Disclosures:

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Learning Objectives

• Recognize the relationships between sleep apnea and cardiovascular disease
• Cognizant of ongoing research examining the effects of treating sleep apnea and heart disease
• Familiarity of sleep apnea treatment options in patients with cardiovascular disease
What is Sleep Disordered Breathing?

Repetitive cessation or near cessation of breathing during sleep
- Desaturation
- Arousal

Obstructive Sleep Apnea
- Pharyngeal airway obstruction

Central Sleep Apnea
- Interruption of central drive to breathe

Mixed Sleep Apnea
Mechanisms of Obstructive Sleep Apnea

Decreased distal airway traction
- supine posture
- small lung volumes

Loss of static pharyngeal dilator tone during REM sleep
- genioglossus and tensor palatini
- ?? leptin, ghrelin, IL-6, TNF-α

Proximal airflow resistance
- mandible length
- tongue volume
- hyoid position
- adiposity
Treatment of Sleep-Disordered Breathing

Oral appliances
Surgery
Weight loss
Supplemental $O_2$
Positive Airway Pressure
  • CPAP/BiPAP
  • Adaptive servo-ventilation (ASV)
Hypoglossal nerve stimulation

Sleep Apnea & Cardiovascular Disease

Prevalence of Sleep Apnea & Cardiovascular Disease

Cardiac Event Risk in Severe OSA

CPAP Therapy & Cardiac Event Risk in Mild-Moderate OSA

CPAP Therapy & Cardiac Events: RCT Data

Sleep-Disordered Breathing & Specific Cardiac Conditions
Coronary Artery Disease & OSA

Severe OSA increases risk for ischemic events
• Independent of co-morbidities

OSA carries increased risk for incident CAD
• Independent of co-morbidities

OSA is associated with poorer CAD outcomes
• Medical therapy
• Revascularization

Impact of CPAP therapy on CAD outcomes
OSA & STEMI Survival

120 STEMI patients
- 105 sleep studies
- No OSA treatment

OSA prevalence
- Severe: 42%
- Non-severe: 58%

Combined endpoint
- Death, repeat MI, stroke, unplanned TVR, CHF

Hypertension: CPAP Effect – RCT

Hypertension: CPAP Affect – Resistant HTN

Sleep-Disordered Breathing & Heart Failure

OSA & Heart Failure

- Arousal
- Augmented hyperadrenergic state in OSA & CSA
  - ↑ Sympathetic activation
  - ↓ Vagal tone
  - ↑ Blood pressure, ↓ Heart rate, ↑ VO₂
  - ↑ RAA system
  - ↑ Fluid retention
  - ↓ P.O₂
  - ↑ PCO₂

- Airway collapse
- Oxidative stress
- ↑ Afterload
- ↑ Tensional pulmonary arterial hypertension
- ↑ Vasoconstrictor tone

- Arousal
- Fluctuating thoracic pressure
- ↑ Tensional pulmonary arterial hypertension
- ↑ Vasoconstrictor tone

- P.O₂ and P.CO₂ oscillation
- Cardiovascular sympathetic neuron cyclic activation
- Respiratory centre alterations

CSA & Heart Failure

- Arousal
- Apnoea threshold
- ↓ P.CO₂

- Respiratory centre alterations
- ↑ Tensional pulmonary arterial hypertension
- ↑ Vasoconstrictor tone

- ↑ P.CO₂ sensitivity
- ↑ Ventilatory rate
- ↑ Pulmonary venous pressure

- Tensional pulmonary arterial hypertension
- ↑ Vasoconstrictor tone

- ↑ Stretch receptor stimulation
- ↓ Pulmonary congestion

Heart failure

OSA & Heart Failure Survival

CPAP & Heart Failure Survival - CSA

ASV & Heart Failure Survival - CSA

- Increase PAP decreases cardiac output
- CSA is a compensatory mechanism for HFrEF
- Older generation ASV → excessive ventilation

Sleep-Disordered Breathing & Heart Failure - Summary

Severe OSA increases risk for heart failure in men

OSA and CSA are both prevalent in heart failure populations

Untreated severe OSA decreases heart failure survival

Impact of CPAP on heart failure mortality unclear
- OSA: CPAP improves hemodynamics.

Impact of heart failure therapy on OSA unclear
SUMMARY

Sleep-disordered breathing is highly prevalent in patients with cardiovascular diseases

- Associated with substantial morbidity

CPAP therapy improves quality of life in symptomatic OSA

Research on CPAP on cardiac outcomes is ongoing