

Hypoxia: Physiologic Responses

Anesthetic Pearls: Anesthetic Implications and Management of Hypoxia

Ventilatory Changes:

During spontaneous ventilation under anesthesia:

1. Increased respiratory rate
2. Little change tidal volume
3. Increased minute ventilation
4. Increase in dead space/tidal volume ratio
5. Decrease in arterial pH (acidosis)
6. Decreased PaCO₂

Changes are more pronounced in awake patients, although the response to hypoxia is blunted by very low levels of inhaled anesthetic.

These changes are altered by hypothermia (less increase in minute ventilation).

Circulatory changes:

A. Increases in:

1. Cardiac output
2. Heart rate
3. Arterial blood pressure
4. Pulmonary vascular resistance initially, followed by return to normal if hypocapnia develops in response to ventilatory changes
5. Cerebral blood flow

B. Maintained oxygen consumption

C. Decreases in: 1) Oxygen delivery, 2) Systemic vascular resistance

Severe or prolonged hypoxia leads to:

- profound hypotension
- bradycardia
- dysrhythmias
- eventual CV collapse

Mechanical ventilation: (if PaCO₂ is kept normal using mechanical ventilation with paralysis)

Decreased: 1) heart rate; 2) pH of arterial blood (acidosis)

Increased: 1) arterial blood pressure; 2) peripheral vascular resistance

Other signs:

- A. Cyanosis: requires a arterial saturation < 85%; necessitates > 5 grams of reduced hemoglobin to be clinically apparent; less useful in anemic patients
- B. Dark blood in surgical field
- C. Restlessness or agitation in conscious patients (for example in recovery room)

