The International Franco - Palestinian Congress in Sleep Medicine

“Temporomandibular Disorders and Sleep Apnea”

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Effective CPAP and BiPAP Titration

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PATHOLOGIC BREATHING CYCLE: OSA

Wakefulness

- Airway Patency Compensation

Sleep

- Decreased Compensation
- Airway Collapse
- Hypoxia/Hypercapnia
- Increased Effort

Hyperventilation

- Hyperventilation \( \downarrow \text{CO}_2 / \uparrow \text{O}_2 \)
- Arousal/Sleep Fragmentation
- Sympathetic Activation
Sleep Tech Responsibilities

• Psychologist
• Apply Sensors and Monitoring Devices
  • EEG
  • Cardiac
  • Respiratory
• Understand equipment and computers
• Collect good and usable data
• Troubleshooter for all of above
• Bed & Breakfast Concierge
PAP therapy for patients with OSA

• **CPAP**
  - One level of pressure on inspiration and expiration
  - Device may have the option to provide pressure relief in early exhalation

• **Bi-level therapy**
  - One level of pressure on inspiration and lower level of pressure on expiration
  - Device may have the option to provide pressure relief in early exhalation
General Titration Protocol Goals

• The goals should be individualized to meet the needs of each patient.
  • 1. Keep the airway open (airway management)
  • 2. Stabilize breathing patterns by monitoring the patient’s response to therapy
  • 3. Adjust user set parameters as needed for optimal therapy efficacy and adherence
  • 4. Ensure proper mask fit to enhance comfort and acceptance, and to minimize leaks
The Sleep Center
Sleep lab titration options

- Most titration systems have multiple modalities available:
  - CPAP, AutoCPAP
  - Bi-level therapy modes such as S, S/T, PC, or T
  - BiPAP Auto
  - BiPAP autoSV Advanced
- Advanced features include:
  - AVAPS
  - A-Flex, Bi-Flex, and C-Flex+
CPAP

Continuous Positive Airway Pressure
Acclimation zone

GOAL: Adjust user-set parameters for optimal efficacy and adherence

Set mode to CPAP

- Establish initial settings as indicated below or as ordered by physician
- Ensure proper mask fit to enhance comfort and acceptance, and to minimize leaks
- Have patient lie down and breathe on CPAP device at basic settings below
- Recheck mask fit, assure patient comfort and acceptance
- May adjust CPAP and C-Flex or C-Flex+ to patient comfort

CPAP 4 cm H₂O
C-Flex or C-Flex+ To patient comfort
I ❤ MY CPAP
GiggleMed.com
CPAP Airway Management

• Pneumatic Splint – treatment of choice for OSA
• Delivers one continuous pressure during the entire breathing cycle
CPAP Therapy: Treatment of Choice for OSA

*Continuous Positive Airway Pressure*

- Non-invasively provides a continuous stream of air pressure through nose using a mask
- Air pressure prevents airway collapse, allowing you to breathe freely during sleep
- Can alleviate OSA symptoms when used as prescribed
Goals of treating OSA with PAP

**Short term**
- Maintain open airway
- Improve quality of sleep
- Alleviate daytime symptoms
  - Sleepiness
  - Moodiness/Impaired concentration/Memory loss
  - Morning headache

**Long term**
- Reduce mortality and morbidity
  - Decrease cardiovascular consequences
  - Reduce sleepiness
- Improve quality of life

AASM Recommended Guidelines

Kushida, Chediak, Berry, et al, JCSM Vol 4, #2, 2008
CPAP - “Airway Stent”

Axial MRI images of the retropalatal level

Midsagittal MRI images

Schwab RJ AM J RESPIR CRIT CARE MED 1996;154:1106-1
Down Titration

• One study with 85 OSA patients used a CPAP protocol in which the pressure was increased by 1 cm H2O in a stepwise fashion until respiratory events disappeared (effective pressure 1, Peff1); the pressure level was then decreased by increments of 1 cm H2O until respiratory abnormalities reappeared. The pressure was re-increased by increments of 1 cm H2O to normalize respiration (Peff2).

• The pressure obtained after the “down” titration had to be re-increased in 79 patients due to various respiratory events.

• The Peff2 level was significantly lower than Peff1 with a mean difference of 1.5 cm H2O
Can’t Sleep

Change to BiPAP
Can’t stand the Pressure

Change to BiPAP
Bi-level therapy for the sleep disordered breathing patient
Bi-level therapy in the sleep center

- Bi-level therapy is initiated because:
  - CPAP titration is ineffective
    - Inability to exhale
    - Frequent microarousals
    - Patient feels pressure too high
  - Typically seen in patients at pressures of 13 cm H2O or higher although some patients at lower pressures cannot tolerate CPAP
Why bi-level therapy?

• Simulates a breathing pattern similar to normal respiration
• Pressures consistently fluctuate between two set pressures
  • IPAP (Inspiratory Positive Airway Pressure)
    • Always the higher number
  • EPAP (Expiratory Positive Airway Pressure)
    • Always the lower number
• Lower pressure on exhalation decreases mask pressure and incidence of leaks
AASM Bi-Level Titration Guidelines

Kushida, Chediak, Berry, et al, JCSM Vol 4, #2, 2008
Min’s and Max’s

• The recommended minimum IPAP-EPAP differential is 4 cm H2O and the recommended maximum IPAP-EPAP differential is 10 cm H2O

• Not a ventilation mindset in this application of Bi-level modality

Kushida, Chediak, Berry, et al, JCSM Vol 4, #2, 2008
Titration Pitfalls

- Claustrophobia
- Circuit leak – leading to trigger failure
- Not enough pressure to clear obstruction
- Central apnea induced by CPAP
- Nasal blockage – Humidity vs Structure
- Over titration (deserves its own slide)
Over titration

• Be careful when with pressure increases following body movements
  • If pathology seems to be under control before movement – WAIT before > pressure
  • Airway may reestablish patency within a few minutes
  • Over titration will exacerbate...everything!
Grading of Titration

• An optimal titration reduces RDI to <5 per hour for at least a 15-min duration and should include supine REM sleep at the selected pressure that is not continually interrupted by spontaneous arousals or awakenings (Consensus).
Grading System

• A good titration reduces the overnight RDI to ≤10 per hour, or by 50% if the baseline RDI is <15 per hour and should include supine REM sleep that is not continually interrupted by spontaneous arousals or awakenings at the selected pressure (Consensus).
Grading System

• An adequate titration is one that does not reduce the overnight RDI to ≤10 per hour but does reduce the RDI by 75% from baseline (especially in severe OSA patients), or one in which the titration grading criteria for optimal or good are met with the exception that supine REM sleep did not occur at the selected pressure (Consensus).
Grading System

• An unacceptable titration is one that does not meet any one of the above grades (Consensus).

• A repeat PAP titration study should be considered if the initial titration does not achieve a grade of optimal or good and, if it is a split-night PSG study, it fails to meet AASM criteria (Consensus).
Summary

• Patients new to CPAP therapy will require special attention
• Education and a controlled acclimation period will improve acceptance of CPAP therapy
• Time on pressure is NREM and REM plus supine position is essential for optimal titration