

Gerhard K. Wolf, MD

Young Clinician Award 2009

## Investigator Profile

### Education

- Doctor of Medicine, Ludwig Maximilians University, Munich, Germany
- MD, Ludwig Maximilians University, Munich

### Clinical/Professional Appointment

- Instructor in Anesthesia, Harvard Medical School
- Associate in Anesthesia, Children's Hospital Bostc.,
- Pediatric Medical Director, Boston MedFlight
- Associate Director, Critical Care Transport Team, CHB



## Impact on Care

- Pediatric acute lung injury (ALI) has a high mortality (22%) compared with the overall mortality of pediatric intensive care unit patients.
- There is an urgent need to improve ventilation strategies in children with ALI.
- Assessing lung volume in critically ill children with acute respiratory distress syndrome (ARDS) is particularly important since ARDS is a heterogeneous disease, and different areas in the lung are associated with atelectasis and over distension, potentially leading to additional lung injury during mechanical ventilation.
- Regions of alveolar collapse and atelectasis differ from regions of over distension by conductivity and impedance, both of which can be quantitated non-invasively by electrical impedance tomography (EIT).
- Goal is to provide real time measurement and assessment of lung over distention and lung atelectasis during mechanical ventilation thus reducing the chance of ventilator associated lung injury (VALI) in critically ill children with acute lung injury.

## Abstract

Current strategies to provide lung protective ventilation rely on avoiding lung over distension by reducing tidal volumes and on opening atelectasis by applying adequate positive end-expiratory pressure. However, it is currently impossible to continuously measure regional lung over distension and atelectasis while a child is ventilated, but it would be extremely relevant information that could lead to reducing ventilator-induced lung injury.

Electrical impedance tomography (EIT) is the only technology that reliably quantifies regional lung volumes non-invasively. Electrodes around the child's chest are situated to create an EIT-scan using micro-currents. Regional volume changes measured by EIT have been highly correlated with changes in air content seen on CT in animals and humans. A ventilation strategy using EIT that protects children from additional lung injury could significantly reduce mortality. Currently there is a clear knowledge gap: EIT has only been used retrospectively, but has not yet been used to guide mechanical ventilation to improve lung protection.

In order to guide mechanical ventilation reliably, an EIT software application that allows for real-time monitoring of regional lung over distension and atelectasis needs to be developed. This application will then be implemented in a clinical study of lung recruitment in children with acute lung injury.

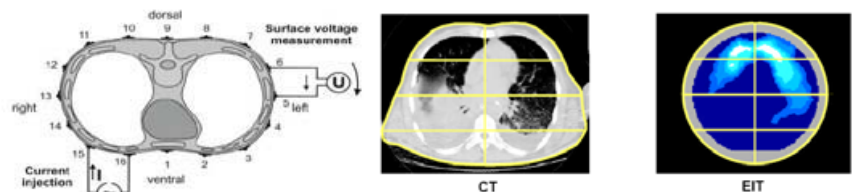


Figure 1a-c: placement of EIT electrodes around the chest, CT-scan, EIT-scan