

European Respiratory Society Annual Congress 2012

Abstract Number: 3709

Publication Number: 3285

Abstract Group: 4.2. Sleep and Control of Breathing

Keyword 1: Sleep studies **Keyword 2:** Circulation **Keyword 3:** Apnoea / Hypopnea

Title: Prediction of cardiovascular risk from nocturnal pulse wave signal using the autonomic state indicator technology

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Body: Introduction Analysis of continuous physiological signals measured by pulse oximetry during sleep may provide a novel method to assess cardiovascular (CV) risk. The sleep period appears to be a particularly useful window for assessment. Methods Subjects (n=520, 346 males, age 55.0±13.4 yrs, BMI 29.9±6.1 kg/m²) were referred to five sleep centers in Germany and Sweden. CV risk factors were assessed and subjects were classified by the ESC/ESH risk matrix into five separate risk classes. The autonomic state indicator (ASI) algorithm extracted patterns of the peripheral pulse wave and SpO₂ signal by amplitude and time/frequency analysis from the overnight digital photoplethysmographic recording and computed a CV risk score (range 0-1, ≥0.5 equals to high risk). Nine derived parameters (irregular pulse, RCDC, pulse rate variability, pulse wave variability, pulse propagation time, oxygen desaturations, duration of periodic symmetric desaturations and baseline SpO₂) were used to determine the final score. Results In the validation group (n=390), the developed algorithm detected high CV risk (ESC/ESH scores 4 and 5) patients with a sensitivity of 74.5% and specificity of 76.4%. The area under the ROC curve was 0.80. The ASI CV risk score was elevated in patients with an already established CV endpoint (MI and/or stroke, n=50) compared with all other patients (0.73±0.27 vs. 0.42±0.34, p<0.001). Conclusions The ASI technique appears to provide a possibility to detect increased CV risk from a recording of physiological signals during sleep. The technique – based on a modified pulse oximeter – may be useful in both sleep and cardiovascular medicine.