

## **Abstract**

There are different methods monitoring thoracic organ function in the critically ill by using various imaging methods (chest x-ray, computed tomography, magnetic resonance, and the newly popular lung ultrasound as a stand-alone method or combined with echocardiography). The disadvantages of these methods make lung ultrasound in this group of patients an exquisite bedside imaging tool to assess and diagnose a myriad of lung pathologies, gauge therapeutic interventions and ultimately assess the diaphragm, extradiaphragmatic apparatus and cardiopulmonary changes during weaning of mechanical ventilation and as thus predict its potential failure or success. Furthermore, lung ultrasound has also proved to be extremely useful during the COVID-19 pandemic in assessing COVID-19 pneumonia and its complications with a resultant reduction in potential cross-contamination of staff and patients due to transport to and from the radiology department for imaging. Moreover, vital information can be attained on the hemodynamics of a patient when lung ultrasound is combined with vascular assessment and echocardiography.

This doctoral thesis delved into evaluating chest drain positioning on chest x-ray using several simple parameters (chest drain inclination, tortuosity of the chest drain and its foreshortening) and we further sought to locate a chest drain on lung ultrasound post drainage. These investigations into chest drain positioning help in the diagnosis of chest drain malposition which can potentially lead to residual/occult pneumothoraces which further can have dire implications in mechanically ventilated patients. We also challenged the established method of quantifying pleural fluid volume on lung ultrasound wherein this method could give erroneous pleural fluid estimates in patients with consolidated lungs and lastly, we sought the impact of serial imaging with the growing popularity of lung ultrasound on the intensive care unit outcome of patients with COVID-19, acute respiratory distress syndrome treated with extracorporeal membrane oxygenation.

**Keywords:** Lung ultrasound, chest x-ray, computed tomography, pneumothorax, pulmonary consolidation, pleural effusion, pulmonary edema, COVID- 19 pneumonia, acute respiratory distress syndrome, pulmonary embolism, fluid loading, extravascular lung water, proning, weaning failure, diaphragm dysfunction