

In this month's issue, we are pleased to publish the papers from the Journal Conference, "Adult Mechanical Ventilation in Acute Care: Issues and Controversies." These should be of interest to anyone who cares for patients receiving mechanical ventilation. We are grateful to Rich Kallet and Neil MacIntyre for their help in organizing this conference and bringing together a world class faculty.

Ventilator-induced lung injury (VILI) results from injury to the blood-gas barrier caused by mechanical ventilation. The determinants of VILI include the nature, duration, and intensity of the exposure, as well the pattern of initial insult to the lungs. Lung-protective ventilation founded on these basic principles has resulted in improved hospital and long-term mortality. Biehl and colleagues appraise the most recent evidence informing the best preventive approach in patients with or at risk for ARDS.

As presented by Marini, relatively little attention has been directed toward damage inflicted upon the airway network that connects the alveoli, or toward the problems caused by invasive ventilation for patients with severe airflow obstruction. Positive pressure ventilation may cause non-edematous barotrauma, inflict airway injury, and promote lung remodeling. Interactions between patient and ventilator include functional consequences for hemodynamics, respiratory muscle function, breathing workload, and patient-ventilator synchrony. Awareness of such associations not only helps avoid complications during and after the critical phase of obstructive illness, but also opens a window to improved patient comfort and safety.

Evidence strongly supports use of noninvasive ventilation (NIV) in patients presenting with COPD exacerbation and in patients with acute cardiogenic pulmonary edema. As discussed by Hess, there is now evidence supporting or not supporting the use of NIV in various other causes of acute respiratory failure. Although a variety of interfaces are available, the oronasal mask is the best initial interface in terms of leak prevention and patient comfort. Some critical care ventilators compensate well for leaks, but as a group, the ventilators designed specifically for NIV have better leak compensation.

Patient-ventilator synchrony and patient comfort are assumed to go hand in hand, yet few studies provide support for this common sense idea. Branson et al point out that synchrony between the patient and ventilator is complex and can be affected by the ventilator settings, type of ventilator, patient-ventilator interface, and sedation. Airway pressure and flow waveforms are reliable for detecting asynchrony. Although there is an association between asynchrony, ventilator-induced diaphragmatic dysfunction, and duration of mechanical ventilation, whether these are cause and effect or simply associated remains to be determined.

As discussed by Mietto et al, ventilator-associated pneumonia (VAP) is a frequent hospital-acquired infection occurring in intubated patients. Although it has been proposed as an indicator of quality of care, clinical diagnosis has poor accuracy and reliability. Institutions are reporting a VAP zero rate in surveillance programs, raising skepticism. The Centers for Disease Control and Prevention introduced a new definition based upon objective data. The principal source of VAP is contaminated oropharyngeal secretions that pool above the airway cuff and subsequently leak into the lungs. VAP prevention should be addressed by factors related to the endotracheal tube.

Intra- and inter-hospital transport is common due to the need for advanced diagnostics and procedures, and to provide access to

specialized care. Adverse events are frequent during transport, with the most common being equipment malfunctions. During inter-hospital transport, increased transfer time is associated with worse patient outcomes. The use of specialized teams for the transport of children has been shown to decrease adverse events. Intra-hospital transports often involve critically ill patients, which increases the likelihood of adverse events. Blakeman and Branson recommend that portable ventilators be used for transport because studies show that use of a manual resuscitator results in inconsistent ventilation. Diligent planning and monitoring during transport may decrease adverse events and reduce risk.

Sedation is used almost universally in the care of critically ill patients requiring mechanical ventilation or other life-saving invasive procedures. The paper by Piriyaapatsom and colleagues focuses on sedation strategies and reviews the pharmacology of commonly used sedative agents. The role of neuromuscular blocking agents is examined and the pharmacology of commonly used agents is reviewed. A strategy for use of sedative and neuromuscular blocking agents in critically ill patients is proposed.

Extracorporeal membrane oxygenation (ECMO) is a mainstay of therapy in neonatal and pediatric patients with life threatening respiratory and/or cardiac failure. Turner and Cheifetz discuss patient selection, indications, contraindications, comorbidities, and pre-ECMO support. Once the decision is made to cannulate a patient for ECMO, a priority is placed on lung rest and minimization of VILI. Reports demonstrate > 70% survival in some circumstances for patients requiring ECMO for refractory respiratory failure.

Kallet describes the rationale and examines the evidence supporting adjunctive therapies during mechanical ventilation. Intrapulmonary percussive ventilation may enhance pulmonary secretion mobilization and might reverse atelectasis, but its impact on outcomes is uncertain. The role of aerosolized antibiotics is controversial, particularly with VAP caused by multi-drug resistant pathogens. Inhaled pulmonary vasodilators provide a short-term improvement in oxygenation. Uncontrolled studies suggest aerosolized heparin with N-acetylcysteine might be useful in patients with severe inhalation injury. There is low-level evidence that heliox is effective in reducing airway pressure and improving ventilation with airway obstruction. Each of these therapies is supportive, but none has been shown to improve patient outcomes.

The ventilator discontinuation process is reviewed by MacIntyre. Recommended are regular assessments focusing on the causes of ventilator dependence, regular assessments for evidence of disease stability/reversal, use of regular spontaneous breathing trials (SBTs) as the primary assessment tool for ventilator discontinuation potential, use of separate assessments to evaluate the need for an artificial airway in patients tolerating the SBT, and the use of comfortable ventilator modes between SBTs. Recent developments have focused on the importance of linking sedation reduction protocols to ventilator discontinuation protocols. Patients with repeated SBT failures often require prolonged mechanical ventilation (PMV). There remains room for improvement and further clinical studies related to the ventilator discontinuation process.

Kacmarek describes the competencies of the respiratory therapist regarding mechanical ventilation in 2015 and beyond. Respiratory therapists are expected to be the experts on the ventilator and all aspects of the application of mechanical ventilation. They will be considered consultants on all aspects of ventilatory support. This requires an expanded education in a number of areas.