

## Optimal approach to mechanical ventilation after cardiac arrest



Return of spontaneous circulation after cardiac arrest results in a systemic inflammatory state called the post-cardiac arrest syndrome (PCAS), characterised by oxidative stress, coagulopathy, neuronal injury, and organ dysfunction. Further, patients who suffer cardiac arrest are at high risk for pulmonary infection. Meticulous attention to mechanical ventilation, early assessment and optimisation of respiratory gas exchange, and therapies targeted at potential pulmonary complications may improve outcome after cardiac arrest, says an article in press in the journal CHEST.

In the article, Dr. Nicholas J. Johnson, from the Department of Emergency Medicine, University of Washington, Seattle, WA, and co-authors provide an overview of ventilator management and respiratory care geared towards improving neurologic outcome. The authors note that "maintenance of normal oxygen and carbon dioxide tensions, aggressive surveillance for pulmonary infection, and ventilation with low tidal volumes have been associated with improved outcome among patients with PCAS."

### Oxygenation and ventilation

Oxygen management after cardiac arrest, the authors explain, attempts to strike a balance between sufficient oxygen delivery to meet the metabolic needs of the cells while avoiding hyperoxia and the potential injury from excess oxygen present during ischaemia and reperfusion. Hypoxaemia produces ongoing ischaemia, irreversible cellular injury, and organ dysfunction, while hyperoxaemia may increase oxidative stress, amplify free radical production, and worsen organ function. Whether hyperoxaemia and hypoxaemia are biologically harmful, or simply markers of underlying illness or less attentive care, is not yet known in the post-arrest population.

Meanwhile, an important interaction exists between arterial partial pressure of carbon dioxide (PaCO<sub>2</sub>) and outcome after cardiac arrest with a variety of possible mechanisms. Arterial hypocarbia appears to be associated with poor neurologic outcome, and should be avoided. Because of this, the authors say early blood gas analysis is crucial in this population.

"Normal arterial oxygen and carbon dioxide tensions have been associated with improved neurologic status, and preliminary data indicate that mild hypercarbia might also be useful," write Dr. Johnson and colleagues.

### Lung injury and pulmonary infection

Patients who suffer cardiac arrest are at risk for lung injury due to a variety of mechanisms. Risk factors, such as aspiration, shock, pulmonary contusion due to chest compressions, infection, and reperfusion injury are common in this population. Patients who suffer from cardiac arrest are also at risk of developing the acute respiratory distress syndrome (ARDS).

"Patients with ARDS after cardiac arrest should be ventilated according to the ARDSnet low-tidal volume strategy with  $\leq 6$  ml/kg of predicted body weight. Post-arrest patients without ARDS may benefit from a low tidal volume ventilation strategy, though prospective trials are needed," the authors write.

Further, pulmonary infection is a common complication of cardiac arrest. Risk factors may include witnessed aspiration, seizure, duration of mechanical ventilation, pre-existing dementia, and the use of targeted temperature management at 33°C. "Clinicians should seek to exclude pneumonia in these patients by obtaining sampling of the lower respiratory tract and beginning empiric antibiotics in any patients with evidence of aspiration. Culture data can then subsequently be used to narrow or stop antimicrobials," the authors explain.

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