



Detection of Airway Obstruction Using Alar Photoplethysmography

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Introduction

Alar photoplethysmography (aPPG) measures blood volume changes from the nasal ala where intrathoracic pressure changes associated with breathing are reflected in the signal. The authors hypothesized that aPPG signals and small SpO₂ changes (“mini-desaturations”) can independently detect the presence of partial airway obstruction in spontaneously breathing patients, and that combining the metrics can be used to judge the severity of obstruction. The ability to quantify changes in airway obstruction can be important for the early detection of drug-induced respiratory depression (DRD).

Methods

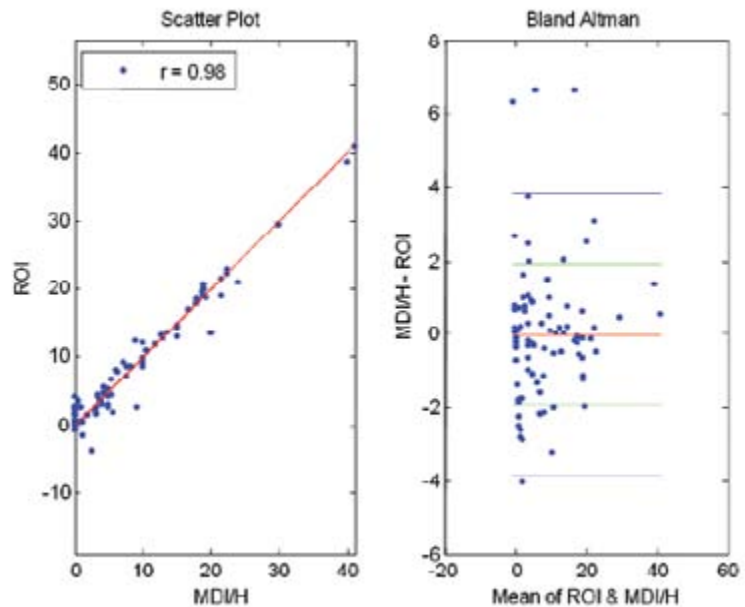
The study included 87 subjects, 37 male and 50 female, ages 18-65 in an outpatient setting. Assurance® Alar Sensors (Xhale Assurance, Inc., Glastonbury, CT) were placed on either nasal ala and connected to an OxyPleth oximeter (Dixtal Medical, Wallingford, CT). 65.8 hours of high resolution raw data was analyzed. For each subject a “mini-desaturation index” (MDI) was calculated from SpO₂ changes of >3% of baseline and a “respiratory obstruction index” (ROI) based on six aPPG parameters was developed and computed independently.

Results

Increasing MDI and ROI scores are highly correlated ($r=0.98$; Pearson coefficient computed using Matlab, Natick, MA), with higher scores indicating greater airway obstruction. The figures below show a scatter plot and Bland-Altman analysis of MDI/H and ROI scores.

Conclusions

Indices derived from the aPPG signal appear to have practical application as sensitive indicators of the degree of partial obstruction.



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