

Pulmonary rehabilitation has been shown to be an effective therapy in COPD, but logistics make adherence with regimen a problem. Benzo and colleagues report on use of a home pulmonary rehab program using a tablet, activity monitor and oximeter. Exercises included walking and full body strength training 6 days a week. In this pilot study, the authors used health coaching and readily available components to facilitate remote monitoring. The promise of the digital age and remote monitoring and guidance is only now coming to fruition. Collins opines that such a program makes pulmonary rehab accessible for those patients unable or unwilling to attend a center-based program. Further work in this vein is needed.

Noninvasive ventilation (NIV) presents important challenges for aerosol delivery, particularly in pediatrics. Velasco and Berlinski evaluated aerosol delivery during NIV in a pediatric model using a dual-limb ventilator circuit. They varied nebulizer type, position in the circuit and ventilator settings delivered to a non-vented mask. They report that mesh nebulizers performed better than jet nebulizers regardless of position. Additionally, they demonstrated that increasing inspiratory pressure only improved delivery from the jet nebulizer placed at the ventilator. These data suggest that nebulizer efficiency depends on nebulizer type and position in the circuit. Importantly, data on aerosol delivery during invasive ventilation cannot predict NIV delivery. Xu and Ma contrast the role of the ventilator circuit in invasive ventilation (as a reservoir) compared to NIV where a fixed-leak results in loss of drug to the atmosphere.

High-flow nasal cannula (HFNC) is widely used in pediatrics and adults with good results. The mechanisms of action include washout of the anatomical deadspace, development of end expiratory pressure, and consistent F_{IO_2} delivery. Nielsen and colleagues evaluated HFNC in infant, pediatric and adult models. Using 3-D printed upper airway models and a lung model featuring hypercapnia, they demonstrated that increasing flow improved CO_2 elimination to a point above which further increases failed to change CO_2 but markedly increased expiratory pressure. Not surprisingly, open mouth breathing significantly decreased expiratory pressure. These data help to define responses seen clinically with HFNC.

Mechanical models of the respiratory system are often based on engineering assumptions and values from normal patients. This leads to a multitude of lung model studies using widely disparate values for compliance and resistance. Arnal and others attempted to address this issue by evaluating compliance and resistance values from a group of mechanically ventilated subjects with normal lungs, COPD and ARDS. Consistent with pathology, COPD subjects had higher resistance and higher compliance values while ARDS was associated with low compliance values. These data can be used to describe mechanical models of disease using clinically encountered data.

Esophageal manometry has been shown to be useful in selecting PEEP in patients with altered chest wall compliance and monitoring the work of breathing. A caveat in esophageal pressure monitoring is correct placement of the catheter such that transpulmonary pressure can be determined. He and colleagues describe an alternative to the typical occlusion test to ascertain proper placement. Using the cardiac cycle locating method they found that they could

more reliably detect improper placement of the esophageal balloon. Reduction of this method to practice might increase the reliability of esophageal pressure measurements.

Hotz and colleagues also evaluated esophageal balloon use in a pediatric model. They found that optimal filling of the balloon prevents both under- and overestimation of simulated pressures. Their data suggest a need for improved esophageal catheters for pediatrics and determination of the optimal filling volume for measurement accuracy.

Mechanical insufflation-exsufflation (MI-E) has been shown to improve secretion clearance in neuromuscular disorders. Siriwat and others compared MI-E to traditional chest physiotherapy in children with cerebral palsy. There were no differences in clinical outcomes, but they report a shortened therapy time (by 1 d) in the MI-E group. These small differences in a group of 22 children suggests MI-E is safe and as effective as traditional chest physiotherapy.

The use of extracorporeal membrane oxygenation (ECMO) in adults has increase exponentially in the last 5 years. The untoward impact of ECMO is often lost amongst the stories of success in critically ill patients. Hayes and coworkers retrospectively reviewed subjects requiring ECMO prior to lung transplant. They found that survival was 82%, but that leg complications and physical function were poor at ICU discharge. Compared to subjects not requiring ECMO, these subjects had worse physical function at ICU and hospital discharge. This small study was complicated by possible differences in severity of illness between groups but it reminds us that survival beyond ICU following heroic measures carries important consequences.

Monitoring the electrical activity of the diaphragm (EA_{di}) and using this signal for controlling the ventilator is the basis of neurally adjusted ventilatory assist (NAVA). However, monitoring EA_{di} alone may have some utility in determining synchrony and patient workload. Singh and others monitored EA_{di} in a convenience sample of 21 preterm infants with respiratory distress during discontinuation from ventilator support. They found that lower birthweight and younger gestational age were associated with extubation failure. The mean peak EA_{di} did not discriminate failures from successes.

In a group of pediatric subjects following cardiac surgery, Crulli and coworkers retrospectively reviewed their use of both invasive and noninvasive NAVA. In 28 subjects they demonstrated that NAVA was associated with lower peak and mean airway pressures compared to conventional ventilation. Unfortunately, there was no protocol or consistency in the approach to conventional ventilation, limiting the meaning of these airway pressure changes. The authors reliably conclude that NAVA was effective following cardiac surgery, but no changes in clinical outcomes were able to be elucidated with this study design.

Height, race, age and sex are the major determinants of lung capacity and function. Haynes and Stumbo address the issue of non-birth sex on the interpretation of spirometry in subjects with airflow obstruction. Current issues related to gender identity make this paper of topical interest. They found that in transgender subjects with airflow obstruction and the use of non-birth sex to determine predicted values increased the risk of both misdiagnosis and inappropriate treatment.