## Answers to Medical Quiz

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A1. The endotracheal tube was placed incorrectly in the right main bronchus, as shown in figure 1. This had caused obstruction of the left main bronchus, and left lung collapse as shown in figure 2.

A2. The tip of an endotracheal tube should be placed approximately 5 cm above the carina, just below the level of T1.

A3. Increased density of a Hemithorax:

- a. With central Mediastinum:
  - i. Consolidation
  - ii. Small Pleural Effusion.
  - iii. Mesothelioma.
- b. With Mediastinal Displacement away from Dense Hemithorax.
  - i. Pleural effusion.
  - ii. Diaphragmatic hernia.
- c. With Mediastinal Displacement toward the dense Hemithorax:
  - i. Collapse.
  - ii. Post-pneumonectomy.
  - iii. Pulmonary agenesis and hypoplasia.

### DISCUSSION

Complications of endotracheal intubation include acute laryngotracheal injury, tooth displacement or avulsion, laryngospasm, sinusitis, pneumothorax, edema of the vocal cords and glottis, pharyngeal injury, tracheal ulcers, epistaxis, aspiration of gastric contents, cardiac arrest, seizures, anoxic brain damage, and malpositioning of the endotracheal tube, including esophageal intubation. Complications occur most often following a prolonged intubation attempt, defined as four or more intubation or an intubation attempt lasting more than two minutes.

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Accidental intubation of a mainstem bronchus will lead to absent breath sounds on the contralateral side with worsening atelectasis, tracheal deviation to the contralateral side, and hyperinflation of the intubated lung. Hypoventilation and hypoxemia may result. While intubation of the right mainstem bronchus occurs in 7-9% of all intubations, left mainstem bronchus intubation is much less common. Awareness of the length of the tube inserted will aid in preventing tube malpositioning. In men, the tube is commonly placed to a depth of 23 cm at the lips, while in women it is commonly placed to 21 cm at the lips. Other indications of correct tube placement,

include visualization of the cords during intubation, palpation of the tube in the larynx, and measurement of end-tidal CO<sub>2</sub>; however, those may not aid in detecting intubation of a mainstem bronchus. Absent breath sounds over one lung and asymmetrical chest expansion during breathing may help the diagnosis. A chest radiograph will verify the position of the tube and help to exclude a pneumothorax.

In a recent study of 246 patients intubated in ICU, their radiographs demonstrated that 185 had malpositioned endotracheal tubes. In 107 patients the tube was at or above the level of the clavicles, while in an additional 78 the distal end of the tube was within 2 cm of the carina. Patient movement can account for many of these cases, as head extension can raise the tip of the tube 2 cm, and head flexion can lower the tip 2 cm. With the head in a neutral position, the tip of the tube should be placed with the tip 5-7 cm above the carina. While tubes placed too deeply can cause a mainstem bronchus intubation, a shallow tube can lead to vocal cord injury or inadvertent extubation. Frequent checks of the endotracheal tube position as well as securing the tube are essential measures to ensure the tube stays in the correct position.

## **References**

1. Chapman S, Nakielny R. *AIDS to Radiological Differential Diagnosis*. 3<sup>rd</sup> ed. Philadelphia: Saunders, 1995.
2. Goodman L, Putman C. *Critical Care Imaging*. 3<sup>rd</sup> ed. Philadelphia: Saunders, 1991.