

# Obstructive Sleep Apnea

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This Presentation is Approved for  
1 CRCE Credit Hour

## Learning Objectives

- Describe the epidemiology, risk factors & complications of obstructive sleep apnea (OSA)
- Explain the pathophysiology of OSA
- Identify the manifestations of OSA
- Describe diagnostic techniques applied to OSA
- Outline management techniques for OSA, including strategies to increase patient compliance

## Introduction

## Definitions

- Obstructive sleep apnea (OSA): cessation of airflow with persistent respiratory effort
  - ❖ Partial or complete airway collapse during sleep
  - ❖ Reduced airflow
  - ❖ Impaired gas exchange
  - ❖ Recurrent arousals from sleep

## Definitions

- Central apnea is the cessation of airflow with no respiratory effort
- Mixed apnea: begins as central apnea & ends as obstructive apnea

## Definitions

- Apnea: cessation of airflow for 10 sec
- Hypopnea: airflow reduced by 50% for 10 sec or by 30% with desaturation
- Apnea hypopnea index (AHI): measure of apneic events/hour

## Prevalence

- Diagnosis of OSA is relatively new
- Adult men: 3 - 7%
- Adult women: 2 - 5%

## Significance

- Patients with OSA use healthcare resources at increased rates, even before formal diagnosis
- Early recognition & treatment may prevent complications that result from OSA

## Risk Factors

- Age > 65 (65% incidence)
- Excess body weight
  - ❖ 60% of tested patients are overweight
  - ❖ 10 kg increase → likely increase in apnea-hypopnea events by > 15/hr
- Gender: male > female

## Risk Factors

- Race: African-American > white
- Shift workers
- Craniofacial abnormalities
  - ❖ Brachycephaly: wide head
  - ❖ Micrognathia: small mandible
  - ❖ Macroglossia: large tongue
- Large neck circumference

## Risk Factors

- Nasal congestion
- Familial predisposition
- Current smoking: airway inflammation
- Secondhand smoke exposure
- Alcohol consumption
- Pregnancy (females)

## Complications

- Cardiovascular disease: associated only with hypopneas with  $\geq 4\%$  desaturation
- Systemic hypertension
- Pulmonary hypertension
- Atrial fibrillation
- Stroke

### Complications

- > Sudden death
- > Increased risk for post-surgical complications
- > Daytime sleepiness
  - ❖ MVAs
  - ❖ Work-related accidents

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- > Sudden death
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- > Daytime sleepiness
  - ❖ MVAs
  - ❖ Work-related accidents
- > Impaired cognitive function
- > Decreased health-related quality of life (HRQL)

### Complications

- > Metabolic complications
  - ❖ Insulin resistance
  - ❖ Oxidative stress
  - ❖ Pro-inflammatory stress
  - ❖ Impaired vasodilator response: impairs treatment for hypertension

FYI see links below for metabolic complications of sleep apnea article

### Pathophysiology

### Normal Sleep Patterns

- > Sleep cycles
  - ❖ 4 - 5 cycles/night
  - ❖ 90 - 110 min/cycle
  - ❖ Five stages each cycle
  - ❖ Alternate between REM & non-REM sleep

### Normal Sleep Patterns

- > Non-REM Stages
  - ❖ Stage one: dozing
  - ❖ Stage two: light sleep
  - ❖ Stage three: deep sleep (slow wave)
  - ❖ Stage four: deeper sleep (slow wave)

## Non-Rapid Eye Movement (NREM) Sleep

- Absence of dreaming
- Slow (delta) EEG waves
- Reduced sympathetic tone → reduced HR, BP
- Deep sleep: regular, slow breathing
- PaCO<sub>2</sub> increases 5 torr
- PaO<sub>2</sub> decreases 5 torr

FYI see links below for sleep patterns article

## REM Sleep

- Dreaming
- Increased HR, RR
- Muscular paralysis
- First REM stage: 10 minutes
- Longer duration for subsequent cycles, up to 90 minutes REM

## REM Sleep

- Dreaming
- Increased HR, RR
- Muscular paralysis
- First REM stage: 10 minutes
- Longer duration for subsequent cycles, up to 90 minutes REM
- Decreased airway tone: permits obstruction
- Decreased response to hypercapnia, hypoxemia

## Obstructive Apnea

- During REM sleep
- Inactive genioglossus muscle enables soft palate & uvula to impose on posterior pharynx

See links below for image of genioglossus muscle

## Obstructive Apnea

- During REM sleep
- Inactive genioglossus muscle enables soft palate & uvula to impose on posterior pharynx
  - ❖ Obstruction
  - ❖ Snoring
  - ❖ Hypopnea/apnea event
  - ❖ Desaturation
  - ❖ Arousal from sleep

## Manifestations

## Sleep Apnea

- Types
  - ❖ Central
    - Absence of ventilatory effort
    - Absence of flow
  - ❖ Obstructive: airway closure
    - Presence of effort
    - Absence of flow
  - ❖ Mixed: central apnea/obstructive apnea

## Symptoms

- Snoring: disrupted snoring 70% predictive sensitivity
- Witnessed apnea: 90% predictive sensitivity
- Sleep complaints
  - ❖ Insomnia
  - ❖ Disrupted sleep
  - ❖ Daytime somnolence

## Symptoms

- Cognitive deficits
- Sexual dysfunction
- Gastroesophageal reflux (GERD)

## Signs

- Obesity
  - Large neck circumference
    - ❖ Male  $\geq 17$  in.
    - ❖ Female  $\geq 15$  in.
- Airway abnormalities
  - ❖ Severe nasal obstruction
  - ❖ Low-hanging soft palate
  - ❖ Large (hypertrophied) uvula
  - ❖ Enlarged tonsils &/or adenoids
  - ❖ Macroglossia

## Manifestations: Severe OSA

- Formerly, Pickwickian syndrome
  - Middle-aged, fat, snoring male
  - Daytime somnolence
  - Systemic hypertension
  - Pulmonary hypertension
  - Cor pulmonale (right ventricular failure)
  - Cyanosis
  - Polycythemia
- FYI see links below to view Charles Dickens' John

## Diagnosis

## Screening Questionnaires

- > Various questionnaires for practitioners
- > Screening for anesthesia
  - ❖ STOP scale
  - ❖ Berlin questionnaire

See links below for OSA screening questionnaire  
FYI see links below to download STOP questionnaire article

## Polysomnography

- > Gold standard for sleep disorders
- > Electroencephalogram (EEG): brain activity
- > Electro-oculogram (EOG): eye motion
- > Electromyogram (EMG): muscular activity

FYI see links below for polysomnography testing: sensors, etc.

## Polysomnography

- > Electroencephalogram (EEG): brain activity
- > Electro-oculogram (EOG): eye motion
- > Electromyogram (EMG): muscular activity
- > Respiratory inductive plethysmography (RIP): thoracic & abdominal motion
- > ECG
- > Nasal airflow sensor
- > Pulse oximetry

## Unattended PSG

- > Apnea risk evaluation system (ARES)
  - ❖ Wireless: worn on forehead
  - ❖ Oxygen saturation (SpO<sub>2</sub>)
  - ❖ Pulse rate
  - ❖ Airflow
  - ❖ Respiratory effort
  - ❖ Venous volume
  - ❖ Snoring levels
  - ❖ Head movement & position

FYI see links below for ARES

## Unattended PSG

- > LifeShirt system
  - ❖ Adult & pediatric monitoring
  - ❖ Analyzes breathing patterns
  - ❖ Incorporates RIP technology
  - ❖ Distinguishes obstructive sleep apnea from central sleep apnea
  - ❖ Validated by research

See links below for illustration & photo of LifeShirt system

## Unattended PSG

- > Less cost
- > Comparable results (research)
- > Approved by Medicare, insurers
- > Greater validity: less first-night effect
- > Not recommended for
  - ❖ Patients with comorbidities
  - ❖ Screening asymptomatic patients

See links below for comparison of standard vs. portable PSG

## Obstructive Apnea

- > Cutoffs for levels vary among sleep centers
- > Recommendations for levels of apnea-hypopnea indices (AHIs)
  - ❖ Mild 5 - 15/hr
  - ❖ Moderate 15 - 30/hr
  - ❖ Severe > 30/hr

## Management

## Management: Central Apnea

- > O<sub>2</sub> therapy
- > CO<sub>2</sub> : respiratory stimulation
- > NIPPV: with backup rate
- > Respiratory stimulants
  - ❖ Acetazolamide (Diamox)
  - ❖ Theophylline

FYI see links below for management of central sleep apnea article

## Management: Obstructive & Mixed

- > Weight loss: sometimes cures OSA
- > Medications: rarely prescribed
- > Oral appliance: mandibular advancement splints
  - ❖ May be available from dentists
  - ❖ Custom made
  - ❖ "Boil & bite"

See links below to view mandibular advancement splints

## Management: Obstructive & Mixed

- > Tracheotomy: bypass obstruction
- > Reconstructive surgery
  - ❖ Maxillomandibular advancement: most effective surgical intervention
  - ❖ Uvulopalatopharyngoplasty (UPPP)
  - ❖ Pharyngeal flap
  - ❖ Tonsillectomy: cure for some patients

See links below for description & images of surgical interventions

## Management: Obstructive & Mixed

- > Continuous positive airway pressure (CPAP)
- > BIPAP
- > Guidelines for selection & titration cited in references: Kushida et al. 2008.

FYI see links below for ACP clinical practice guideline on management of OSA for adults (Oct 2013)

## Management: Obstructive & Mixed

- > APAP: automatic positive airway pressure
  - ❖ Automatically adjusts pressure to ensure ventilation
  - ❖ May replace some sleep studies

See links below to view  
Respironics BiPAP AVAPS™ & Resmed Autoset™

## Patient Interfaces

- > Nasal mask
- > Full face mask
- > Nasal pillows

FYI see links below for CPAP & BiPAP equipment videos

## Patient Interfaces



Full Face Mask

Nasal Mask

Nasal Pillows

## CPAP & BiPAP Compliance

- > OSA severity :: CPAP compliance
- > About 50% OSA patients comply with prescriptions
- > Barriers to compliance
  - ❖ Discomfort with interface
  - ❖ Claustrophobia
  - ❖ Nasal congestion

## CPAP & BiPAP Compliance

- > Strategies to improve compliance
  - ❖ Patient/family education
  - ❖ Appropriate type & level of treatment
  - ❖ Most comfortable interface
  - ❖ Humidification: preferred by some patients
  - ❖ Automatic devices: preferred by some
  - ❖ Follow-up: especially by physicians

FYI see links below for article on improving compliance

## Didgeridoo Playing for OSA

- > Serendipitous discovery: players with OSA noticed reduced symptoms
- > Randomized trial found decreased
  - ❖ AHI
  - ❖ Snoring
  - ❖ Daytime sleepiness

FYI see links below for article on didgeridoo & OSA



## Didgeridoo Playing for OSA

- Disadvantages
  - ❖ Practicality
  - ❖ Neighbors
- Implication: exercises that mimic didgeridoo playing may be effective

FYI see links below for didgeridoo store

## Provent™ for OSA

- Nasal EPAP device
- Adheres to nares
- Effectiveness demonstrated in trials
- Well tolerated by patients
- Why didn't I think of that?

FYI see links below for Provent™ website  
Up next: Videos of didgeridoo playing & Provent™

## Summary & Review

- Epidemiology
  - ❖ Definitions
  - ❖ Prevalence
  - ❖ Significance
  - ❖ Risk factors
  - ❖ Complications

## Summary & Review

- Pathophysiology
  - ❖ Normal sleep cycles, stages
  - ❖ Obstructive apnea events
- Manifestations
  - ❖ Types of sleep apnea
  - ❖ Symptoms
  - ❖ Signs

## Summary & Review

- Diagnosis
  - ❖ Screening questionnaires
  - ❖ Polysomnography: gold standard
  - ❖ Unattended sleep studies
  - ❖ Cutoff scores

## Summary & Review

- Management
  - ❖ Weight loss
  - ❖ Oral appliances
  - ❖ Surgical interventions
  - ❖ Noninvasive ventilatory support
  - ❖ Compliance issues

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