Abstract 854599

Can non-invasive measurements of respiratory phase angle offer a surrogate of disease severity in COPD?

Type: Tidal Breathing Data

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Introduction

- The aim of the study was to interrogate respiratory Phase differences during Tidal breathing (TB) between COPD patients who were admitted to the wards and controls.
- During respiration, the thorax and abdomen change in volume. Increased resistance changes the respiratory phasing of these movements.
- Structured Light Plethysmography(SLP) and the SLP-based, the Thora 3Di™, utilises a non-invasive, non-contact imaging method of recording anterior-ribcage and abdominal wall movements.
- The method is based on projection of a grid of light onto the chest and abdomen of the patient (Figure 1), the movement of which is recorded by two digital cameras.
- Complex algorithms then interpret the distortion of the grid. The movement of a projected grid of light records compartment volume change, from which a Konno-Mead loop (KM) (Figure 2), phase angle (Phi) and entropy can be derived.
- The method does not require a face mask / mouth piece, and does not require the placement of markers on the body.

Figure 1: The Thora 3Di™

Methods

- TB data were collected from 10 COPD patients in exacerbation (av Age 71.8, (47-92) (PFT clinically unrecordable), and 10 controls (Av Age 55, Av FEV1% 95 (95-105).
- 17 parameters were derived including Overall Phase (OPhi), principal angle (PA), KM spread, IT and ET. KM loop principal angle and spread was derived from Principal Component Analysis
- For all parameters except OPhi, the mean, median and entropy (ApEn*) were calculated. The Mann Whitney and Brown-Forsythe tests were applied for significance.

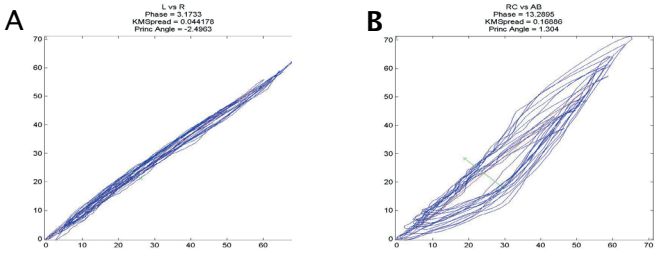

Figure 2:

Sample KM Plots from COPD patients in exacerbation:

A) Left Vs Right Hemithorax

B) Chest Vs Abdomen

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Results

	Brown Forsyth(two tailed)			Mann-Whiney U
Staitisic	**0.01**	**0.025**	**0.05**	**p**
Overall Phase				0.60652
Mean Phase-w		*	*	0.071445
Median Phase-w				0.089931
ApEn Phase-w			*	0.030528
Mean Phase-b			*	0.57102
Median Phase-b			*	0.39543
ApEnPhase-b				0.91796
KM Spread			*	0.68032
Principle Angle				0.16434
Mean Angle Change			*	0.35389
Median Angle Change				0.22264
ApEn Angle Change				0.43978
Mean Insp Time				0.02344
Median Insp Time				0.020253
ApEn Insp Time			*	0.001956
Mean Expr Time				0.36742
Median Expr Time				0.30287
ApEn Expr Time				0.0045575
Resp Rate				0.18906
Mean Tidal Vol				0.050329
Median Tidal Vol				0.084458
ApEn Tidal Vol				0.15518

Mean Phi, Median Phi, ApEn, KM Spread, Mean Angle Change, Mean IT, Median IT, ApEn IT, and ApEn ET were statistically significant.

For controls KM Spread, the ApEn Phi was low, suggesting regular TB. Entropy of IT and ET, was high in COPD.

Conclusions

•SLP enables a non-invasive, non-contact, and objective assessment of the chaotic tidal breathing patterns in COPD patients.

•Further work is on-going to further compare SLP measurements with traditional measurements of pulmonary function

Bibliography

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