Obstructive Sleep Apnea

Arthur Jones, EdD, RRT

http://rc-edconsultant.com/

Learning Objectives:
- Describe the epidemiology, risk factors and 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 and 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 and 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 ≥4% desaturation
- Systemic hypertension
- Pulmonary hypertension
- Atrial fibrillation
- Stroke
Complications
- Sudden death
- Increased risk for post-surgical complications
- Daytime sleepiness
  - MVAs
  - Work-related accidents

Complications
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- Daytime sleepiness
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  - 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

Pathophysiology

Normal Sleep Patterns
- Sleep cycles
  - 4-5 cycles/night
  - 90-110 min/cycle
  - Five stages each cycle
  - Alternate between REM and 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
- PaCO2 increases 5 torr
- PaO2 decreases 5 torr

FYI - Link to article on sleep patterns
http://www.talkaboutsleep.com/sleep-disorders/archives/intro.htm

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

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

Click to view image of genioglossus muscle
http://www.innerbody.com/image_dige01/dige31-new.html

**Manifestations**
- Obstruction
- Snoring
- Hypopnea/apnea event
- Desaturation
- Arousal from sleep
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...> 17 in.
    - female...> 15 in.
- Airway abnormalities
  - severe nasal obstruction
  - low-hanging soft palate
  - large (hypertrophied) uvula
  - enlarged tonsils and/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 - Click to see Charles Dicken's John
http://biomed.uninet.edu/2006/n1/rabec/graf1.jpg

**Diagnosis**
Screening Questionnaires

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

Click to see OSA screening questionnaires (adult and pediatric)
http://www.sleephealth.com/existing-patients-questionnaire.htm
FYI - click to download article on STOP questionnaire

Polysomnography

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

FYI - Link to polysomnography testing- sensors, etc.
http://classes.kumc.edu/cahe/respcared/cybercas/sleepapnea/trenpoly.html

Polysomnography

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

Unattended PSG

- Apnea risk evaluation system (ARES)
  - wireless- worn on forehead
  - oxygen saturation (SpO2)
  - pulse rate
  - airflow
  - respiratory effort
  - venous volume
  - snoring levels
  - head movement and position

FYI - Link to ARES
http://watermarkmedical.com/products.php

Unattended PSG

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

Click for illustration of LifeShirt system
http://www.pdacortex.com/Vivometrics/howitworks.gif
Click for photograph of LifeShirt system
http://www.tms.org/pubs/journals/JOM/0507/fig6.large.gif

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
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
- O2 therapy
- CO2- respiratory stimulation
- NIPPV- with backup rate
- Respiratory stimulants
  - acetazolamide (Diamox)
  - theophylline

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"

FYI - Click for article on management of central sleep apnea

Management- obstructive & mixed
- Tracheotomy- bypass obstruction
- Reconstructive surgery:
  - maxillomandibular advancement- most effective surgical intervention
  - uvulopalatopharyngoplasty (UPPP)
  - pharyngeal flap
  - tonsillectomy- cure for some patients

Management- obstructive & mixed
- Continuous positive airway pressure (CPAP)
- BiPAP

Click for description and images of surgical interventions
http://www.sleepapneasurgery.com/pharyngoplasty.html
Management - obstructive & mixed

❖ APAP - automatic positive airway pressure
  ◆ automatically adjusts pressure to ensure ventilation.
  ◆ may replace some sleep studies

Click to see Respironics BiPAP AVAPS (TM)
http://bipapavaps.respironics.com/
Click to see Resmed Autoset (TM)

Patient interfaces

❖ Nasal mask
❖ Full face mask
❖ Nasal pillows

FYI - Link to videos about CPAP & BiPAP equipment
(bookmark this)
http://www.cpap.com/listVideos.php?VGID=ALL

Patient Interfaces

nasal mask

full face 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

FYI - Link to 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 - Click to download article on didgeridoo and OSA
http://www.bmj.com/cgi/content/full/332/7536/266
Didgeridoo Playing for OSA

- Disadvantages
  - practicality?
  - neighbors?
- Implication- exercises that mimic didgeridoo playing may be effective.

FYI - Click for video of didgeridoo playing
http://www.youtube.com/watch?v=9g592I-p-dc
FYI - Link to the didgeridoo store
http://www.didgeridoostore.com/didgeridoo_sleepapnea_snoring.htm

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 - Click for video Provent™ therapy
http://www.sleepdt.com/provent-therapy/
FYI - Link to Provent website
http://www.proventtherapy.com/hcp/index.php

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
References