TITRATION OF ADVANCED PAP THERAPIES: WHAT TO USE, WHEN, WHY AND HOW

- Kala Bingham, CRT RCP RPSGT
- Sleep Care Manager
- The Sleep Wellness Institute
General Titration Goals

- The goals should be individualized to meet the patient need

  - Airway management - keep the airway open
  - Stabilize breathing patterns by monitoring the patient's response to therapy
  - Set parameters for optimal therapy
  - Ensure mask fit
Sleep disordered breathing

- OSA
  - CPAP
  - BiPAP

- Central
  - BiPAP
  - ASV

- Hypoventilation
  - BiPAP
  - AVAPS
BiLevel: indications for use

- OSA patients with:
  - intolerance of CPAP pressures
  - hypoxemia despite resp event control
  - elevated CO2 levels despite resp event control

- Hypoventilation syndrome
- Complex or Central Sleep Apnea
What is BiLevel

- Provides two independently set pressures to maintain airway stability and support ventilation requirements while the patient sleeps
  - IPAP
  - EPAP
BiLevel terms

- **Rise Time**=the time it takes for BiPAP to change from EPAP to IPAP. You can adjust for patient comfort

- **Tidal Volume** - Vt
Titration BiLevel for control of apnea:

- Increase expiratory pressure (EPAP) in a stepwise fashion to control obstructive apnea.
- Increase Inspiratory pressure (IPAP) in a stepwise fashion (maintaining at least 4 cm difference from EPAP) to control hypopneas and snoring.
  - IPAP 4-6 cm > EPAP and snoring or hypopneas persist, → trial of increasing EPAP.
  - Central apneas → back up rate.
Titration of BiLevel for persistent hypoxemia in OSA

- IPAP/EPAP → control of apnea, hypopnea and snoring.
- Hypoxemia persists → increase IPAP in 2 cm increments.
- IPAP > 4 cm above level for control of OSA without benefit to sats or increases not tolerated → reduce to lowest effective level + add supplemental O2 to keep sats > 89-90%

- NOT ALL HYPOXEMIA IS HYPOVENTILATION
Effects of sleep on normal ventilation

- Decrease muscle tone
- Increased airway resistance
- Decrease drive to breath

- ↑ PaCO₂ 2 – 8 mm Hg
- ↓ PaO₂ 3 – 10 mm Hg

- NI wake PaCO2 38-43 mm
- NI sleep PaCO2 37-50 mm
Hypoventilation-Respiratory Insufficiency

- The state in which a reduced amount of air enters the alveoli of the lungs resulting in:
  - $\text{PaO}_2$ falls
  - $\text{PaCO}_2$ rises

Occurs due to:
1. decrease tidal volume ($\text{Vt}$)
2. increased dead space ($\text{Vd}$)
3. decreased respiratory rate ($\text{RR}$)
Development of respiratory insufficiency

HYPOVENTILATION

Thoracic disease

Decrease muscle tone & tidal volume

Increased airway resistance

Decrease drive to breath

Hypoventilation

↑CO₂
↓O₂

Abnormal PaCO₂ in sleep > 50 or change > 7 mm Hg from wake to sleep

Respiratory insufficiency

Night → N+Day
Common causes of thoracic disorder

1. Respiratory muscle weakness – decreased Vt, increased dead space, increased RR

- Amyotrophic Lateral Sclerosis
- Muscular Dystrophy
- Spinal Muscular Atrophy
- Post-Polio Syndrome
Common causes of thoracic disorder

2. **Restrictive thoracic** – decrease in the lung’s ability to expand due to an external restriction of the chest wall or stiffness of the lung tissue.

- Kyphoscoliosis
- Sarcoidosis
Common causes of thoracic disorders

3. Obstructive lung disease – Increased airway resistance, partial air-flow obstruction, increased dead space, air trapping.

- COPD
- Emphysema
- Severe Asthma
- Overlap syndrome
Common causes of thoracic disorders

4. Obesity hypoventilation syndrome – decreased Vt, increased RR
Titration options for patients with hypoventilation or respiratory insufficiency

1. Bi-Level PAP

2. Average Volume Assured Pressure Support (AVAPS)
Titration of BiLevel for persistent hypoxemia in OSA

- Titrate BiLevel to pressures appropriate for control of apnea, hypopnea and snoring
- If hypoxemia persists, increase IPAP in 2cm increments in attempt to improve 02 saturation
Titration of BiLevel for persistent hypoxemia in OSA

- If increasing IPAP >4 cm above level appropriate for control of OSA without benefit to sats or increases not tolerated, add supplemental 02 as needed to maintain sats >89-90%

- NOT ALL HYPOXEMIA IS HYPOVENTILATION
BiLevel S (spontaneous mode)

- Used with patients who are able to maintain a constant respiratory rate, but require an IPAP:EPAP pressure difference to augment tidal volume while you sleep.
BiLevel S (spontaneous mode)

- Can be used with the following patients:
  - Obesity hypoventilation
  - Neuromuscular weakness disorders
  - Restrictive thoracic disease
  - Obstructive lung disease
BiLevel S/T (timed back up rate)

- This mode is used with patients that require:
  - Time rate from the device to support their inconsistent respiratory pattern (more common in NM disease)
BiLevel S/T (timed back up rate)

- Pressure support to augment their tidal volume when the device provides a breath to the patient
- Patient has the ability to spontaneously initiate breaths or tolerate timed back up breaths from the device
How can we affect ventilation?

To increase ventilation:

- 1. Insure patent airway.
- 2. Increase Vt.
  - I:E differential
  - Vt setting with AVAPS.
- 3. Increase respiratory rate
- 4. Body position
Titration of BiLevel for control of hypoventilation

1. Transcutaneous (TCCO2) or End-Tidal CO2 (ETCO2) monitoring.

2. *Excessive leakage must be prevented.*

3. Initiate BiLevel at IPAP/EPAP 10/4 cm or EPAP at pressure previously demonstrated as effective to control obstructive apnea. Initiate IPAP at (EPAP +6 cm).

4. Increase EPAP only until obstructive events are controlled.

   Increase EPAP $\rightarrow$ increase IPAP same

   ***Want lowest possible EPAP***
Titration of BiLevel for control of hypoventilation (cont’d)

5. Increase IPAP (as tolerated) until the following parameters are achieved:
   
a. TCCO2 or ETCO2 < 50 mm (or RR 2-4 BPM < baseline wake RR )
   b. Minimal hypopneas
   c. Improvement in O2 sat if > 89%
Titration of BiLevel for control of hypoventilation (cont’d)

5. **Central apneas** or inconsistent efforts → back up rate → = match RR during relaxed wake.

6. Increase RR in increments of 2 BPM if CO2 remains > 50 mm despite use of maximally tolerated IPAP.
Bi-Level with (AVAPS)

- Fixed EPAP
- Vt selected – based on IBW (8-10 ml/kg)
- Adjusts pressure support (IPAP-EPAP) to maintain a consistent tidal volume
  - Able to provide a **constant tidal volume as patient ventilation changes**.
    - Allows for compensation of Intra-night and inter-night changes in breathing status.
AVAPS – Who is it appropriate for?

- Individuals with anticipated variable pressure support needs
  - Neuromuscular disease
  - Obesity-hypoventilation, COPD or hypoventilation with marked deterioration in REM sleep
AVAPS auto-titration algorithm

Automatically adjusts the IPAP within a *preset range* to maintain a consistent tidal volume. IPAP will automatically increase or decrease.
AVAPS is \textit{NOT recommended} for patients with periodic breathing

- Treatment of periodic breathing requires a rapid and variable breath by breath response system so the patients' PaCO$_2$ stabilizes quickly.

- AVAPS does not have a quick variable response to changes in tidal volume.
Titration protocol with AVAPS for respiratory insufficiency

*Goal: Adjust user parameters for efficacy and adherence*

- Set mode to S/T with AVAPS on
- Establish initial settings as indicated below
- Ensure proper mask fit to allow algorithm to work effectively
- Have patient breathe on bi-level device at basic settings below
- May Adjust IPAP, I-Time and Rate to patient comfort

<table>
<thead>
<tr>
<th>EPAP</th>
<th>4 cm H₂O</th>
<th>I-Time</th>
<th>1.2 sec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPAP&lt;sub&gt;min&lt;/sub&gt;</td>
<td>10 cm H₂O</td>
<td>Rate</td>
<td>8-10 BPM or</td>
</tr>
<tr>
<td>IPAP&lt;sub&gt;max&lt;/sub&gt;</td>
<td>25 cm H₂O</td>
<td></td>
<td>2 below wake rate</td>
</tr>
<tr>
<td>Rise Time</td>
<td>2 or 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Suggested starting point for AVAPS tidal volume

3 ways to chose a starting tidal volume with AVAPS:
1. MD suggestion
2. Patient comfort
3. Ideal body weight – 8 ml/kg based on height

*AVAPS suggested tidal volume settings based on height.*

<table>
<thead>
<tr>
<th>HEIGHT</th>
<th>59&quot;</th>
<th>61&quot;</th>
<th>63&quot;</th>
<th>65&quot;</th>
<th>67&quot;</th>
<th>69&quot;</th>
<th>71&quot;</th>
<th>73&quot;</th>
<th>75&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEAL WEIGHT</td>
<td>52.0 kg</td>
<td>55.5 kg</td>
<td>59.0 kg</td>
<td>62.5 kg</td>
<td>66.5 kg</td>
<td>70.5 kg</td>
<td>74.5 kg</td>
<td>78.5 kg</td>
<td>83.0 kg</td>
</tr>
<tr>
<td>8 ml/kg $V_T$</td>
<td>420 ml</td>
<td>440 ml</td>
<td>470 ml</td>
<td>500 ml</td>
<td>530 ml</td>
<td>560 ml</td>
<td>600 ml</td>
<td>630 ml</td>
<td>660 ml</td>
</tr>
</tbody>
</table>
At lights out observe for patient's inability to maintain sleep due to obstructive apneas

- If yes:
  - For patient comfort and to allow sleep onset, increase EPAP to open the airway

At lights out observe for indications of therapy intolerance

- If yes:
  - For patient comfort and to allow sleep onset, increase IPAPmin by 2 cm H₂O
Unable to maintain sleep due to obstructive apneas

Unable to maintain tidal volume with sleep

Unable to maintain SaO_2 >90% for 5 continuous minutes

Observe for inadequate back-up rate

If yes, increase EPAP and IPAPmin by same amount to open the airway

If yes, increase IPAPmin setting to increase tidal volume. If IPAP reaching max and Vt too low, increase IPAP max. CHECK LEAK

Add supplemental oxygen

Increase rate by 2 bpm. Assess I-Time and Rise Time for comfort

Return to *

Return to *

Return to *

Return to *

* Monitor patient PSG
Wait… Observe… Think 
_Patience_ is the _key_ to successful titration
Complex and Central Sleep Apnea

- Definition
- Treatment approaches
3 main forms of Central Sleep Apnea

- **Idiopathic Central Sleep Apnea**
  - Brain issue with control of respiration
  - Narcotics

- **Periodic breathing**
  - Heart failure
  - Chemoreceptor issue/CO₂ issue
  - Narcotics

- **Complex Sleep Apnea**
  - “CPAP Emergent central events”
  - Chemoreceptor issue
Idiopathic central sleep apnea – PSG view

• No output from respiratory center of the brain causing lack of movement of the thorax.

• No movement of thorax & abdomen causes apnea
Idiopathic central sleep apnea

**Cause of Idiopathic Central Apnea:**
- The respiratory center of the brain does not fire during sleep causing periodic apnea (see below)
- Seen during the diagnostic night and titration night
- Generally seen in non REM sleep clears during REM sleep
- Generally seen in younger populations

- May appear as part of a neurological disease process or injury
- Relationship between chronic opioid therapy and central sleep apnea¹
- Impacts very small population of people

---

Treatment recommendations for idiopathic central sleep apnea

**Oxygen therapy**
- Must have desaturation ≤88% for 5 minutes or longer to qualify for oxygen therapy (CMS guidelines) OR ≤88% for 5 minutes with history of either CHF, Pulm. HTN, Cor Pulmonale or increased RBC count

**Medications:**
- Theophylline
- Acetazolamide
- Gradual reduction of opioid medications may improve narcotic-induced CSA

**BiPAP S/T or ASV**

Remember: <2% of SDB

2 Javahari, S. AJRCCM: 2006:173(2) 234-237
Periodic breathing

- Characteristics: waxing and waning breathing pattern
- Length of cycle is based on disease process causing the breathing pattern
  - Longer events for patients in heart failure\(^1\)
    - 50-70 second events of CSR then followed by normal respiration (waxing and waning of respiration) in patients with heart failure\(^1\)
  - Shorter events in those at altitude/neurological disorder/renal failure\(^1\) (picture B)
    - 20–40 seconds on length\(^1\)

1 Thomas, et. al. Curr. Opin Pulm Med. 2005
Periodic breathing

- Prevalence: ~5% of patients
- Higher prevalence of PB found in the following populations:
  - Heart failure (~40 - 50%)\(^1,2\)
  - Neurological disorders or disease (dementia, stroke, etc.)
  - Altitude
  - Renal failure/dialysis patients
  - Opioid therapy

- Characteristics
  - Emerges in non-REM sleep → resolve with REM sleep
  - Seen with smaller, thinner patients with slight desaturation events
  - May not be present throughout the entire PSG

---

1 Javaheri, et. al.
2 Thomas, et.al Curr Opin Pulm. Med. 2005:11(6); 485-483
Periodic breathing sample
Treatment of periodic breathing (PB)

- Medical management of underlying disease
  - Medical Management of Heart Failure is KEY in treatment of PB¹
- Mainly PB, (PB > 50%), CSA > 5, AHI or RDI > 5
  - CPAP Therapy¹
  - Auto Servo Ventilation³
  - Bi-Level Therapy with back up rate²
- Mainly OSA (< 50% PB), CPAP or BiPAP S should be prescribed and patient followed for signs of emerging or non-resolving PB

² Kasi, et. al. Circ. J.; 200569:913-921
Complex sleep apnea

- OSA which converts to central apnea with CPAP application
  - Typically emerges during titration
  - Not obvious during diagnostic PSG
  - Often occurs at ~ 30 second intervals vs. 60-90 second intervals with CSR

- Minimal data available
  - Estimated prevalence 1/7 or ~15% of the SDB population

1 Morgenthaler, et. al. Sleep 2006; 29 (9):1203-1209
Central apnea emerges on patient with OSA and CPAP therapy on 7 cm H$_2$O (seen with highlighted area)
Complex sleep apnea

Due to a combination of upper airway resistance and abnormal respiratory drive

- OSA eliminated with CPAP → allows for normal RR.
- The change of the RR changes CO₂
- Brain reads the change in CO₂ as “hyperventilation” → central apneas during the CPAP titration
- Central apnea → CO₂ rises → re-establishes drive to breathe

- Chemoreceptor issues are unmasked when OSA is eliminated
- Often an temporary abnormality of ventilatory control

1 Interview with Dr. Younes & Dr. Sanders
2 Morgenthaler, et.al. Sleep 2006
Not all Central apnea on CPAP is Complex Apnea

1. Inadequate PAP ("false" centrals")
2. Unstable sleep (centrals of sleep transition)
3. Excessive CPAP pressure

Often a transient phenomenon. Resolves with correction of obstruction over time.
Treatment options for complex sleep apnea

- CPAP + Time on Therapy to reset chemoreceptors¹
  - 30-day trial on CPAP → follow up patient re: EDS and compliance data AHI, if improved keep on CPAP

- No improvement in daytime sleepiness after 30 days, try alternatives
  - Auto Servo Ventilation
  - Bi-Level therapy with backup rate

¹ Dernaika T et.al; Chest 2006 s;130(4)129
2 Adult Sleep Apnea Task Force, AASM, ; Journal of Clinical Sleep Medicine 2009; 5(3)
BiPAP autoSV
ADVANCED
Overview
Looks like Auto CPAP! EPAP only changes every 2 min

SV works ‘on top’ of Auto EPAP
SV works ‘on top’ of Auto EPAP

Auto-EPAP Looks like Auto CPAP! EPAP only changes every 2 min
Servo Ventilation Algorithm

On a breath by breath basis peak flow is captured.

Peak flow is monitored over a moving 4 minute window.

As 1 breath is added, the initial breath falls off.

At every point within this 4 minute period an **Average Peak Flow** is calculated.

The **Peak flow target** is established around that average and is based on the patient’s needs.
IF: Peak flow is at target
THEN: autoSV delivers CPAP pressure
IF: Peak flow falls below target  
THEN: autoSV increases pressure support
BiPAP autoSV Titration Protocol
Titrating protocol for BiPAP autoSV Advanced for periodic and complex breathing

*Goal: Adjust user parameters for efficacy and adherence*

- Establish initial settings as indicated below
- Ensure proper mask fit to allow algorithm to work effectively
- Have patient breathe on autoSV Advanced at basic settings below
- Adjust EPAPmin, Bi-Flex and PSmin settings to patient comfort

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPAP(_{\text{min}})</td>
<td>4 cm H(_2)O*</td>
</tr>
<tr>
<td>EPAP(_{\text{max}})</td>
<td>15 cm H(_2)O</td>
</tr>
<tr>
<td>PS(_{\text{min}})</td>
<td>0 cm H(_2)O</td>
</tr>
<tr>
<td>PS(_{\text{max}})</td>
<td>15 cm H(_2)O</td>
</tr>
<tr>
<td>Max pressure</td>
<td>30 cm H(_2)O</td>
</tr>
<tr>
<td>Rate</td>
<td>Auto</td>
</tr>
<tr>
<td>Bi-Flex</td>
<td>2 or 3</td>
</tr>
</tbody>
</table>

*If pt has known CPAP pressure of <10 set EPAPmin at 4 cm H\(_2\)O or patient comfort*

*If pt has known CPAP pressure of >10 set EPAPmin at 6-8 cm H\(_2\)O or patient comfort*
At lights out, observe for patient's inability to maintain sleep due to severe obstructive apneas and for indications of therapy intolerance.

For patient comfort and to allow sleep onset, increase EPAPmin to open the airway.

If yes:
- Return to *

If no:
- For patient comfort and to allow sleep onset, increase PSmin or adjust Bi-Flex settings.
- Return to *
- Increase PSmax 2 cm H₂O.
- Return to *
- Set fixed rate to a minimum 8-10 bpm or 2 below resting respiratory rate including apneas; set I-Time for 1.2 seconds.
- Return to *

Observe for continuous PB and/or Inspiratory Pressure riding at PSmax.

If yes:
- Increase PSmax 2 cm H₂O.
- Return to *
- Set fixed rate to a minimum 8-10 bpm or 2 below resting respiratory rate including apneas; set I-Time for 1.2 seconds.
- Return to *

If no:
- Observe for inadequate back-up rate.
- Return to *

* Monitor patient PSG
Wait… Watch… Observe… Think *Patience* is the key to successful titration.
Complex Sleep Apnea

- CSA patients may challenge even the most experienced, skilled sleep technologist
- Helpful hints for CSA titrations
- If changes are needed—Watch, Wait and Observe
Summary of treatment strategies for SDB patients

~5% have CSA or CSR

Treatment includes:
Medication mgmt.
Oxygen therapy
Bi-level therapy
ASV therapy

~85% - 90% of patients have OSA

Treatment includes:
CPAP or BiPAP S

~10% have Complex SDB

Treatment includes:
CPAP therapy
CPAP + Oxygen
Bi-level therapy
ASV

Medicare RAD policy requirements for central or complex sleep apnea

Medicare Definition of Complex Sleep Apnea

Persistence or emergence of central events upon exposure to CPAP/BiPAP when obstructive events have disappeared

- Mainly obstructive or mixed apneas on diagnostic sleep study, ≥ 5 events / hour, OA>CA
- On CPAP/BiPAP → patterns of central apnea that meet the definition of Central Sleep Apnea
Medicare definition of central sleep apnea

Central sleep apnea

- Apnea index > 5
- Central apnea > 50% of the total apneas
- Central apneas ≥ 5 times per hour
Respiratory Assist Device (RAD)

- Coverage-The treating physician must fully document in the patients medical record symptoms characteristic of sleep-associated hypoventilation.
Coverage is for patients with clinical disorder groups characterized as:
- (I) restrictive thoracic disorders
- (II) severe COPD
- (III) central sleep apnea
- (IV) hypoventilation
Definitions

- **Respiratory assist device without backup rate (E0470)** – delivers adjustable, variable levels (within a single respiratory cycle) of positive air pressure by way of tubing and a noninvasive interface to assist spontaneous respiratory efforts and supplement the volume of inspired air into the lungs.
Definitions

- **Respiratory assist device with backup rate (E0471)** – delivers adjustable, variable levels (within a single respiratory cycle) of positive air pressure by way of tubing and a noninvasive interface to assist spontaneous respiratory efforts and supplement the volume of air into the lungs. Back up rate
Definitions

- **FIO2** – the fractional concentration of oxygen delivered to the patient for inspiration. A patient’s prescribed FIO2 refers to the oxygen concentration the patient normally breathes when not undergoing testing to qualify for a RAD.
Definitions

- **FEV1** – the forced expired volume in 1 second
- **FVC** – the forced vital capacity
- **FRC** - forced residual volume
- **ABG’s** – Arterial Blood Gas
Restrictive Thoracic Disorders

- Documentation of neuromuscular disease or severe thoracic cage abnormality in the patient’s medical record
Restrictive Thoracic Disorders

- Perform **one** of the following
  - ABG’s (done while awake and on prescribed FiO2) $\text{PaCO}_2 \geq 45 \text{ mm Hg}$ OR
  - Sleep oximetry - $\text{O}_2$ saturation $\leq 88\%$ for $\geq 5$ minutes, minimum 2 hours of recording time OR
  - For neuromuscular - Either $\text{FVC} < 50\%$ of predicted or $\text{MIP} < 60 \text{ cm H}_2\text{O}$
COPD

- ABG’s done while awake on prescribed Fi02 with a PaCO2 $\geq 52$ mmHg
- Sleep oximetry-02 sats $\leq 88\%$ for $\geq$ for 5 continuous minutes
- Qualify for E0470 (no back up rate)
COPD-Situation 1

- After initial use of E0470
- ABG’s-shows PaCO2 worsens $\geq 7$ mm Hg compared to original ABG
- Facility-based PSG-demonstrates oxygen saturation $\leq 88\%$ for $\geq$ a cumulative 5 minutes, minimum 2 hours nocturnal recording time
COPD-Situation 2

- 61 days after initial issue of E0470
- ABG-done while awake and on prescribed FiO2) shows PaCO2 ≥ 52 mm Hg;
- Sleep Oximetry-demonstrates oxygen saturation ≤ 88% for ≥ a cumulative 5 minutes, minimum 2 hours nocturnal recording time
Central Sleep Apnea/Complex Sleep Apnea

- Completed facility-based attended PSG documents the following
- Diagnosis of CSA/Comp SA
- Improvement of sleep-association hypoventilation with the use of E0470 or E0471 on settings that will be prescribed for initial home use
Central Sleep Apnea

- AHI $\geq 5$ AND
- Total of CA $\geq 50\%$ AND
- Central AHI $\geq 5$ per hour AND
- Presence of sleep symptoms AND
- No evidence of daytime or nocturnal hypoventilation
Complex Sleep Apnea

- PSG demonstrates persistence or emergence of central apneas or central hypopneas AND
- Resolution of obstructive events central apneas > 50% AND
- Resolution of obstructive events CAHI $\geq$ 5
Hypoventilation (E04070)

- ABG’s done while awake and on prescribed FiO2 with the PaC02 $\geq 45$ mmHg AND
- Spirometry FEV1/FVC 70% AND
- ABG’s during sleep or immediate awakening worsen PaC02 OR
- PSG/HST
Hypoventilation (E0471)

- Covered E0470 is being used AND
- Spirometry FEV1/FVC $\geq 70\%$ AND
- ABG’s done while awake and on prescribed Fi02 worsens $\geq 7mm$ Hg compared to ABG result used for E0470 OR
- PSG or HST
Respiratory Assist Device (RAD) Qualifying Guidelines

I. Restrictive Thoracic Disorders

Perform one of the following:
- ABGs done while awake and on prescribed FIO2, PaCO2 > 45 mm Hg or
- Sleep oximetry
  Oxygen saturation < 88% for > 5 minutes, minimum 2 hours of recording time (on patient's prescribed FIO2 or
  COPD does not contribute significantly to pulmonary limitation
- For neuromuscular disease only:
  Either FVC < 50% of predicted or MIP < 60 cm H2O

II. COPD

ABGs (done while awake and on prescribed FIO2) PaCO2 > 57 mm Hg
Sleep oximetry
  Oxygen saturation < 88% for > cumulative 5 minutes, minimum 2 hours nocturnal recording time (on 2 L/min O2 or patient's prescribed FIO2, whichever is higher)

OSA and CPAP treatment has been considered and ruled out (formal sleep testing is not required if medical record demonstrates sleep apnea is not predominant cause of awake hypoxemia or nocturnal arterial oxygen desaturation)

(E0470)

C. For COPD patients to qualify for a RAD with backup rate (E0471):

Situation 1: After period of initial use of an E0470, ABG (done while awake and on prescribed FIO2) shows PaCO2 worsens > 7 mm Hg compared to original ABG result; feasibility-based PSG demonstrates oxygen saturation < 88% for > cumulative 5 minutes, minimum 2 hours nocturnal recording time while on an E0470 and not caused by obstructive upper airway events (ie, AHI < 5)

ResMed E0470 and E0471 Devices
- E0470–Bilevel without a backup rate:
  - AirCurve 10 VAuto
  - AirCurve 10 ASV
  - VPAP® COPD
- E0471–Bilevel with a backup rate:
  - AirCurve 10 ST
  - AirCurve 10 ASV
  - VPAP ST-ASV
  - Stellar®

* For incentive use, code E0672
III. Central Sleep Apnea or Complex Sleep Apnea

- Complete facility-based attended PSG documents the following
- Diagnosis of central sleep apnea or complex sleep apnea (see definition below)
- Improvement of sleep-associated hypoventilation with the use of an E0470 or E0471 device on settings that will be prescribed for initial use at home (on patient's prescribed FiO2).
- Based on the treating physician's judgment

IV. Hypoventilation

- ABGs (done while awake and on prescribed FiO2) PaCO2 ≥ 45 mm Hg
- Spirometry FEV1/FVC ≥ 70% Refer to severe COPD category for information about device coverage for patients with FEV1/FVC < 70%
- Covered E0470 is being used
- Spirometry FEV1/FVC ≥ 70% Refer to severe COPD category for information about device coverage for patients with FEV1/FVC < 70%
- ABGs (done during sleep or immediately upon awakening on prescribed FiO2) PaCO2 worsens ≥ 7 mm Hg compared to original ABG or
- PSG or HST demonstrates oxygen saturation ≤ 88% for ≥ 5 minutes, minimum 2 hours nocturnal recording time not caused by obstructive upper airway events (i.e., AHI < 5)
- ABGs (done while awake and on prescribed FiO2) PaCO2 worsens ≥ 7 mm Hg compared to ABG result used to qualify for E0470 or
- PSG or HST demonstrates oxygen saturation ≤ 88% for ≥ 5 minutes, minimum 2 hours nocturnal recording time, and not caused by obstructive upper airway events (i.e., AHI < 5 while on E0470)

A diagnosis of central sleep apnea (CSA) requires all of the following:
1. An apnea-hypopnea index ≥ 5; and
2. Sum total of central apneas plus central hypopneas > 50% of the total apneas and hypopneas; and
3. CAHI* ≥ 5 per hour; and
4. Presence of either sleepiness, difficulty initiating or maintaining sleep, frequent awakenings, or non-restorative sleep, awakening short of breath, snoring, or witnessed apneas; and
5. No evidence of daytime or nocturnal hypoventilation

Note: Not all types of HST are appropriate for the evaluation of CSA or CompSA as necessary parameters are not monitored.

Complex sleep apnea (CompSA) is a form of central apnea identified by all of the following:
1. PSG demonstrates the persistence or emergence of central apneas or central hypopneas upon exposure to CPAP or an E0470 device when titrated to the point where obstructive events have been effectively treated (AHI < 5 per hour); and
2. After resolution of the obstructive events, the sum total of central apneas plus central hypopneas is > 50% of the total apneas plus hypopneas; and
3. After resolution of the obstructive events, CAHI** ≥ 5 per hour


*For CSA diagnosis, central apnea-central hypopnea index (CAHI) is defined as the average number of episodes of central apnea and central hypopnea per hour of sleep without the use of a PAP device.

**For CompSA, the CAHI is determined during the use of a PAP device after obstructive events have disappeared.
Today’s improvements

New technology targeting specific diseases
Thank you