Clinical Follow-up of Positive Airway Pressure (PAP) Therapy

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Objectives

• To identify elements of PAP therapy which are key to successful treatment of obstructive sleep apnea.
• To identify methods available for monitoring and modifying PAP therapy.
• To understand how objective data recorded by PAP machines can be interpreted.
• To identify measures to deal with abnormal data and patients’ problems with PAP therapy.
Disclosure

I have no actual or potential conflicts of interest in relation to this program/presentation.

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The History of OSA

- Sleep apnea was discovered in 1965
  - American physicians noticed that some obese patients complained of fatigue and excessive sleepiness
Pickwickian Syndrome

Obstructive sleep apnea was called the Pickwickian syndrome in the past because Joe the Fat Boy who was described by Charles Dickens in the Pickwick papers had typical features with snoring, obesity, sleepiness and "dropsy". The term Pickwickian syndrome was originally applied to those patients who had sleepiness, obesity and evidence of right heart failure. Some of the patients probably had central alveolar hypoventilation syndrome and obesity hypoventilation syndrome rather than typical obstructive sleep apnea syndrome as we now know it.
• They mistakenly attributed the excessive sleepiness to a combination of weight and increased CO2 levels.

• They later discovered that the cause was to position of the tongue and the tissues of the throat.

• The term “Apnea”, the Greek word for breathlessness, was applied.
Consequences of OSA

• Increased risk of cardiovascular/cerebrovascular disease
  • 65% of patients with a stroke have sleep disordered breathing
  • Heart attack risk increased by 30%
  • Risk of CHF increased by at least 58% in severe OSA
  • 30-85% of patients with hypertension have OSA

• OSA can precipitate or aggravate Type II DM and other metabolic abnormalities

• Increased likelihood of motor vehicle accidents and workplace accidents

• Reduced quality of life
Prevalence of OSA

• Prevalence appears to be high, but it is not clear
  • Approximately 42 million American adults have SDB
  • 1 in 5 has mild OSA
  • 1 on 15 has severe OSA
  • 9% of middle-aged women and 25% of middle-aged men suffer from OSA

• Most patients are asymptomatic or unaware of the indicators
  • At least 75% of patients with OSA remain undiagnosed
  • Prompts to seek medical attention
Increasing Rate of Discovery

- Wisconsin Sleep Cohort Study 1988-2011
  - 10% of adults 30-60 years old had clear evidence of OSA

- The Sleep Heart Health Study in the late 1990's
  - Approximately 17% of adults had OSA

- The National Sleep Foundation Poll in 2005
  - As many as 25% of American adults are at high risk for OSA
Rate of Discovery (cont.)

• Prevalence increases with age
  • Less than 10% at age 40
  • Approximately 20% at age 60

• Increases in the incidence of obesity
Increased Need for Knowledgeable Professionals to Manage Treatment of OSA
The History of PAP Therapy

• Prior to PAP therapy, there were very few treatment options
  • Tracheostomy

• Colin Sullivan – Australian physician- Respiratory Unit of Sydney’s Royal Prince Alfred Hospital

• Late 1970’s – Dog studies
  • English Bulldogs and other breeds with pushed-in faces are the only animals besides humans to have OSA
  • Developed a mask to fit over the dogs’ snouts and experimented with a vacuum cleaner motor, tubes, and mask
First Use of PAP Therapy in Humans

• June 1980
  • Man with very severe OSA
  • Sullivan’s pressure machine was tried
  • It worked!
  • The patient felt better than he had in years
Alternatives to PAP Therapy

• Mandibular Repositioning Devices
  • Prevent collapse of the tongue and tissues by supporting the jaw in a forward position +/- vertical support
  • Approximately 50% effective for severe OSA
  • Patients with lower BMI an AHI have higher success rates
  • Certain craniofacial features have increased success
  • No way of predicting effectiveness
  • Can cause dental/TMJ problems
  • Compliance cannot be monitored
  • Not effective for complex sleep apnea
  • Can be as effective as PAP therapy in some patients
Positional Therapy

- Tennis balls in a sock
- Belts with foam blocks
- Vibrating devices worn on the neck
- Compliance cannot be monitored
- Long-term efficacy is poor
Winx Sleep Therapy System

- Uses negative pressure in the oral cavity
- Requires free nasal airflow
- No way of predicting efficacy
- Not covered by most insurance plans
Tongue Retaining Devices

• Results similar to mandibular repositioning devices
• Success is limited by nasal airflow obstruction
Nasal Microvalves

- Increase positive pressure on exhalation
- Not appropriate for patients with nasal airflow problems
- No way of predicting efficacy or monitoring compliance
- Single use, costly, ? Insurance coverage
Surgical Treatment

• Pillar Procedure

• Variable and unpredictable results
Surgical Treatments (cont.)

• Somnoplasty

• Most effective for mild to moderate OSA
• Reduces snoring, little effect on sleep apnea
Surgical Treatments (cont.)

- Success depends on favorable anatomy
- Weight reduction in patients with BMI > 40 a better option?
Surgical Treatments (cont.)

• Bariatric Surgery
  • Best candidates have BMI > 40 and AHI > 15
  • AHI might not improve significantly
Surgical Treatments (cont.)

• Upper Airway Stimulation

• Long term side effects uncertain
PAP or No PAP?

• 2006 AASM Practice Parameters
  • PAP therapy is an option in mild OSA
  • Mixed results in studies of outcome
  • PAP reduces AHI, but does not necessarily reduce BP or improve EDS, mood, or quality of life
    • Of 32 patients with AHI < 10, ten had improved quality of life at 4 weeks
    • At 3 months, only 4 continued to adhere to PAP therapy
  • Important to correlate AHI with symptoms and co-morbidities
  • Use judgment when deciding to recommend PAP titration and home trial of PAP therapy
  • Consider alternative treatments
  • Examples of “overtreatment”
Adherence to PAP Therapy

• Defined as use for at least 4 hours, 70% of nights
• Greater than 6 hours of use results in normal levels of objective and subjective measures of daytime sleepiness, memory, and daily functioning
• 50-60% of patients are adherent to PAP therapy
• The decision is usually made during the first week of therapy
• Use increases gradually once the decision to adhere is made
Patient Factors Affecting Adherence

- EDS
- Severity of oxyhemoglobin desaturation
- Weak relationship to the AHI
- Low nasal airflow resistance
Patient Factors Affecting Adherence (cont.)

- Decision to seek medical attention
- Claustrophobic tendencies
- Self-efficacy
  - Motivation
  - Problem solving skills
  - Confidence in ability to engage in health behaviors
- Social Support
- Mood disorders do not strongly influence adherence to PAP therapy
Patient Factors Affecting Adherence (cont.)

- Psychological impact of being diagnosed with a chronic disease
- Stages of Grief Model
  - Denial
  - Anger
  - Bargaining
  - Depression
  - Acceptance
Patient Factors Affecting Adherence (cont.)

- Education and Psychological Support
- Pre-testing/treatment education
- Phone calls?
- Timing of follow-up visits?
- Cognitive Behavioral Therapy
  - Possibly more effective than advanced PAP modalities
Physical and Technical Factors

• Approximately 2/3 of PAP users report side effects
• Modes of PAP Therapy
  • Fixed Pressure or Auto-titrating PAP
    • Little difference in the use, efficacy, or adherence to therapy
    • AutoPAP undertreats in the lower end of the pressure range
  • Bi-Level PAP
    • More commonly used in sleep related ventilator failure (COPD, Neuromuscular Disorders, Obesity related hypoventilation)
    • Little rationale for use except in a “rescue role” after poor adherence to CPAP
• Adaptive Servo Ventilation
  • Complex sleep apnea
  • Many cases of complex sleep apnea resolve with continued use of standard CPAP
  • SERVE-HF Study
• Consider differences in breathing patterns (Men/women, lung disease, disorders of arousal)
Physical and Technical Factors (cont.)

• Mask Fit
  • Mask leak and discomfort is significantly higher in non-adherent patients

CPAP-associated Red Eye

- Clinical Problems
  - Dry eye syndrome
  - EXW CL intolerance
  - Recurrent Corneal Erosion
  - Infectious conjunctivitis

- Causes
  - Air leaks
  - Retрогrade air flow thru nasolacrimal apparatus

- Treatment
  - Lubricating ointments, HS, punctal plugs
  - CPAP refitting: adjust headgear and pressure

Source: Optometry. 2007-70:312-335
Physical and Technical Factors (cont.)

- Humidification
  - PAP therapy does not work well if there is nasal/upper airway congestion
  - Irritation from cold/dry air causes congestion and/or rhinorrhea
  - Patients > 60 are 5x more likely to require heated humidification
  - Patients taking 2 or more medications are 6x more likely to require HH
  - Patients with chronic mucosal disease are 4x more likely to need HH
    - Treat with topical corticosteroids and address allergies
  - Cool rooms – Rainout
  - Patients misunderstand symptoms of inadequate humidification
  - Examples
  - Every patient needs to have access to HH
Physical and Technical Factors (cont.)

- Impact on bed partner
  - Noise
    - Newer machines are very quiet
    - Mask Leak
  - Air impacting partner
    - Exhaust port diffusers
Interpretation and Use of Data Recorded by PAP Machines

• Adherence Data
• Apnea/Hypopnea Index
  • Airflow tracked/averaged
  • Events
    • Apneas > 10 seconds
    • Obstructive vs Central events – “echo technology”
    • Hypopneas – Reduced airflow from baseline meeting criteria
    • Vibratory Snores
    • Air Leak
  • Algorithms intended to detect “awake breathing” and reduce pressure to avoid sleep disturbance
• Machines do what they are programmed to do
Interpretation and Use of Data Recorded by PAP Machines (cont.)

• Correlate data with the polysomnogram and the patient
Mask Fit Problem
Extreme Mask Leak
Mouth Leaks Resulting in EDS
Naïve to CPAP
Treatment Emergent Central Apneas
Excessive Pressure?

Inadequate Humidity?

Other Sleep Disturbances?
Under-treatment with Auto CPAP
Discontinuation of Nasal Steroid Spray
Aspiration Pneumonia

Seizures
Knee Replacement
Shoulder Surgery
The Big Picture

• PAP is the gold standard
  • Patient Factors
  • Technical/Physical Factors
    • Mask Fit
    • Humidification
    • Mode of PAP
  • Interpretation and Use of Data
• Knowledge is the Key to Success
Questions ?
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