Scott Shelbo, 2006 Research Scholar Summer Intern

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Respiratory Care Department

- Summary of Experience

The Research Scholar Summer Internship Program provided both an organized and positive educational experience. I am thankful for the opportunity to be exposed to a clinical setting whose reputation is one of the best in the nation. The internship presented a unique opportunity to work in a teaching institution with clinicians, practitioners, administrators, therapists, and educators. My experience has vastly improved my knowledge of healthcare, respiratory care, and medical practices in general.

During my time with Lehigh Valley Hospital’s Respiratory Care Department, I was exposed to many aspects of respiratory and pulmonary care. The great thing about my internship was that I wasn’t just exposed to respiratory care, but all departments of medicine. I was able to see how respiratory care is practiced in each different department. The departments that I observed were Respiratory, MICU, SICU, NICU, PICU, NSICU, OHU, Trauma/ER, Burn Unit, Sleep Lab, Asthma Clinic, PFT Lab, and the OR. From total exposure in the different units of the hospital, I was able to see how everything (resources) and everyone (staff/patients) comes together to produce efficient and effective medicine.

In the Respiratory Care Department, I worked closely with the members of respiratory, including technicians, administrators, educators, and therapists. I attended daily physician rounds and ventilator rounds in the different units. When attending ventilator rounds, I received lectures on the different ventilators, how to use each ventilator, their modes of ventilation (SIMV, CMV, APRV, CPAP), and which type of ventilation different patients receive depending on their diagnosis and symptoms. I observed tracheotomies, bronchoscopies extubations, intubations, and heliox. While discussing different patients on vent and physician rounds, we often referred to chest X-rays and CT scans to diagnose and evaluate each patient. I observed bedside care procedures and was able to witness the relationship between patient and practitioner. When I shadowed a respiratory therapist on call for the ER, I attended trauma alerts and surgery. In other departments, I observed C-sections, sleep apnea tests, pulmonary
function tests, ABG, and asthma tests. As well as observing in the clinical setting, I attended departmental meetings for the Journal Club, Metavision, Abstract Proposal Committee, and Practice Care Committee. I also attended clinical in-services and coordinator meetings. My entire experience with Lehigh Valley Hospital and the Respiratory Care Department has upheld my interest in healthcare and I am committed to help further improve national healthcare. This was the single best educational experience I have ever been part of. If other healthcare institutions emulate Lehigh Valley Hospital and its values, missions, and goals, healthcare will continue to move forward. LVHHN sets the standard for exceptional healthcare.

- **Summary of Research**

  The research that I performed with members of the Respiratory Care Department focused on Airway Pressure Release Ventilation (APRV). APRV is a ventilatory strategy used in the critical care setting for patients with Acute Lung Injury (ALI) or Acute Respiratory Distress Syndrome (ARDS). These are basically the same, but ALI is sometimes less severe. ALI is defined as a bilateral lung process and a reaction to other lung injury or underlying illnesses. It occurs when fluid builds up in the lungs and makes breathing difficult. The fluid buildup in the lungs causes the alveoli to collapse. Alveolar cells in the lungs normally release surfactant that functions to lower the surface tension of water and prevent the collapse of lungs. Without functional alveoli, the lungs also collapse, impeding gas exchange, ventilation, and CO₂ removal. Therefore, a patient is intubated and APRV functions to maintain alveolar inflation by maintaining a constant airway pressure in the lungs and not allowing the lungs to collapse. The goal of APRV is to improve the patient’s oxygenation and ventilation while protecting the lungs. Also, Automatic Tubing Compensation (ATC) is a ventilatory adjunct that helps the patient to overcome airway resistance associated with breathing through an artificial airway (i.e. it makes it more comfortable for the patient to breathe).

  The bench study performed is titled “Comparison of Five Critical Care Mechanical Ventilators during the Delivery of Airway Pressure Release Ventilation.” The goal of the study was to perform such a comparison and also determine whether Automatic Tubing Compensation (ATC) affects the release volume. Before carrying out the bench study, we hypothesized that all critical care ventilators would
deliver APRV pressure and volume ventilation in a similar and consistent manner, and that activation of ATC would not influence the APRV results. The five different ventilators tested were the Avea, Drager, Servo-I, Galileo, and Puritan Bennett 840. Each different ventilator was individually connected to a Michigan Lung Simulator and the PneuView Adult Lung Project Software for data collection. Release volumes, peak proximal airway pressures, and right lung volumes were evaluated at three different lung compliances and three different airway resistors at five different pressure levels. This was tested with both ATC activated and deactivated. Duration of pressure delivered, expiratory time, and oxygen delivery were kept constant for all measurements.

I carried out the entire bench study and research project while working with a respiratory technician and administrators/educators/coordinators. I was in charge of updating the PneuView software, setting up the five different ventilators to the test lung, setting up and changing the ventilator parameters, composing data tables, charts, and graphs, the entire data collection, trend analysis, results comparison, and research analysis. This type of study was never done before, making it exciting and challenging.

We concluded that there was no significant difference in the five different ventilators during the APRV settings with the ventilatory adjuncts deactivated. However, when ATC was activated on the Drager ventilator, we observed a noticeable increase in pressure delivered. This has the potential of inducing further lung injury. Also, the Puritan Bennett 840 could not maintain a constant airway pressure when the compliance was low and resistance was high (i.e. a very stiff and diseased lung). The Galileo, Avea, and Servo-I seemed to be the most favorable ventilators based on their consistent data collection and performance.

This study leads one to question the role of ATC in APRV delivery and makes it evident that caution needs to be addressed when using the Drager and Puritan Bennett 840 during APRV. Clinicians need to better understand the delivery of ventilatory modes via their critical care ventilators. APRV is an efficient way to ventilate as long as the ventilator works as it is intended to. More efficient ventilation means faster extubation and quicker liberation, thus decreasing the length of stay and healthcare costs.

**I also worked with the Neonatal/Pediatric Coordinator in APRV PICU data collection.