



Computer Aided Lung Sound Analysis as an Outcome Measure for Respiratory Physiotherapy

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This research is about developing a new outcome measure for respiratory physiotherapy because the current ones all have weaknesses that affect their usefulness.

Abstract

Introduction: There is a lack of sufficient accuracy, reliability, and sensitivity of the current measures to assess the effectiveness of respiratory physiotherapy. It is known that lung sounds provide useful, specific information, but that standard auscultation techniques are too subjective to allow them to be used as an outcome measure. In this study Computer Aided Lung Sound Analysis (CALSA) is proposed as a new objective, non-invasive, bedside clinical outcome measure for one particular area of respiratory physiotherapy i.e. alveolar recruitment and airway clearance techniques.

Methods: To determine CALSA's potential as an outcome measure, an experimental study was designed, incorporating both 'before-and-after' and 'repeated measures' components. Ten cystic fibrosis (CF) and 14 bronchiectasis (BT) patients were recruited from routine respiratory out-patient clinics. Demographic and anthropometric, lung function, oxygen saturation, breathlessness and lung sound data were collected. Repeated lung sound recordings were taken at seven anatomical sites, before and after patients' routine self-treatment to clear chest secretions. Lung sound data were recorded using a digital stethoscope connected to a laptop computer containing customised Matlab software, used in analysis. Established signal processing techniques were applied to the data and algorithms were developed to determine the best analysis of the lungs sounds.

Results: Preliminary analysis of the lung sound data suggests that coarse, low frequency crackles are much more frequent than fine, high frequency crackles in both pathologies. The within-subject variability was found to be acceptable. When the before and after treatment data was examined, CF and BT patients were found to generate different patterns of results. CF patients had more wheezes than BT patients and their crackles' initial deflection width (IDW) and two cycles deflection (2CD) changed post treatment to become shorter and of higher frequency. The BT patients generally showed an increase in IDW and 2CD length and consequently lower crackle frequency post treatment.

Conclusions: The findings to date suggest that it is not possible to reject the hypothesis that CALSA has potential as an outcome measure for physiotherapy interventions, but more work is required before the hypothesis can be positively supported.