

Mechanical Ventilation Case Questions And Answers

Case 1

A 55 year-old man with a history of COPD presents to the emergency room with a two day history of worsening shortness of breath which came on following a recent viral infection. In the emergency room, his oxygen saturation is 88% on room air. He is working hard to breathe and is only speaking in short sentences. On exam, he has diffuse wheezes and a prolonged expiratory phase. His chest x-ray reveals changes consistent with COPD but no new focal infiltrates. An arterial blood gas (ABG) is done and shows pH 7.17, PCO₂ 55, PO₂ 62, HCO₃⁻ 25.

What are the indications for starting a patient on mechanical ventilation?

There are several primary indications for initiating mechanical ventilation including: hypercarbic respiratory failure, hypoxemic respiratory failure, to prevent or reverse atelectasis, to prevent or reverse ventilatory muscle fatigue, to permit sedation and/or neuromuscular blockade (eg. surgery), to stabilize the chest wall (eg. massive flail chest) or to ensure airway protection (eg. a patient with altered mental status and a large upper gastrointestinal bleed).

One should be aware that with hypercarbic and hypoxemic respiratory failure, there are no specific thresholds that are used to determine when to initiate mechanical ventilation. For example, you do not automatically intubate a patient when their PCO₂ rises above 60 mm Hg or their room air PO₂ falls below 55 mm Hg. Instead, you must take into account the overall clinical situation and assess whether the degree of hypercarbia or hypoxemia is putting the patient's life at risk. If they can be supported by other means, such as oxygen by face mask, you might hold off on initiating mechanical ventilation, whereas if their PO₂ continues to fall despite high levels of supplemental oxygen, mechanical ventilation would be necessary. Similarly, if a patient is hemodynamically stable, you might try oxygen by facemask for hypoxemic respiratory failure but if the patient is showing signs of sepsis with hemodynamic instability and multiorgan dysfunction, you would move more quickly to intubate the patient and stabilize their respiratory status in order that you can focus on other important issues.

What do you think about the possibility of using non-invasive positive pressure ventilation (bi-level positive airway pressure) in this patient?

There are two forms of mechanical ventilation – *invasive* mechanical ventilation, in which an endotracheal tube is inserted in the patient's airway, and *non-invasive* ventilation, in which the patient receives respiratory support through a tight fitting mask applied to their face. There are some situations in which invasive modes of mechanical ventilation are necessary and other situations in which patients can be supported by non-invasive means.

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