Free Communications: Abstract 5

Assessment of cardiovascular comorbidities in obstructive sleep apnea using SpO_2

M. Deviaene[1,2], D. Testelmans[3], P. Borzée[3], B. Buyse[3], S. Van Huffel[1,2], C. Varon[1,2]

[1] Department of Electrical Engineering (ESAT), STADIUS Center for Dynamical Systems, Signal Processing and Data Analytics, KU Leuven, Leuven, Belgium

[2] Imec, Leuven, Belgium

[3] Department of Pneumology, UZ Leuven, Leuven, Belgium

Introduction: Obstructive Sleep Apnea Syndrome (OSAS) is the most common sleep related breathing disorder. The recurrent respiratory events result in hypoxia, hypercapnia, arousals and negative intrathoracic pressure swings which affect the cardiovascular system via different pathways. These adverse effects cause patients with OSAS to have an increased risk of developing cardiovascular diseases, even when adjusted for confounding factors. A study of Marin et al. suggested that OSAS treatment can prevent the development of cardiovascular disease. Therefore timely diagnosis and treatment of OSAS patients at highest cardiovascular risk is needed. The apnea-hypopnea index (AHI), however, is not a very good predictor of cardiovascular events. Therefore, this study investigates if parameters computed from the blood oxygen saturation (SpO_2) signal could be used to assess the cardiovascular status of the patient.

Methods: SpO_2 signals extracted from polysomnography recordings of 100 OSAS patients with an AHI larger than 15 are analyzed. 50 patients with a known cardiovascular comorbidity are matched to patients without any comorbidity. The included comorbidities are: hypertension, hyperlipidaemia, diabetes, myocardial infarction and stroke. Algorithms were developed to automatically analyze the signals. All oxygen desaturations were detected and linked to respiratory events, for each of them time-domain, desaturation severity, statistical and periodicity parameters are extracted, which are then averaged per patient. The parameters which are most discriminative between patients with and without cardiovascular comorbidities are selected, and a classification system was developed based on these parameters.

Results: A total of seven SpO_2 parameters was selected, all concerning the slopes of the desaturations and resulting resaturations or the severity of the desaturations. Patients with a cardiovascular comorbidity had oxygen desaturations with larger areas under baseline and slower changes in the SpO_2 desaturation slopes after a respiratory event. The developed classification system based on these features was tested on an independent test set containing 30 patients, an accuracy of 76.7 % was achieved for classification of patients as having a cardiovascular comorbidity or not.

Conclusions: The findings in this study suggest that cardiovascular comorbidities in OSAS patients can be detected based on changes in the SpO_2 signal. This could be interesting for the phenotyping of OSAS patients and their treatment decisions. In order to further validate and improve these results, more data should be included containing also patients with lower AHIs. Moreover if we want to move from assessing cardiovascular comorbidities to predicting the development of cardiovascular disease, follow-up data would be interesting.