Identifying Asthmatic Children using Tidal Breathing Parameters Measured by Structured Light Plethysmography (SLP)

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ABSTRACT

SLP is a novel technique which measures breathing patterns by measuring chest and abdominal wall movements during tidal breathing (1). We have previously shown that several tidal breathing parameters measured using SLP varied between asthmatic children and healthy (2). However, we did not test the classification power of this model which incorporates the identified parameters. In this study a classifier was constructed and its performance was evaluated in differentiating asthmatic children from healthy.

30 clinically diagnosed asthmatic children with abnormal spirometry (FEV1 <80% predicted) aged 7-16 years and an age matched cohort of 41 healthy children were analysed. Tidal breathing parameters that showed trend level significance (p<0.01) in our previous study were selected as predictors. These were: median inspiratory time (T1), inspiratory to expiratory time ratio (T1/T6), duty cycle (T1/T1T6), time to peak tidal expiratory flow over expiratory time (TPEF/TE) and its variability, inspiratory to expiratory displacement rate at 50% of displacement (IES50) and its variability. Employing a K-fold cross validation procedure (K=5), a linear discriminant analysis classifier was trained and tested on this dataset. The overall accuracy was 80.3%, (sensitivity=80.0%, specificity=80.5%). Area under the receiver operating characteristic curve (AUROC) was 0.85.

Sensitivity, specificity and AUROC all suggest there is potential in exploring tidal breathing for diagnostic purposes. Given that all the information required for the classification are parameters extracted from five minutes of quiet tidal breathing using a non-contact device. It may be useful to explore the use of SLP to assist in diagnosing children with asthma.

REFERENCES

3. Dr. Iriz Levai, Dr. Virpi Sidoroff, Dr. Richard Iles. An Introduction to the Non-invasive Non-contact. Assessment of Respiratory Function. Respiratory Therap, 7 (5) October-November 2012