

STRATEGIES TO OPTIMIZE GAS EXCHANGE ON MECHANICAL VENTILATION

■ ARTERIAL OXYGENATION

The optimal partial pressure of arterial oxygen (P_{aO_2}) and oxygen saturation measured by pulse oximetry (SpO_2) during mechanical ventilation remain uncertain. Although tissue hyperoxia can cause oxidative injury, with some clinical studies of mechanically ventilated patients suggesting worse clinical outcomes with higher F_{IO_2} and when P_{aO_2} frequently reaches supraphysiologic levels, randomized studies comparing conservative oxygen delivery to a more liberal oxygen strategy have not demonstrated a clear advantage to conservative oxygen delivery. In ARDS, targeting a lower P_{aO_2} of 55–70 mmHg (or SpO_2 of 88–92%) versus a higher, but more physiologic, P_{aO_2} of 90–105 mmHg (or $SpO_2 >96\%$) did not lower mortality, with adverse events being more frequent in the lower P_{aO_2} group, including mesenteric ischemia. P_{aO_2} and SpO_2 targets, therefore, should be individualized to patients considering circumstances where even mild hyperoxia may be harmful, such as in recovery from ischemic brain injury and, conversely, where lower P_{aO_2} levels (<55–70 mmHg) may be less optimal, such as in patients with ARDS and evidence of bowel dysfunction. Regardless of the approach, there is no evidence that a supraphysiologic P_{aO_2} (>100 mmHg) has clinical benefit; thus, sustained hyperoxia should be avoided.

Arterial hypoxemia refractory to standard mechanical ventilation techniques is common in severe acute lung disease, especially ARDS. In general, if the F_{IO_2} requirement is >0.6 or the $P_{aO_2}:F_{IO_2}$ ratio is <150 mmHg, additional interventions should be considered to improve arterial oxygenation. The application of adequate PEEP to prevent alveolar collapse during exhalation improves oxygenation by decreasing $\dot{V}/\dot{Q}$ mismatch and shunt in areas of atelectatic lung. PEEP should ideally be set at the lower inflection point of the most compliant region of the lung pressure-volume curve ([Fig. 302-2B](#)). Although optimal PEEP may improve arterial oxygenation, achieving