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Editorial

Sleep Apnea Diagnostic in Cardiac Rehabilitation – Needless? Necessary? State of the Art?

Erik Skobel*
Clinic for Cardiac and Pulmonary Rehabilitation, Germany

***Corresponding author:** Clinic for Cardiac and Pulmonary Rehabilitation, Germany

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Editorial

Sleep related breathing disorders (SRBD) are common in cardiovascular disease, obesity and diabetes with massive effect on social-economic burden. Whereas prevention often aims control of blood pressure, weight and glucose level, sleep apnea is not included in general diagnostics. This editorial gives a general view of studies regarding prevalence of sleep apnea in cardiovascular disease and raises question if screening for sleep apnea should be done generally in cardiac rehabilitation.

The number of patients worldwide with diabetes is more than 280 million [1]. The mortality on cardiovascular disease is 17 million patients [2], while the prevalence of SRBD is 3-9 % in women and 10-17 % of men [3]. The rising incidence of obesity will lead to a raising incidence of SRBD in the future.

The prevalence of SRBD in cardiovascular disease is high and has effect on mortality and reoccurrence of cardiac events. But a routinely performed screening for SRBD in cardiovascular disease is rarely used and still under discussion [4].

Obstructive sleep apnea (OSA) is the most prevalent type of SRBD. It is defined as repetitive episodes of partial or complete cessation of airflow in the upper airways during sleep.

Patients with OSA typically present with symptoms such as disruptive snoring, witnessed apnea or gasping, excessive daytime sleepiness, morning headache, sleep disturbance and cognitive dysfunction [5, 6]OSA has been associated with increases in cardiovascular morbidity and mortality.[7-9] The most important mechanisms to cause myocardial damage are increased sympathetic activity, heart rate variability, endothelial dysfunction, systemic inflammation, oxidative stress, platelet activation and metabolic abnormalities [5, 10-18] and are associated with hypertension, cardiac hypertrophy, heart failure, stroke, arrhythmias, myocardial infarction (MI), pulmonary arterial hypertension (PAH), and end-stage renal disease. [4, 5, 19, 20]

The simultaneous absence of inspiratory airflow and respiratory movement indicate the presence of central sleep apnea episodes. Cheyne-Stokes respiration (CSR) is a form of periodic breathing in which apneas and hypopneas with ventilatory periods having a crescendo-decrescendo pattern of tidal volume [21] Cheyne-Stokes-respiration (CSR), a frequent breathing disorder in heart failure (HF) patients, is known to have negative impact on mortality, quality of life and increases the incidence of depression [22, 23]. Increased peripheral and central chemo sensitivity, prolonged circulation time, activation of lung vagal irritant receptors by increased LV-filling pressure, and reduced blood gas buffering capacity have been discussed as pathophysiological mechanisms [21, 24].

Diagnosis of SRBD can be made using polysomnography (PSG) or at-home poly graphy. Although the American Academy of Sleep Medicine (AASM) recommends PSG for the evaluation and diagnosis of SDB [21], many centres do not have this type of facility and poly-graph is a feasible and validated alternative [25-33]. According to AASM Task Force definitions [21] an AHI of ≥5/h defines the presence of SRBD, although the AHI cut-off for diagnosing SRBD varies between studies, whereas a cut-off ≥ 15/h is clinical significant with profit from nCPAP-therapy if OSA is present [34, 35].

In the last few years different registries evaluated the prevalence of SRBD in cardiovascular disease and add important information about risk evaluation for SRBD.

a) Prevalence of SRBD in diabetes and metabolic syndrome

OSA in diabetes and metabolic syndrome was found between 73% and 86 % and was associated with CAD and worse HbA1c [36, 37, 38, 39, 40]. Severe OSA (AHI > 30/h) was present in 30 % [40]. The International Diabetes Federation recommends a general screening for OSA [1].

b) Prevalence in hypertension

There is a known association between OSA and hypertension with a prevalence of 40-60 %, in refractory hypertension up to 71% [41, 42].

c) Prevalence in CAD and myocardial infarction

In patients with CAD there is a prevalence of 73 % documented. In acute MI 69 % of the patients exhibit medium to severe SRBD [43]. OSA is associated with re-infarction and thrombosis of stent grafts [7].

d) Prevalence of SRBD in HF with reduced (HFREF) and preserved (HFPEF) left ventricular function

In patients with HFREF there is a high prevalence of SRBD (49 % - 72%) with high amount of CSR [23, 44, 45]. Also in hypertrophic cardio myopathy (83 %) [46] and HFPEF (69 %) a high prevalence is reported [47-51]. SRBD in HF are associated with high mortality. Sleepiness is not very common mostly in CSR, but SRBD is associated with lower quality of life and occurrence of depression [23].

e) Prevalence of SRBD in patients with arrhythmia and cardiac pacing

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In patients with atrial fibrillation the reported prevalence is between 30-75 % in all types of atrial fibrillation [52-55]. OSA is associated with enlargement of the atrium with higher recurrence rate of atrial fibrillation. Also there is high prevalence in atrial flutter (82 %) [56], Brugada syndrome (45 %) [57] and in patients with cardiac pacers (59 %) with severe SRBD in 21 % [58].

f) Prevalence in heart valve disease

In patients with valvular aortic stenosis SRBD were found in 72 % with OSA and CSR present [59]. The effect on mortality has not been evaluated yet.

g) Prevalence in pulmonary hypertension

SRBD are one reason for pulmonary hypertension owing to lung disease and hypoxia (WHO group III) or can be associated with PAH (WHO group I).Chronic nocturnal hypoxias are patho physiological reason for elevated pulmonary pressure at night with effect on right ventricle and influence on endothelial-related vasoconstriction and dilatation with hypertrophy of media and intima obstruction (based on Endothelin-1). The prevalence of PH in OSA is prescribed between 20 and 73 % [60, 61]. Also in idiopathic pulmonary hypertension and chronic-thromboembolic pulmonary hypertension (CTPH) there is a high prevalence of SRBD (up to 89 %) with nocturnal hypoxemia and sleep apnea [62, 63].

h) Prevalence of SRBD in cardiac rehabilitation (CR)

Cardiac rehabilitation focuses on risk factors for CAD and is an ideal stage for diagnostic of SRBD. So diagnostic and treatment of SRBD are more and more evaluated in cardiac rehabilitation [64]. Sharma et al. for example evaluated a possible prevalence of OSA in CAD patients during cardiac rehabilitation of 50 %. They used the Berlin questionnaire for evaluation. A polygraphy was not used for further evaluation [65]. In our own evaluation we were able to show a prevalence of SRBD of more than 50 % in patients with HFREF during rehabilitation in our facility [66]. In a multi center trial of the German Society of Prevention and Rehabilitation in 9 cardiac rehabilitation facilities in Germany, 1152 patients were screened for sleep-disordered breathing with 2-channel polygraphy. Parameters recorded included the Apnea-hyperpnoea index (AHI), number of de saturations per hour of recording (ODI), mean and minimum nocturnal oxygen saturation, and number of snoring episodes. Patients rated subjective sleep quality on a scale from 1 (poor) to 10 (best) and completed the Epworth Sleepiness Scale (ESS). Clinical significant sleep apnea (AHI ≥15/h) was documented in 33 % of patients. ESS score and subjective sleep quality differ only slightly significantly between patients with and without apnea. Logistic regression model analysis identified age, body mass index, male gender, diabetes and hemoglobin levels as risk factors for sleep apnea in CR patients [67].

So is a general screening necessary for SRBD in cardiovascular disease and rehabilitation?

A screening for SRBD is recommended in the Guidelines of the International Diabetes Federation [1] and the Guidelines of the European Society for Cardiology for therapy-refractory hypertension (ESH/ESC Guidelines) [6, 68]. As treatment for OSA with nCPAP has high evidence for reducing cardiovascular events, also screening in CAD and after MI is recommended [35, 69]. In HFREF and HFPEF the presence of OSA is also associated with high mortality and effect on outcome. nCPAP- therapy can reduce the mortality in HF if OSA is present [45]. In central sleep apnea optimal heart failure treatment with beta blockers [70] or cardiac resynchronization therapy (CRT) [71] has positive effect and should be discussed if CSR in HF is present. The use of adaptive servo ventilation (ASV) for central sleep apnea is still under investigation [72]. OSA is associated with atrial fibrillation and the treatment with nCPAP [20] can reduce the risk of recurrence.

As in cardiac rehabilitation screening for SRBD is easy to perform, a screening in patients with diabetes, CAD, MI, HF and atrial fibrillation is recommended. Initiation of treatment with nCPAP is easy to perform and has effect on recurrence and outcome in these patients. Furthermore training for the use of the nCPAP-device is also possible during the rehabilitation process to improve compliance. As a first step in cardiac rehabilitation the use of questionnaires (Berlin, Epworth sleepiness score) should be performed. Secondly 24h-ecg also gives the possibility today to evaluate the risk for sleep apnea. If there is high risk present, 2-channel poly graphy as a screening tool are easy to use and if SRBD is present, six-channel-polygraph or polysomnography are needed. These diagnostic features are not available in all cardiac rehabilitation facilities, as reimbursement by health care providers for diagnostic and treatment of SRBD in cardiac rehabilitation is still refused (in Germany for example).

Here more data is needed to show the benefit of diagnostic and treatment during cardiac rehabilitation to improve outcome in patients with cardiovascular disease. So we need more discussion of these diagnostic features of well known but still under diagnosed SRBD.

General screening for SRBD in cardiac rehabilitation is necessary, but actually not state of the art. Here further work has to be done.

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