



Sleep Less, Heart Stress: Exploring the Connection between Sleep Disorders and Heart Health

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Disclosure

- I have no actual or potential conflict of interest in relation to this presentation.

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Objectives

- Understand common sleep disorders and their cardiovascular impact
- Review the pathophysiology linking sleep and CV disease
- Highlight screening and treatment strategies

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Why Sleep Matters

- Sleep is foundational** for cardiovascular, metabolic, and mental health
 - Sleep duration and quality are correlated with cardiovascular morbidity and mortality
- Obstructive Sleep Apnea (OSA)** affects 24–30% of men and 9–17% of women
 - OSA increases risk of **stroke by 2–3x** and **heart failure by 140%**
- Up to 45% of U.S. adults** report insufficient sleep (CDC, 2022)
 - Linked to a **1.5–2x increased risk** of hypertension, diabetes, and obesity
- AHA added **sleep duration (7–9 hrs/night)** as one of the “Life’s Essential 8” for cardiovascular health in 2022
- Improving sleep in patients with cardiovascular disease is associated with **better medication adherence, lower rehospitalization, and enhanced recovery**



Ugale-Suresh M et al. Circulation. 2022;146:e438–e452.
Pothanidis P et al. Eur Heart J. 2016;37(12):1457–1464.
Rothman TD et al. J Clin Sleep Med. 2008;4(3):239–246.
Marshall GS et al. Am J Respir Crit Care Med. 2009;180(2):191–196.
Rander W et al. J Gen Intern Med. 2013;28(2):246–254.

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Obstructive Sleep Apnea – OSA

- Repetitive collapse of the upper airway** during sleep, especially at the level of the soft palate and tongue base
- Occurs due to **anatomical narrowing** (e.g., obesity, retrognathia) and/or **reduced neuromuscular tone** during sleep

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Obstructive Sleep Apnea – OSA



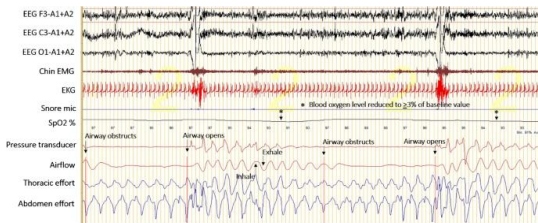
When we sleep, our airway muscles and tongue relax. For people with OSA, the tongue relaxes into a position that blocks the airway.



When your airway is blocked you get less oxygen to your brain, triggering you to wake up to take a breath. This cycle happens repeatedly, preventing quality sleep.

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Obstructive Sleep Apnea- OSA



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Obstructive Sleep Apnea – OSA

Apnea

Definition: A drop in airflow by $\geq 90\%$ of baseline

Duration: For ≥ 10 seconds

Types:

- **Obstructive Apnea:** Continued respiratory effort despite airflow cessation
- **Central Apnea:** Absent respiratory effort during airflow cessation
- **Mixed Apnea:** Features of both central and obstructive components

AHI (Apnea/Hypopnea Index)

Mild: 5- <15 events/hr

Moderate: 15- <30 events/hr

Severe: 30+ events/hr

Hypopnea (AASM Recommended Rule)

Definition: A $\geq 30\%$ reduction in airflow (nasal pressure signal)

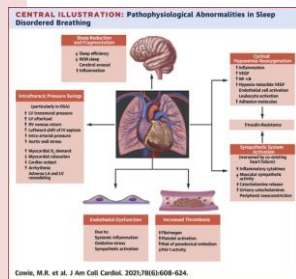
Duration: For ≥ 10 seconds

With either:

- $\geq 3\%$ oxygen desaturation, or
- An associated EEG arousal
- *Medicare 4% Oxygen Desaturation

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- Leads to intermittent hypoxia, hypercapnia, and frequent arousals
- Hypoxia and arousals trigger sympathetic nervous system activation, raising nocturnal and daytime blood pressure
- Results in oxidative stress, systemic inflammation, and endothelial dysfunction
- Promotes cardiovascular remodeling, including left ventricular hypertrophy and arrhythmogenesis



Cowie, M.R., et al. J Am Coll Cardiol. 2017;70(5):608-624.

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OSA and Atrial Fibrillation

OSA is present in up to 50% of patients with atrial fibrillation (AFib)

Mechanisms linking OSA to AFib include:

- **Large intrathoracic pressure swings** $\rightarrow$ atrial stretch and remodeling
- **Intermittent hypoxia** $\rightarrow$ oxidative stress, inflammation, endothelial dysfunction
- **Sympathetic activation** $\rightarrow$ promotes arrhythmia and autonomic instability

Untreated OSA increases risk of AFib **recurrence** after catheter ablation by 2-3x

PAP therapy reduces AFib recurrence and improves rhythm control

Guidelines recommend routine OSA screening in all patients with new or recurrent AFib (ACC/AHA/HRS)

Alm et al. 2010. Obstructive sleep apnea, chronic hypoxia, and risk of incident atrial fibrillation. JAMA. 303:2615-2621.
Wiggins et al. 2016. Association of obstructive sleep apnea with sleep disordered breathing. The Sleep Heart Health Study. Am J Respir Crit Care Med. 193:1079-1085.
Nishino et al. 2016. Sleep apnea and risk of incident atrial fibrillation: a prospective cohort study. Am J Respir Crit Care Med. 193:1079-1085.
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OSA and Heart Failure

Present in:

- **30-40%** of patients with **HFREF**
- **50%** of **HFpEF** patients with nocturnal symptoms have OSA

Associated with:

- Increased **hospital readmissions** and **mortality**
- Worsened **diastolic dysfunction**, **AFib**, and **pulmonary hypertension**

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OSA and Resistant Hypertension

Defined as: BP above goal despite ≥ 3 antihypertensive medications, including a diuretic

- OSA is a leading secondary cause of resistant hypertension
- Up to 70-80% of patients with resistant hypertension have moderate to severe OSA
- Non-dipping and reverse-dipping BP patterns are common in OSA

CPAP therapy reduces nighttime and 24-hour BP, particularly in sleepy or high-AHI patients

- Mean systolic BP reduction with CPAP: 4-8 mmHg (especially with good adherence)

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OSA Treatments

- PAP (Continuous Positive Airway Pressure)**
- Gold standard for **moderate to severe OSA**
 - Prevents airway collapse → reduces hypoxia, arousals, BP surges
- Oral Appliances (MAD)**
- For **mild to moderate OSA** or CPAP-intolerant patients
 - Anteriorly advance mandible to maintain airway patency
 - May lower nighttime BP, but less effective than CPAP for severe cases
- "Orphan" Devices**
- INAP
 - excite OSA
- Lifestyle Interventions**
- Weight loss (≥10% reduction) can significantly reduce AHI
 - Exercise improves sleep efficiency and BP control
 - Alcohol and sedative reduction prevents airway collapsibility
- Surgical Options**
- Uvulopalatopharyngoplasty (UPPP), MMA, nasal surgery
 - Considered when CPAP and oral devices fail

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Controversy: Does CPAP Always Improve CV Outcomes?

- Some **randomized controlled trials (RCTs)** have shown **no significant reduction in CV events** with CPAP in patients with OSA and existing cardiovascular disease
- **SAVE Trial (NEJM, 2016):**
 - 2,717 patients with moderate-to-severe OSA and prior CV events
 - CPAP **did not reduce** rates of MI, stroke, or CV death vs. usual care
 - Median CPAP use: **3.3 hours/night**

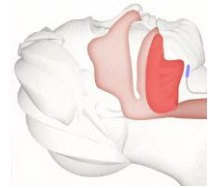
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Controversy: Does CPAP Always Improve CV Outcomes?

- **Poor CPAP adherence:**
 - Most participants used CPAP **<4 hours/night**, below therapeutic threshold
 - Cardiovascular benefit appears **dose-dependent** — greater with longer nightly use
- **Selection bias:**
 - Many participants had **established CVD** — damage may be irreversible
 - Limited ability to assess **primary prevention** potential of CPAP
- **Population heterogeneity:**
 - Not all participants had **excessive daytime sleepiness**, which may identify patients most likely to benefit
- **Short duration of follow-up** relative to time needed for structural CV changes

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Hypoglossal Nerve Stimulation



- Alternative for CPAP-intolerant patients
- FDA-approved for AHI 15–100*, BMI < 40*
- Mean Adherence >5.7 hours/night
- Cardiovascular benefit under study; early evidence suggests autonomic improvement

Wolke R, et al. Hypoglossal nerve stimulation improves cardiac autonomic modulation during sleep in patients with obstructive sleep apnea.

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SURMONT-OSA

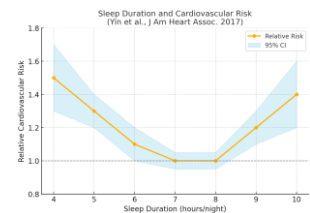
- Phase 3, randomized, placebo-controlled trial of tirzepatide in adults with moderate-to-severe OSA and obesity
- Study 1: Patients ineligible for CPAP
- Study 2: Patients on CPAP
- AHI reduction at 52 weeks:
 - Study 1: -27.4 events/hr (tirzepatide) vs -4.8 (placebo)
 - Study 2: -30.4 events/hr (tirzepatide) vs -6.0 (placebo)
- Mean weight loss: 18% in Study 1, 20% in Study 2 vs 2% with placebo
- Improved ESS scores (daytime sleepiness), BP, and sleep quality



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Sleep Duration – U-shaped Risk

- Mechanisms include metabolic dysfunction and inflammation
- Inadequate sleep increases **C-reactive protein and IL-6**, contributing to systemic inflammation



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Circadian Rhythm Disorders

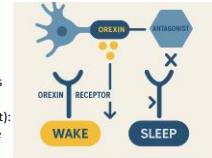
- Shift work, jet lag, delayed sleep phase, Non-24 SW
- Associated with metabolic syndrome, HTN, MI
- Chrono-disruption affects BP, glucose, and lipid rhythms
- Increased "ALL Cause Mortality"



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Treatments for Insomnia and Cardiovascular Benefits

- Cognitive Behavioral Therapy for Insomnia (CBT-I):
 - Increases HRV, reduces BP and inflammation
 - First-line therapy per clinical guidelines
- Melatonin and Ramelteon:
 - Improve circadian alignment and nighttime BP
 - Beneficial for non-dipping hypertensive patients
- Dual Orexin Receptor Antagonists (e.g., Daridorexant):
 - Promote restorative sleep with CV safety profile
 - Preserve autonomic tone, no next-day sedation
- Avoid long-term use of benzodiazepines/Z-drugs in CV patients



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Restless Legs Syndrome (RLS)

- Unpleasant leg sensations and urge to move
- Common in pregnancy, iron deficiency
- Associated with nocturnal hypertension and stroke



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Screening for Sleep Disorders

Ask about snoring, sleep quality, "nocturnal achiness" and daytime fatigue

STOP-BANG for OSA

Epworth Sleepiness Scale (ESS)

Insomnia Severity Index (ISI)

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Sleep Testing Options

- Home sleep apnea test (HSAT) for uncomplicated OSA
- Polysomnography (PSG) for complex cases:
 - CHF, stroke, CSA
 - RLS
 - REM-Behavior Disorder
- PSG-MSLT
 - HLA-DQB1*06:02
 - Hypocretin
- MWT
- Actigraphy
- Dim-Light Melatonin Onset (DLMO)

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Questions?

Obstructive Sleep Apnea (OSA)

Screening: STOP-BANG, Epworth Sleepiness Scale (ESS)

First-line Treatment: CPAP, weight loss,

Additional: MAD (oral appliance), Hypoglossal nerve stimulator, Tirzepatide

Restless Legs Syndrome (RLS)

Screening: International RLS Scale (IRLS), Sleep history

First-line Treatment: Ferritin >70 ng/mL, iron supplementation

Additional: Gabapentin, dopamine agonists (e.g., pramipexole, ropinirole)

Insomnia

Screening: Insomnia Severity Index (ISI), Sleep diary

First-line Treatment: CBT-I

Additional: Ramelteon, melatonin, daridorexant (DORA)



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