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Sleep apnea: State of the art

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ABSTRACT

Many patient with, or at risk of, cardiovascular disease have sleep disordered breathing (SDB), which can be either obstructive (with intermittent collapse of the upper airway) or central (episodic loss of respiratory drive). SDB is associated with sleep disturbance, hypoxemia, hemodynamic changes, and sympathetic activation. Such patients have a worse prognosis than those without SDB. Mask-based therapies of positive airway pressure targeted at SDB can improve measures of sleep quality and partially normalize the sleep and respiratory physiology, but recent randomized trials of cardiovascular outcomes in SDB have either been neutral (obstructive sleep apnea) or suggested the possibility of harm, likely from increased sudden death, in central sleep apnea. Alternative methods for the treatment of SDB are being explored, including implantable technologies, but these have not been studied in adequately powered randomized controlled studies. International guidelines recommend screening for SDB, which can be done easily in clinical practice, as there may be a role for the treatment of patients with obstructive sleep apnea and daytime sleepiness, or resistant hypertension, or atrial fibrillation. Further randomised outcome studies are required to determine whether mask-based treatment for SDB is appropriate for patients with chronic systolic heart failure and obstructive sleep apnea; for those with heart failure with preserved ejection fraction; and for those with decompensated heart failure. The case is made that no longer can the surrogate endpoints of improvement in respiratory and sleep metrics be taken as adequate therapeutic outcome measures in patients with sleep apnea and cardiovascular disease.

Key words: Heart disease, Heart failure, Sleep disordered breathing, Sleep apnea.

Introduction

The results of recent randomized trials are challenging our understanding of the pathophysiology of sleep disordered breathing (SDB) and the effects of currently available therapies on clinical outcome. Although there is a strong therapeutic rationale for the treatment of daytime sleepiness due to obstructive sleep apnea in the non-heart failure population, the evidence that this improves cardiovascular outcome is not secure. The possibility exists that central sleep apnea may be at least partially adaptive in heart failure (HF) patients and treating this may be harmful in some circumstances. The aim of this review is to provide insights into our contemporary understanding of SDB, where the evidence gaps lie, and what therapies are currently available.

What is sleep disordered breathing?

The two major phenotypes of SDB are obstructive sleep apnea (OSA) and central sleep apnea (CSA) (Fig. 1) [1]. In OSA (the most common form of SDB in the general population) there is collapse of the pharynx during sleep with consequent upper airway obstruction, often with snoring. Predisposing factors include obesity, a short neck and retrognathia. CSA, the other type of SDB, is usually associated with heart failure, although it has also been observed in patients with stroke, especially in the acute phase, and in those with renal failure or opiate use. In CSA, the underlying abnormality is in the regulation of breathing in the brainstem respiratory centres: a modest rise in $PaCO_2$ during sleep results in inappropriate hyperventilation due to increased chemosensitivity, driving $PaCO_2$ below

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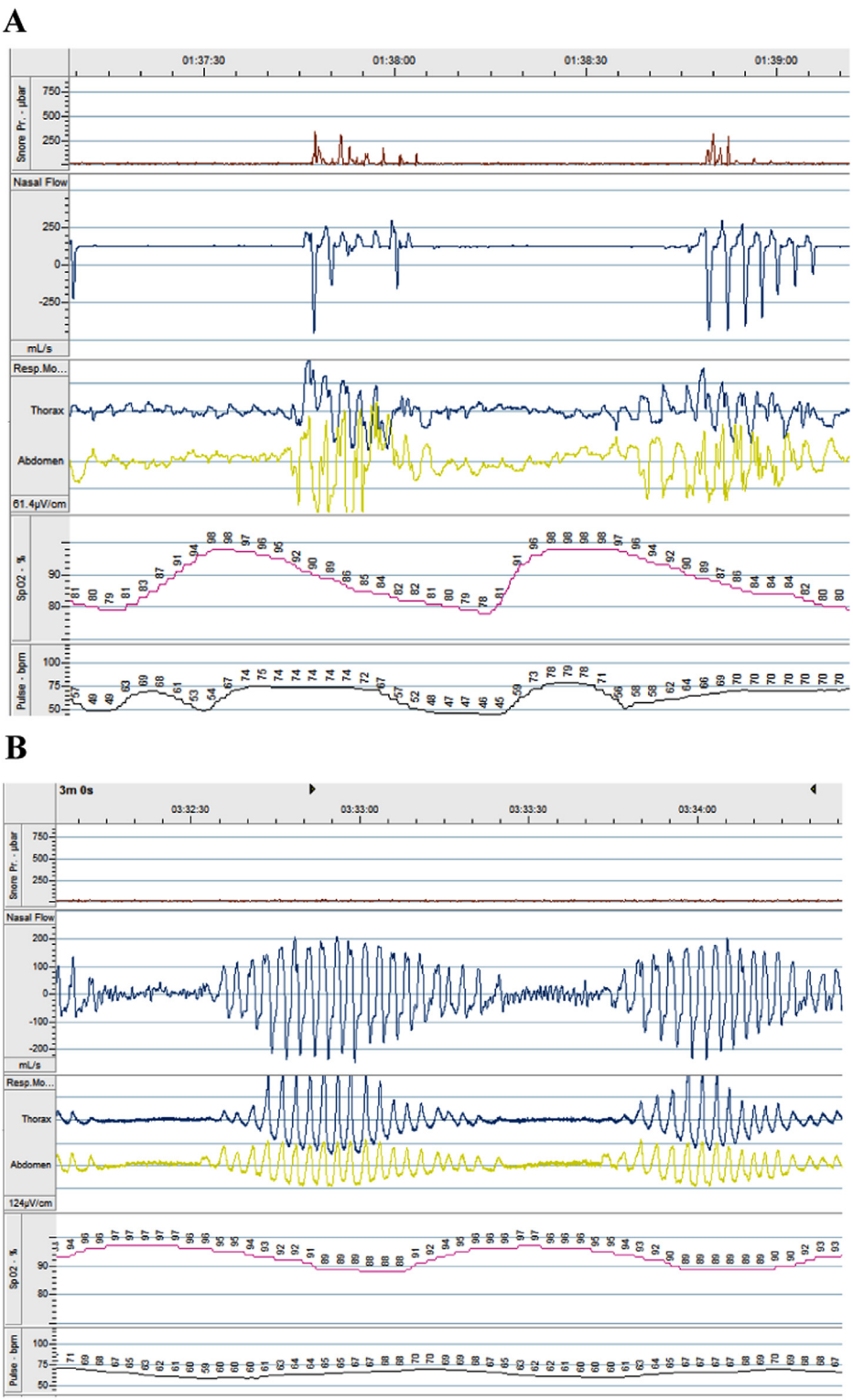

Fig. 1 – Polygraph recordings from a patient with A) OSA and B) CSA. Note the continuation of respiratory movement during the period of apnea in OSA, but the absence of respiratory effort during apnea in CSA. First panel is noise related to snoring (seen in A not B); second is nasal air flow; third is thoracic and abdominal wall movement; fourth is arterial oxygen saturation; and fifth is pulse rate. Modified from Reference [1].

the apnoeic threshold, at which point the neural drive to respire is too low to stimulate effective inspiration and an apnea (complete pause in breathing) or hypopnea (partial reduction in airflow) ensues. $PaCO_2$ subsequently rises and the cycle is repeated. This overshoot of the homeostatic feedback loop is exacerbated by the prolonged circulation time between the alveoli and the brainstem seen in more severe HF. In addition, pulmonary congestion stimulates J