2013

PERCUSSION AND VIBRATION AIRWAY CLEARANCE THERAPY INCREASES INFLAMMATORY FACTORS

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Background

Ventilator associated pneumonia (VAP) is a preventable but common complication of mechanically ventilated (MV) patients due to oral secretions containing bacteria migrating to the lungs via the endotracheal tube. The development of VAP is associated with an increased risk of mortality and substantial increase in hospital stay and healthcare-associated costs. In order to prevent VAP, multiple pulmonary hygiene and airway and secretion clearance therapies (ASCT) have been utilized such as kinetic bed-delivered therapies which include: continuous lateral rotation (CLRT) and percussion/vibration (P/V) therapy.

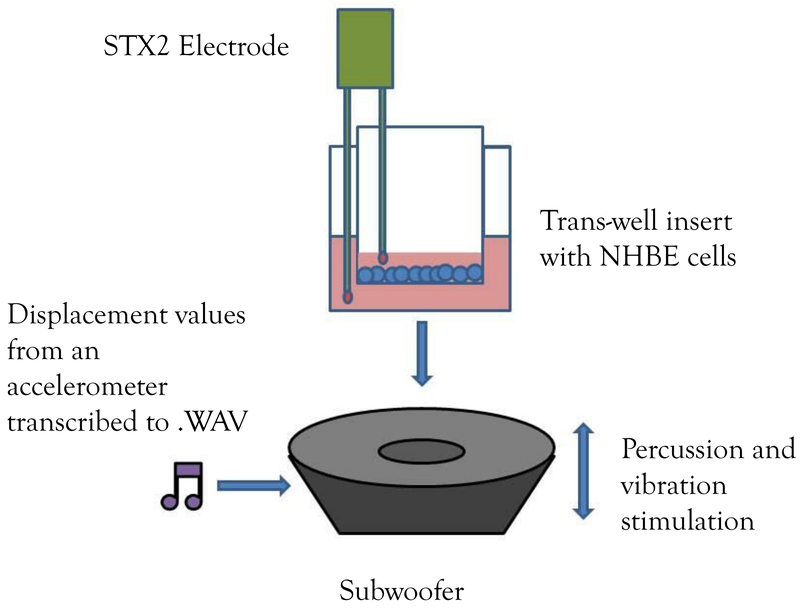
Objective

Currently, there is insufficient empirical evidence to support that kinetic bed therapy reduces the onset of nosocomial pneumonia. The purpose of this study is to mimic the clinical scenario of a patient receiving kinetic bed therapy followed by a bacterial exposure in an *in vitro* model through quantification of IL-8, IFN-γ, TNF-α, 8-isoprostane and nitric oxide.

Methods

Human airway 3D normal human bronchial epithelial (NHBE) air-liquid interface (ALI) cell culture model were grown and followed with bacterial challenge through the application of lipopolysaccharide (LPS). Culture was subjected to three different kinetic conditions (1-Acute: 15 min P/V, 2-Intermittent: 15 min P/V per hour for 6 hours, 3-Continuous: 6 hour P/V). Trans-epithelial electric resistance values were taken before and after each condition. In this experiment, NHBE cells underwent submerged culture conditions for two weeks, and then transitioned to ALI for another two weeks. Cell supernatants were collected, stored at -80° C and batch processed via multiplex cytokine bead assay for IL-8, IFN-γ, TNF-α and via enzyme immunoassay (EIA) for 8-isoprostane. Supernatant samples were also analyzed for nitric oxide.

Submerged Culture → ALI Culture → Stimulate → Analyze



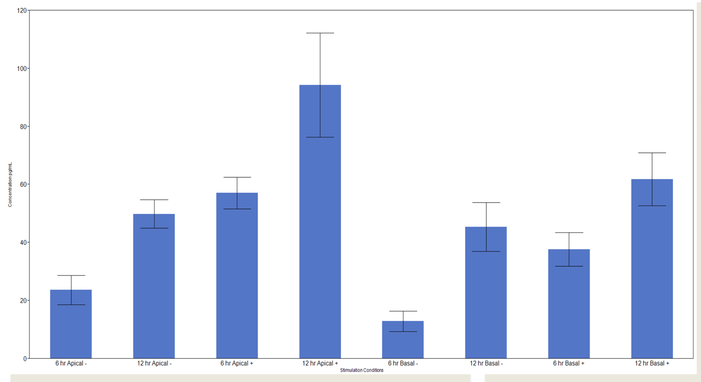


Figure 2 (left): LPS+ and LPS- stimulated NHBE cells underwent P/V for 6 and 12 hrs.
n=3

Discussion

- Vibration and percussion therapy increases inflammation through the activation of the inflammatory and oxidative stress cascade. Breakdown of tight junctions increases the onset of the inflammation and oxidative stress cascade.
- It is unknown if movement, such as continuous lateral rotation, has a more profound effect in preventing infection in the lower airway.
- Analysis of IL-8, IFN-γ, TNF-α, and nitric oxide is pending.

Results

- Continuous vibration loosen tight junctions (Figure 1)
- 8-isoprostane secretions increased the longer it was stimulated (Figure 2)

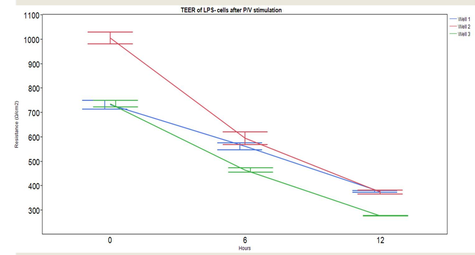


Figure 1 (top): Trans epithelial electric resistance decreased considerably from a healthy tissue layer to non-viable tissue layer.

Acknowledgements

Dr. Bruce K. Rubin – School of Medicine, Department of Pediatrics
Melissa A. Yopp – Mucus Lab
Christopher Corday – Mucus Lab
Shauna Webb-Parker – Mucus Lab
Dr. Clive M. Baumgarten – School of Medicine, Department of Physiology and Biophysics
Dr. Paul A. Wetzel – School of Engineering, Department of Biomedical Engineering
Anathea Pepperl – Wetzel Lab
*National Institute of Nursing Research (K99/R00 NR 012016, A. Montpetit, PI), VCU School of Nursing Adult Health and Nursing Systems Department

**Image from hill-rom.com