The heart of the matter

Sleep apnea and cardiovascular disease

PHILIPS

RESPIRONICS

A sleep apnea is characterized by frequent pauses of breathing during sleep.

There are two kinds of sleep apnea, Obstructive Sleep Apnea (OSA) and Central Sleep Apnea (CSA).

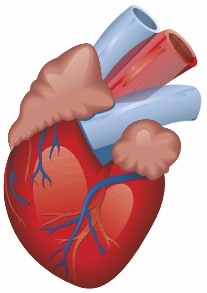
Obstructive Sleep Apnea

OSA is characterized by loud snoring, narrowing and closure of the upper airway during sleep.

Why should a cardiologist care about OSA in his patients?

Medical consequences of Obstructive Sleep Apnea

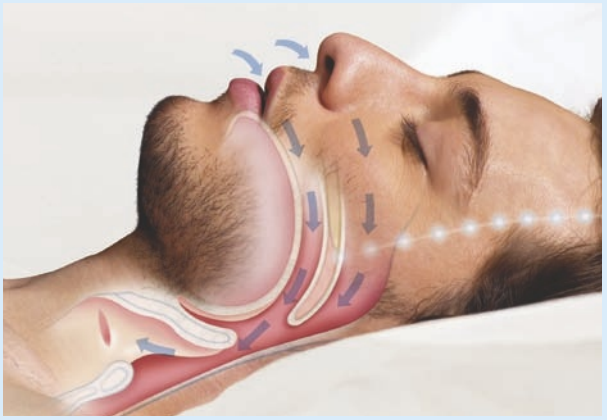
Patients with untreated OSA have a number of short term symptoms, including an increased risk of falling asleep while doing routine tasks. OSA can affect quality of life negatively by impairing alertness, and altering mood and memory. It can also result in workplace and motor vehicle accidents. OSA may also increase the risks of developing other long term health risks such as stroke, heart rhythm abnormalities, high blood pressure or type 2 diabetes.

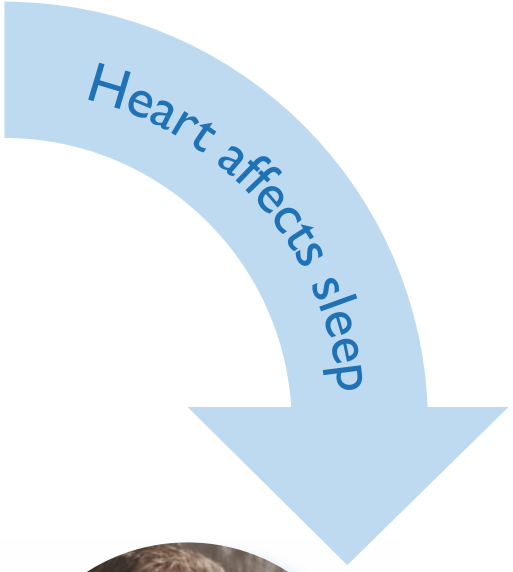


Sleep affects the heart

Central Sleep Apnea

Central Sleep Apnea (CSA) is another form of sleep disordered breathing characterized by airflow cessation due to reduced neural output from the central nervous system.





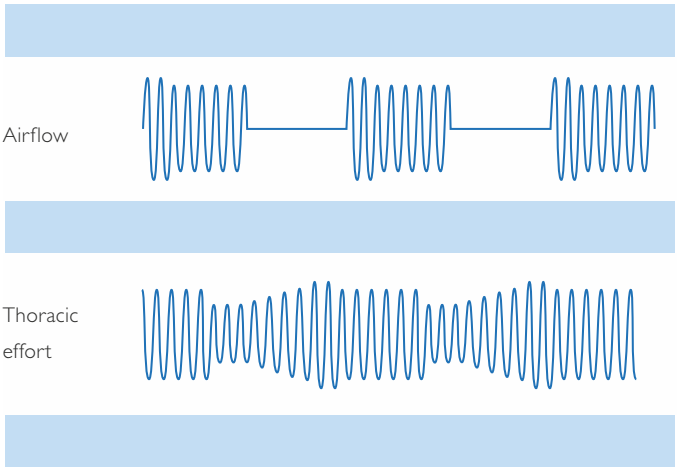
Why should a cardiologist care about CSA in his patients?

Relationship between Central Sleep Apnea, Cheyne-Stokes Respiration and cardiovascular disease

Excess mortality is assocaited with the combination of CSA and Heart Failure (HF).

Obstructive Sleep Apnea

Obstructive Sleep Apnea (OSA) is the most common form of Sleep Disordered Breathing (SDB), affecting approximately 2% of women and 4% of men (Young T. et al. NEJM 1993). It is generally characterized by persistent loud snoring and repetitive partial (hypopnea) and full (apnea) collapse of the upper airway during sleep.



Each collapse of the upper airway lasts for at least 10 seconds and is terminated by an arousal response leading to broken sleep and excessive daytime sleepiness. OSA severity is commonly assessed by using the Apnea/Hypopnea Index (AHI), which indicates the number of collapses of the upper airway that occur per hour of sleep.

Markers of OSA

- Obesity, enlarged neck size
- Crowded pharyngeal airway
- Hypersomnolence
- Increased BP

Daytime symptoms of OSA

- Early morning headaches
- Daytime sleepiness
- Poor concentration
- Irritability
- Falling asleep driving

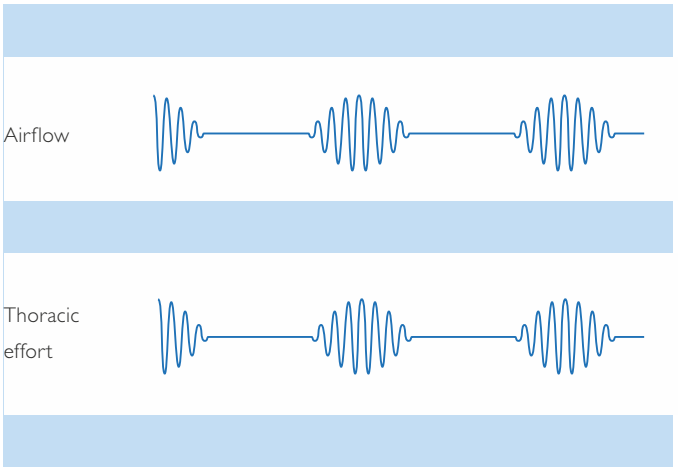
Nighttime symptoms of OSA

- Loud persistent snoring
- Witnessed pauses in breathing
- Choking or gasping for air
- Restless sleep
- Frequent visits to the bathroom

Central Sleep Apnea

Central Sleep Apnea (CSA) is characterized by repetitive pauses of ventilation during sleep resulting from a loss of ventilation drive. Cheyne-Stokes Respiration is defined as alternating periods of hyperventilation with waxing/waning tidal volume and periods of central hypopneas or apneas.

Evidence suggest that 33 – 42% of patients with heart failure have predominant CSA/CSR.
(Sin, D.D. et al. AJRCCM 1999 - Javaheri, M. et al. Circulation 1998)



Cheyne Stokes Respiration is characterized by crescendo-decrescendo patterns with pauses lasting at least 10 seconds and repeating at least 3 times.

Markers of CSA in heart failure patients

- Older (>60 yrs)
- Male
- Atrial fibrillation
- Lower arterial PCO_2 (38 mm Hg)
  (Sin, D.D. et al. Am J Respir Crit Care Med. 1999)
- Heightened sensitivity to CO_2
  (Javaheri, S. N Engl J Med. 1999)

Other predictors of CSA:

- Oscillatory breathing patterns during wakefulness
  (Brack, T. et al. Chest. 2007) and exercise (Leite, J.J. et al. J Am Coll Cardiol. 2003 & Olson, L.J. et al. Chest. 2008)

Symptoms of CSA

Patients with HF and CSA may complain of

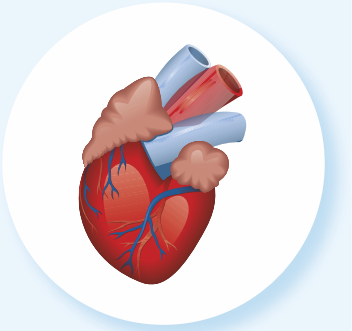
- Paroxysmal nocturnal dyspnea
- Frequent nocturnal arousals and awakenings

Snoring, excessive daytime sleepiness, and obesity are less common than in patients with OSA.

"Thanks to CPAP, and some physical activity, I feel much better with no more palpitations."

A 49 year-old obese man was admitted to hospital complaining of palpitations, light-headedness and shortness of breath, which had awoken him from sleep. He had a history of paroxysmal atrial fibrillation (AF), which spontaneously resolved without specific intervention within 24 hours of onset, and treated hypertension (HT).

Potential cardiovascular risks associated with OSA



Intermediate outcomes

- Hypertension
  (Peppard et al. NEJM 2000)
- Diabetes
  (Reichmuth et al. AJRCCM 2005)

Hard outcomes

- Myocardial infarction
  (Sert Kuniyoshi et al. J Am Coll Cardiol 2008)
- Stroke
  (Yaggi et al. NEJM 2005)
- Congestive heart failure
  (Shahar et al. AJRCCM 2001)
- Death
  (Marin et al. Lancet 2005)

Sleep affects the heart

Clinical examination revealed the patient to be in respiratory distress with a blood pressure of 77/45 and a heart rate of 165 beats per minute.

AF with rapid ventricular response and normal ST segments was confirmed by ECG recording. Cardiac enzymes were within normal limits. A cardioversion with 100J successfully restored the patient to sinus rhythm.

When reviewing the patient's history, the physician identified loud snoring and excessive daytime sleepiness. An examination revealed some upper airway abnormalities suggestive of Obstructive Sleep Apnea (OSA).

The patient underwent a sleep study, which revealed severe OSA with an Apnea Hypopnea Index (AHI) of 37/h and a minimum SpO_2 of 75%. Accordingly, continuous positive airway pressure (CPAP) therapy was initiated.

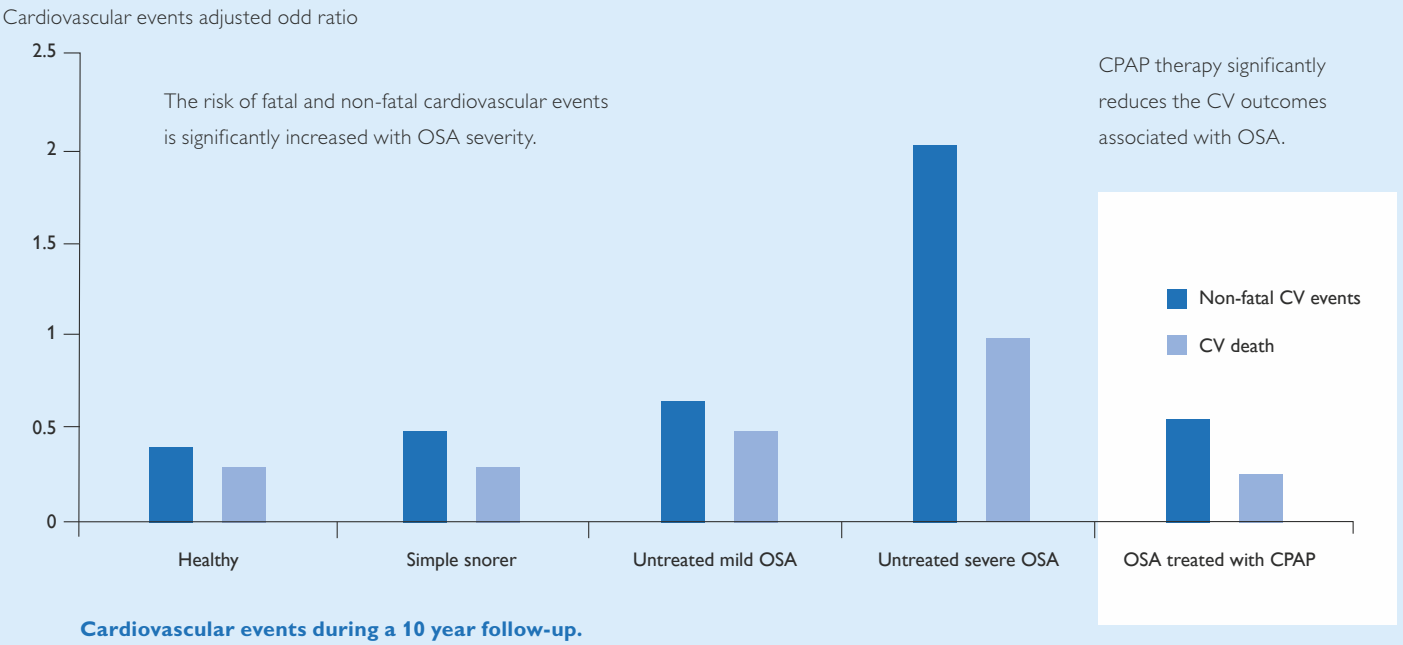
After 1 year, the patient was using his CPAP machine regularly, and significant improvements in daytime sleepiness were reported. Regular exercise had led to a decrease in his BMI and no further episodes of AF had occurred.

(Penn Sleep Centres. "Continuous Positive Airway Pressure Therapy for Patients with Obstructive Sleep Apnea and Atrial Fibrillation." March/April 2009. Penn Medicine. Date accessed 05/08/2010 at: http://www.pennmedicine.org/phys_forum/pto/mar_apr09/sleep.html)

Treatment of OSA with CPAP

- The risk of fatal and nonfatal cardiovascular events is significantly increased with OSA severity.
  (Martin, J. M. et al. Lancet 2005)
- Continuous Positive Airway Pressure (CPAP) is the gold standard treatment for OSA.
- CPAP holds the upper airway open during sleep by providing pressurized air via a nasal or full face mask.
- Effective CPAP therapy has been shown to improve patients' quality of life, reduce the health risks associated with OSA and save on healthcare related costs.
  (Otake, K. et al. Thorax 2002)
- CPAP therapy significantly reduces the cardiovascular (CV) outcomes associated with OSA.
  (Marin et al. Lancet, 2005)

CPAP therapy may decrease cardiovascular risk associated with OSA.



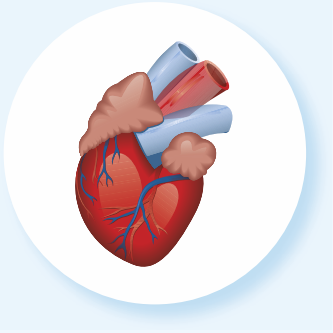
Cardiovascular events during a 10 year follow-up.
CPAP therapy significantly reduces the cardiovascular outcomes associated with OSA.
(Adapted from Marin et al. Lancet, 2005)

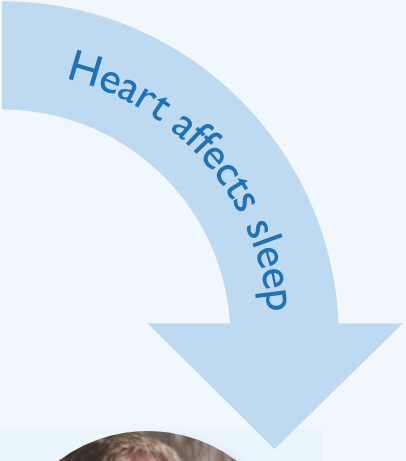
"I'm using my machine about 6 hours a night, and I can have normal activity now!"

A 72 year old overweight male with non-ischemic cardiomyopathy (diagnosed 4 years earlier) was admitted to the hospital for diuretic therapy and was complaining of nocturnal dyspnea, edema and fatigue. He had not been hospitalized for congestive heart failure in the years since diagnosis.

Cardiovascular disease associated with CSA

- Nocturnal CSA is associated with increased mortality in HF patients. (Hanly et al. AJRCCM 1996)
- Nocturnal CSA is an independent factor for cardiac transplantation. (Lanfranchi et al. Circulation 1999)





Treatment of CSA with Servo ventilation

Servo ventillation holds the upper airway open during sleep by providing pressurized air via a nasal or full face mask. In addition, it automatically adjusts inspiratory pressure to eliminate central events.

- The CANPAP trial did not demonstrate a beneficial effect of CPAP on morbidity or mortality in patients with CSA and HF. (Bradley, T.D. et al. NEJM – 2005)
- The results of a post-hoc analysis of the CANPAP trial suggests that successfully treating CSA in these patients can significantly improve survival. (Arzt, M. et al. Circulation 2007)
- BiPAP ASV reduced AHI to below 15 in a group of patients with HF and predominant CSA who were not adequately treated on CPAP. (Arzt et al. Chest 2008)
- CHF patients with OSA and CSA/CSR, receiving optimum medical treatment, had an improved cardiovascular function with servo ventilation therapy. (Kasai et al. Circulation 2010)

A detailed consultation revealed that he was currently NYHA class III and optimally treated with Angiotensin-Converting Enzyme inhibitors, beta-blockers, diuretics and an aldosterone antagonist. An electrocardiogram revealed a normal sinus-rhythm, and there was no other apparent reason for decompensation of pre-existing chronic heart failure such as infection, renal failure, volume overload, or lack of adherence to medication.

Three-dimensional echocardiography revealed a marked left ventricular (LV) dysfunction (LVEF 33%).

The patient did not report subjective daytime sleepiness; however, snoring and gasping were reported by his partner. A sleep study showed severe Central Sleep Apnea with an Apnea Hypopnea Index (AHI) of 57/h and, accordingly, nasal Continuous Positive Airway Pressure (CPAP) was applied.

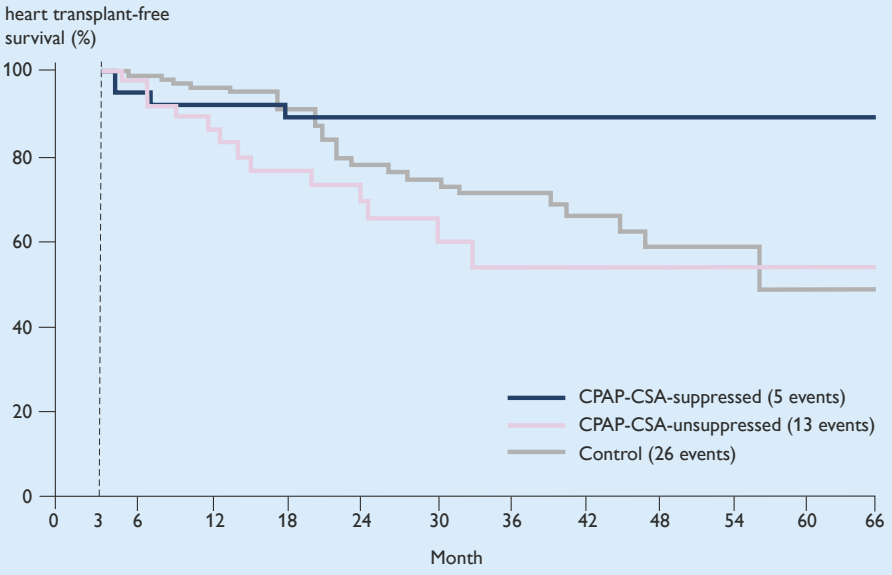
After 4 weeks of CPAP, the AHI had reduced to 30/h, but there was no difference in LVEF or symptoms. Accordingly, the decision was made to implement servo ventilation (SV) therapy.

After 3 months of SV therapy, the AHI had improved to 6/h. The patient's cardiac symptoms improved, and he returned to a normal level of activity with no dyspnea on exertion and no nocturia. Three-dimensional echocardiography revealed an ejection fraction of 40%. The patient demonstrated high compliance with the BiPAP autoSV device (5.2 h/night) over the 3 month treatment period.

(Skowasch et al. Unpublished 2010)

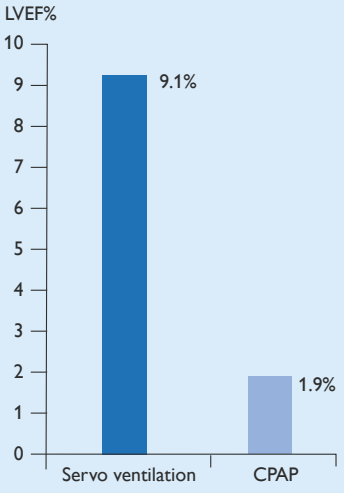
HF patients might benefit from effective therapy of CSA

Optimally treating CSA in HF patients improved survival.
(Adapted from Arzt et al. Circulation 2007)



Increase in LVEF after 3 months

CHF patients with OSA and CSA/CSR who received optimum medical treatment had an improved cardiovascular function with servo ventilation therapy.
(Adapted from Kasai et al. Circulation 2010)



Obstructive Sleep Apnea

Where do we go from here...

1 Ask general questions about sleep:
- Do you snore?
- Has your bed partner witnessed episodes of disrupted breathing during sleep?
- Do you have morning headaches?
- Are you sleeping during the day?

2 Does the patient show 2 or more of the above symptoms? If **yes**, move on to step 3.

3 Optionally, you can screen them with a validated device (like RUSleeping).

4 Diagnose them for sleep apnea (if you are trained) or refer them to a sleep professional.

Existing OSA guidelines

Joint European Society of Hypertension and European Society of Cardiology Guidelines 2007
"It is important to consider sleep apnea in the characterization of obese patients, especially those with hypertension resistant to conventional drug therapy. Furthermore, hypertensive patients, who are classified as 'non-dippers' on ambulatory pressure measurements, should be investigated for obstructive sleep apnea"
(Mancia et al. Eur Heart J 2007)

European Society of Cardiology Guidelines 2008
"Treatment with a CPAP should be considered in OSA documented by polysomnography"
(Dickstein et al. Eur Heart J 2008)

Central Sleep Apnea

Where do we go from here...

1 Look for specific symptoms in patients with optimized medications for HF and ask if they suffer from dyspnea and/or fatigue.

2 Ask whether their bed partner has witnessed periods of distrupted breathing and hyperventilation during sleep.

3 Diagnose them for sleep apnea (if you are trained) or refer them to a sleep professional.

Existing CSA guidelines

American Heart Association Guidelines 2008
"Recognition that a multidisciplinary strategy is critical to appropriate evaluation of sleep-related disease and heightened interaction between specialists in cardiovascular and sleep medicine hold promise for future improved and integrated patient care"
(Somers et al. Circulation 2008)

Collaboration between cardiologists and sleep physicians are critical for good patient management.

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