E-CARE EDUCATION EVENT
JULY 20, 2016
RESPIRATORY THERAPY

Lanny Baker  RRT Director of Respiratory Therapy
Char Raley  RRT  Coordinator of Education
OBJECTIVES

Objectives:
• Oxygen Delivery
• Bronco Dilator Therapy
• Lung Recruitment
• Review of COPD Education: The importance of using teach back method
• Oxygen therapy is the administration of oxygen as a medical intervention, which can be for a variety of purposes in both chronic and acute patient care. Oxygen is essential for cell metabolism, and in turn, tissue oxygenation is essential for all normal physiological functions.
Remember that oxygen is the only drug ever scientifically proven to increase your life span. Why isn’t oxygen then treated like the drug it is - much like an antibiotic or perhaps a steroid? The answer may simply be this. When we talk of oxygen, we always talk of putting a patient “on” oxygen. In reality it is more correct to think of oxygen as a drug we put “in” a patient.

John R. Goodman, BS, RRT
INDICATIONS

- Hypoxemia: Pa02 < 50 on room air with or without cyanosis
- Cyanosis is a late and reliable sign. It may not be noticeable until a Pa02 is 40.
- Increased work of breathing
- Adults a great starting point is a spontaneous resp rate > then 30 bpm.
- Anxiety
INDICATIONS

- Altered level of consciousness
  - unusual irritability
  - lethargic
- Decreased response to parents or painful stimulus
- Increased resp rate.
- Bradycardia or tachycardia and/or arrhythmias
- hypotension
OXYGEN DEVICES

- Nasal cannula
  - 0.1 to 6 lpm

- FiO2 range 22% to 50% (We all breath and FiO2 of 21% which is considered room air)

- Complications: High flow may cause abdominal distention, drying/irritation of nasal passages, easily dislodged.

- FiO2 will vary with the patient’s resp, rate and tidal volume
OXYGEN DELIVERY DEVICES

• Simple Mask
  5-8 l/m

• FiO2 range: 40 to 60%

• Complications: skin irritation, dryness, may aspirate vomitus, children may be fearful or claustrophobic.

• FiO2 will vary with pt’s resp rate, tidal volume
O2 DELIVERY DEVICES

• Non rebreather
  6-10 l/m

• FiO2 range: 70 to 90%

• Complications: same as simple mask

• Note: Liter flow rate of oxygen should be sufficient to keep bag from deflating
### OXYGEN DEVICES

<table>
<thead>
<tr>
<th>Flow rate FiO2</th>
<th>1 LPM 24% - 27%</th>
<th>2 LPM 27% - 32%</th>
<th>3 LPM 30% - 60%</th>
<th>4 LPM 33% - 65%</th>
<th>5 LPM 36% - 69%</th>
<th>7 LPM 48% - 80%</th>
<th>10 LPM 53% - 85%</th>
<th>12LPM 57% - 89%</th>
<th>&gt;15LPM 60% - 90%</th>
</tr>
</thead>
</table>

HIGH FLOW
HIGH FLOW O2

HFNC was better tolerated and more comfortable than face mask. HFNC was associated with better oxygenation and lower respiratory rate. HFNC could have an important role in the treatment of patients with acute respiratory failure.

RESPIRATORY CARE • APRIL 2010 VOL 55 NO 4, Oriol Roca MD, Jordi Riera MD, Ferran Torres MD PhD, and Joan R Masclans MD PhD
There is no evidence that humidification is necessary when oxygen is given by nasal cannula at flows <5 L/min. As evidenced by subjective complaints or severity of symptoms. There are no differences in subjective complaints or in severity of symptoms over time. This finding does not apply to patients receiving oxygen by tracheostomy or transtracheal oxygen (TTO), in whom the catheter has bypassed the upper airway.
OXYGEN ASSESSMENT 101

• Use your bedside clinical assessment skills if the patient does not look good they are not good.

• Know your critical values:
  • If your patient starts out on a nasal cannula and requires that you change to a non-rebreather mask this is a critical indication.
  • 60% or more of delivered FiO2 do have a plan in place?
RAPID RESPONSE
TEAM ACTIVATION

- The primary caregiver will identify a need for the Rapid Response Team based on the following criteria:
  a. Heart rate <40 or >130
  b. Failure to respond to treatment
  c. Acute change in mental status
  d. Chest pain unresponsive to NTG
  e. Blood pressure <90 systolic
  f. Staff concern
  g. Respiratory rate <8 or >30
  h. Oxygen saturation <90% on greater than 6 liters of oxygen
SAO2 MONITORING

• SaO2 monitoring:
  normal ranges;
  pediatric 93% to 100%
  infant 93% to 96%
  adult 88% to 100%

• Remember that a pulse oximeter should be considered a monitoring device.
INCENTIVE SPIROMETRY

• Incentive spirometry is designed to mimic natural sighing or yawning by encouraging the patient to take long, slow, deep breaths. This is accomplished by using a device that provides patients with visual or other positive feedback when they inhale at a predetermined flowrate or volume and sustain the inflation for a minimum of 3 seconds.
INDICATIONS

- Presence of conditions predisposing to the development of pulmonary atelectasis. Upper-abdominal surgery
- Thoracic surgery
- Surgery in patients with chronic obstructive pulmonary disease (COPD)
- Presence of pulmonary atelectasis. Presence of a restrictive lung defect associated with quadriplegia and/or dysfunctional diaphragm
CONTRAINDICATIONS:

- Patient cannot be instructed or supervised to assure appropriate use of the device.
- Patient cooperation is absent or patient is unable to understand or demonstrate proper use of the device.
- IS is contraindicated in patients unable to deep breathe effectively (e.g., with vital capacity [VC] less than about 10 mL/kg or inspiratory capacity [IC] less than about one third of predicted)
- The presence of an open tracheal stoma is not a contraindication but requires adaptation of the spirometer
Positive airway pressure (PAP) adjuncts are used to mobilize secretions and treat atelectasis and include continuous positive airway pressure (CPAP), positive expiratory pressure (PEP), and expiratory positive airway pressure (EPAP).
DESCRIPTION OF PEP THERAPY

• During PEP therapy, the patient exhales against a fixed-orifice resistor, generating pressures during expiration that usually range from 10 to 20 cm H2O.

• PEP therapy does not require a pressurized external gas source.
INDICATIONS:

- To reduce air trapping in asthma and COPD
- To aid in mobilization of retained secretions (in cystic fibrosis and chronic bronchitis)
- To prevent or reverse atelectasis
- To optimize delivery of bronchodilators in patients receiving bronchial hygiene therapy
Critical Care—from once per hour (43) to once every 6 hours, for intermittent PAP as tolerated.

PAP order should be re-evaluated at least every 24 hours based on assessment made during and following each treatment.

RESPIRATORY CARE [Respir Care 1993;38(5):516–521. AARC Clinical Practice Guidelines.]
DEVICES
• “Some RTs and RN, in my humble opinion, get so wrapped up in the idea that the IS must be used to prevent pneumonia, that they focus all their energy on having the patient use it, even though the patient is not using it correctly, or, more than likely, is simply unable to comprehend how to use it.”

respiratorytherapycave.blogspot.
“Nothing is more effective than simple cough and deep breathing and breath hold exercises to eliminate your odds of getting pneumonia. You healthy people don't have to think about your breathing, but anyone at high risk must and should”. 
QUESTIONS?

respiratorytherapycave.blogspot.com/.../pneumonia-heres-how-you-can-prevent-it.ht
AARC Clinical Practice Guidelines.
COPD
OBJECTIVES

• The participants will be able to describe the impact that COPD has had on healthcare.
• The participants will be educated on the proper way to diagnose COPD.
• The participants will learn the recommended therapies for COPD per GOLD Guidelines.
• The participants will be able to identify the importance of using the Teach Back Method and assessing health literacy at the bedside.
• The participants will learn and understand the significance of developing a COPD re-admission team.
BACKGROUND
IMPACT OF COPD READMISSIONS

- COPD will become the number one cause of respiratory-related disability in the world by the year 2020. *Chest* 2007
- Right now COPD is the 3rd leading cause of death in the world.
- Leading cause of morbidity and mortality in the world with significant economic and social burden
- Associated with many comorbidities.
- Total costs incurred by COPD patients are approximately $6000 higher than non-COPD patients.
- 13-14% of COPD patients had a hospital readmission; 41-49% had a readmission within 60 days.

PENALIZING HOSPITALS FOR CHRONIC OBSTRUCTIVE PULMONARY DISEASE READMISSIONS

- October 2014, the U.S. Centers for Medicare and Medicaid Services (CMS) did expand its Hospital Readmission Reduction Program (HRRP) to include chronic obstructive pulmonary disease (COPD).

- Under the new policy, hospitals with high risk-adjusted, 30-day all-cause unplanned readmission rates after an index hospitalization for a COPD exacerbation will be penalized with reduced reimbursement for the treatment of Medicare beneficiaries.
AVERA MCKENNNAN’S JOURNEY

• Develop a working structure
• Start small to work out the kinks
• Act like private investigators
• Recognize that pulmonologists do not “own” COPD
• Educate physicians on evidence-based guidelines
• Use Teach back.
• Pulmonary rehabilitation program
• Dashboards to keep Administrators and Providers engaged
## COPD Readmission

<table>
<thead>
<tr>
<th></th>
<th>National Benchmark</th>
<th>Avera McKennan Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 2012</td>
<td>18.35%</td>
<td>20.13%</td>
</tr>
<tr>
<td>May 2015</td>
<td>18.30%</td>
<td>10.26%</td>
</tr>
</tbody>
</table>
DIAGNOSIS
GOLD Standards of COPD
DIAGNOSIS OF COPD

• Symptoms:
  • Dyspnea, chronic cough, chronic sputum production, history of exposure, family history of COPD
  • Spirometry is required for diagnosis of COPD

GOLD 2015
**CLASSIFICATION OF AIRWAY LIMITATION IN PATIENTS WITH FEV₁/FVC < 0.70**

<table>
<thead>
<tr>
<th>COPD Stage</th>
<th>FEV₁ *</th>
<th>Exacerbations/yr</th>
<th>Hospitalizations/yr</th>
<th>3-yr mortality</th>
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</thead>
<tbody>
<tr>
<td>GOLD 1, Mild</td>
<td>≥ 80%</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>GOLD 2, Moderate</td>
<td>50-79%</td>
<td>0.7-0.9</td>
<td>0.11-0.2</td>
<td>11%</td>
</tr>
<tr>
<td>GOLD 3, Severe</td>
<td>30-50%</td>
<td>1.1-1.3</td>
<td>0.25-0.3</td>
<td>15%</td>
</tr>
<tr>
<td>GOLD 4, Very Severe</td>
<td>&lt; 30%</td>
<td>1.2-2.0</td>
<td>0.4-0.54</td>
<td>24%</td>
</tr>
</tbody>
</table>

Post bronchodilator measurement

TREATMENT OF COPD
COPD MEDICATIONS

Maintenance medications

Long-acting beta₂-agonists (LABA)
Long-acting anticholinergic
Inhaled corticosteroids (ICS)
Combo: LABA+ICS
Methylxanthines

(theophylline)
Systemic steroids
PDE4-inhibitor (roflumilast)
RESCUE MEDS
As needed or “Rescue”

• Short-acting beta$_2$-agonists
  ❖ SABA
• Short-acting anticholinergic
• Combo: SABA + SA-Anticholinergic
Respiratory Inhalers
At a Glance 2016

Short-acting beta₂-agonist bronchodilators
relax tight muscles in airways and offer quick relief of symptoms such as coughing, wheezing and shortness of breath for 3-6 hours

- ProAir® HFA albuterol sulfate
- ProAir® RespiClick albuterol sulfate inhalation powder
- Proventil® HFA albuterol sulfate
- Ventolin® HFA albuterol sulfate
- Xopenex® HFA levalbuterol tartrate
- Arcapta® Neohaler™ indacaterol inhalation powder
- Serevent® Diskus™ salmeterol xinafoate inhalation powder
- Striverdi® Respimat® ipratropium bromide hydrobromide

Inhaled corticosteroids
reduce and prevent swelling of airway tissue; they do not relieve sudden symptoms of coughing, wheezing or shortness of breath

- Alvesco® HFA 80 mcg, 180 mcg fluticasone propionate inhalation powder
- Arnuity® Ellipta™ 100 mcg, 200 mcg fluticasone furoate and vilanterol inhalation powder
- Asmanex® HFA mometasone furoate
- Asmanex® Twisthaler® 110 mcg, 220 mcg mometasone furoate inhalation powder
- Flovent® Diskus® 50 mcg, 100 mcg, 250 mcg fluticasone propionate inhalation powder
- Flonase® Free® 44 mcg, 110 mcg, 220 mcg fluticasone propionate inhalation powder
- Pulmicort® Flexhaler® 90 mcg, 180 mcg budesonide inhalation powder
- QVAR® (HFA) 40 mcg, 80 mcg beclomethasone dipropionate

Combination medications
contain both inhaled corticosteroid and long-acting beta₂-agonist (LABA)

- Advair® Diskus® 100/50, 250/50, 500/50 fluticasone propionate and salmeterol xinafoate inhalation powder
- Advair® HFA 42/112, 210/212 fluticasone propionate and salmeterol inhalation powder
- Breo® Ellipta™ 100/25 mcg, 200/50 mcg fluticasone furoate and vilanterol inhalation powder
- Dulera® 100/5, 200/5 mometasone furoate and formoterol fumarate inhalation powder
- Symbicort® (HFA) 80/4.5, 160/4.5 budesonide and formoterol fumarate inhalation powder
- Anoro® Ellipta™ umecilidinium and vilanterol inhalation powder
- Stiolto™ Respimat® umeclidinium and ipratropium inhalation powder
- Utibron® Neoaler® glycopyrrrolate and indacaterol inhalation powder

Combination (anticholinergic) bronchodilators
relieve cough, sputum production, wheeze and chest tightness associated with chronic lung diseases

- Atrovent® HFA ipratropium bromide
- Incruse® Ellipta® umeclidinium inhalation powder
- Spiriva® HandiHaler® umeclidinium bromide inhalation powder
- Spiriva® Respimat® 15, 30 mcg ipratropium bromide
- Tudorza™ Pressair® aclidinium bromide inhalation powder
- Combivent® Respimat® ipratropium bromide and albuterol

Muscarinic antagonist (anticholinergic) bronchodilators
- Seebri® Neoaler® glycopyrrrolate inhalation powder
- Spiriva® HandiHaler® umeclidinium bromide inhalation powder
- Spiriva® Respimat® 15, 30 mcg ipratropium bromide
- Tudorza™ Pressair® aclidinium bromide inhalation powder
- Combivent® Respimat® ipratropium bromide and albuterol
Figure 2.3. Assessment Using Symptoms, Breathlessness, Spirometric Classification and Risk of Exacerbations

<table>
<thead>
<tr>
<th>Risk (Gold Classification of Airflow Limitation)</th>
<th>Symptoms</th>
<th>Breathlessness</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT &lt; 10</td>
<td>mMRC 0-1</td>
<td>mMRC ≥ 2</td>
</tr>
<tr>
<td>CAT ≥ 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- (C) +LA antichol. ± LABA+ICS
- (D) +LA antichol. + LABA+ICS
- (A) SABA or LA-antichol. +LA antichol. Or LABA

**Adjunct Therapies:**
- Theophylline
- PDE4-inhibitor
- Steroids
## Non-pharmacologic Interventions

<table>
<thead>
<tr>
<th>COPD Assessment</th>
<th>Essential</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>Smoking Cessation ± pharmacologic assistance</td>
<td>Physical Activity Yearly Influenza Vaccine Pneumococcal Vaccine</td>
</tr>
<tr>
<td>Group B - D</td>
<td>Smoking Cessation ± pharmacologic assistance Pulmonary Rehab</td>
<td></td>
</tr>
</tbody>
</table>

Very Severe COPD therapy options:
- Oxygen therapy (>15 hours/day)
- Surgical Interventions
TEACH BACK

• Teach back is so important because it gives you an opportunity to see if your patient is understanding the education session.

“The main problem with communication is the assumption that it has occurred.”
George Bernard Shaw
HEALTH LITERACY STRATEGIES

- Are you speaking clearly and listening carefully?
- Is the information appropriate for the user?
- Is the information easy to use?
- Use a medically trained interpreter for language barriers
- Adapt for learning ability
- Check for understanding frequently (Check and Chunk)
USE OF VALVED HOLDING CHAMBERS

• Unless you’ve got the reflexes of a NASCAR driver or compulsive video gamer, catching that fleeting premeasured dose in a slow, deep inhalation is almost impossible.
The dial can be adjusted to accurately simulate the resistance of popular inhaler devices which include MDI's and DPI's such as Turbuhaler®, Flexhaler®, Twisthaler®, Aerolizer®, Handihaler® and Diskus® among others. The In-Check dial enables clinicians to train patients to the proper inspiratory technique considering force and flow rate to achieve optimal deposition of the medication being inhaled into the lungs.

2015 Alliance Tech
# COPD Zones

## Every Day
- Take your medicine as prescribed.
- Use oxygen as ordered.
- Be as active as you can handle.
- Conserve your energy and rest as needed.
- Use pursed-lip breathing.
- Eat five to six small meals per day.
- Eat a well-balanced diet.
- Drink six to eight glasses of water to help keep mucus thin (unless directed otherwise).
- If you smoke, quit.
- Stay away from second-hand smoke.

Which COPD Zone are you today? Green, Yellow or Red?

## Green Zone
- **All Clear – This zone is your goal.**
  - Your symptoms are under control if:
    - Breathing is normal for you.
    - Activity level is comfortable.

## Yellow Zone
- **Caution – This zone is a warning.**
  - Call your doctor’s office if you have any of the following:
    - More shortness of breath than usual.
    - More coughing with sputum.
    - Green, yellow, or tan sputum.
    - Fever above 101 degrees.
    - Quick relief breathing medication is needed more often.
    - Daily tasks are difficult.

## Red Zone
- **Emergency**
  - Go to the emergency room or call 911 if you have any of the following:
    - Breathing struggles: shortness of breath not relieved by quick relief medications.
    - Chest pain.
    - Confusion or inability to think clearly.
4 Steps to take when you get Short of Breath

1. Stop and Sit.
2. Purse Lip Breathing
   Breathe in slowly for 2 seconds thru your nose. Exhale very SLOWLY thru pursed lips for at least 4 seconds.
3. Take your Rescue medication. (write down the rescue for them)
4. Call someone-
   • If you feel better call a family member or friend and have them check on you in an hour and see how you are doing.
   • If you feel the same, call your Primary Doctor and be seen that day (or go to Urgent Care).
   • If you feel worse or anything is turning blue such as your lips or fingernails or you cannot speak in a complete sentence without gasping, then you need to call 911. Do not drive yourself to the Emergency Room!
CLEANING RESPIRATORY EQUIPMENT

NEBULIZERS -
Daily: Wash with mild soapy water, rinse with clear water and lay out to air dry.
Weekly: Soak for 30 minutes in 1 part white vinegar to 3 parts water. Rinse with clear water and lay out to air dry.

INHALER/MDI SPACERS & AROBICKA -
Weekly: Wash in mild soapy water and, rinse with clear water and lay out to air dry.
Alternative: Soak for 30 minutes in 1 part white vinegar to 3 parts water. Rinse with clear water and lay out to air dry.

DRY POWDER & RESPIMAT INHALERS -
Weekly: Wipe mouthpiece area with a damp cloth and air dry.

CPAP/BIPAPS -
Daily: Wipe inside of mask with a damp cloth.
    Empty water chamber.
    Nightly refill with only distilled water.

Weekly: Soak mask, head gear, water chamber and tubing for 30 minutes in mild soapy water, rinse with clear water and lay out to dry.
Alternative: Soak for 30 minutes in 1 part white vinegar to 3 parts water. Rinse with clear water and lay out to air dry.
Weekly: Check filter on the back of the machine.
    Replace filter when it looks gray.
PULMONARY REHAB

- Exercise training is the cornerstone of pulmonary rehab
- Best option for improving muscle function
- Patient with Moderate, Severe COPD, Restrictive Lung Disease can benefit from pulmonary rehab. A qualifying PFT is required.
- Improvements in muscle function after exercise training can lead to improvement in exercise capacity despite no change in lung function
PULMONARY REHAB AND EXACERBATIONS

• Evidence now shows the role of pulmonary rehab in acute disease, specifically during and after hospitalization.

• Exacerbations are associated with decline in functional status, quality of life, psychological distress, increased morbidity and mortality.


REFERENCES

QUESTIONS???

- Lanny Baker  MBA RRT lanny.baker@avera.org
- Char Raley RRT charlene.raley@avera.org
Noninvasive ventilation/Bipap/Bi-level/IPAP/PS/EPAP/PEEP/CPAP

Making Sense out of it
CONTINUOUS POSITIVE AIRWAY PRESSURE ~ CPAP

• The application of positive airway pressure throughout the ventilatory cycle.

• No inspiratory assistance is provided by machine.

• Patients on CPAP must be breathing spontaneously
WHAT IS CPAP?

• CPAP = PEEP = OXYGEN

• CPAP/PEEP is pressure that is applied to the lungs. This pressure keeps the smaller airways and alveoli open which improves oxygenation
BAD OXYGENATION?
CPAP = LUNG EXPANSION = OXYGENATION
DEVICES
CPAP: CHRONIC VS ACUTE

• **Chronic CPAP use:**
  Patients who have CPAP for the treatment of OSA will not be acutely compromised if they don’t wear their CPAP. *However* the long term effects of not treating OSA are pulmonary hypertension, strokes, high blood pressure and diabetes.

• **Acute CPAP use:**
  Patients who become acutely compromised because of oxygenation delivery failure to the body can and will be acutely compromised if not treated properly.
INDICATIONS FOR NPPV

• Primary vs. Secondary disease stage
• Exacerbated COPD
• CHF
• Obstructed Sleep Apnea
• Neuromuscular disease
• Hypoventilation Syndromes
• Do Not Intubate patients
POTENTIAL BENEFITS OF NPPV

• Avoidance of endotracheal intubation
• Decreased duration of ventilation
• Decreased incidence of pneumonia
• Improved ability to communicate
• Ability to eat and drink
• Retain ability for effective cough
• Decreased need for sedation/paralysis
Noninvasive positive-pressure ventilation (NPPV) has been used increasingly to treat acute respiratory failure (ARF).

Multiple controlled trials have demonstrated that therapy with NPPV avoids intubation and, in the case of COPD and immunocompromised patients, reduces mortality as well.

The best candidates for NPPV are able to protect their airway, are cooperative, and are otherwise medically stable.
POTENTIAL RISKS

• Increased aspiration risk
• Increased duration of ventilation in patients who fail NPPV
• Gastric Distention
• Facial skin necrosis
CONTRAINDICATIONS

- Hemodynamic Instability
- Straight out Apnea
- Vomiting
- GI Bleed
- Uncooperative Patient
- Cardiopulmonary Arrest
- Facial or Cranial Trauma
PROCEDURE

• Explain the procedure to the patient.
• Ensure adequate oxygen supply to ventilation device.
• Place the patient on continuous pulse oximetry and cardiac monitoring.
• Place the delivery the mask over the mouth and nose.
• Secure the mask with provided straps or other devices.
• Start at 5.0 cm H2O of PEEP (pressure may be titrated up to 10 cm H2O as needed, monitor expiratory tidal volume - optimal measured tidal volume 350 to 400 cc
• Check for air leaks.
• Monitor and document the patient’s respiratory response to treatment.
• Monitor vital signs  CPAP can cause BP to drop.
• Continue to coach patient to keep mask in place and readjust as needed.
CPAP = OXYGENATION
CPAP = OXYGENATION
SHAZAM
INDICATIONS THAT A PATIENT MAY BE FAILING CPAP (EPAP, PEEP)

• Respiratory distress with moderate to severe dyspnea, a respiratory rate > 30 bpm
• CPAP set @ 10 cmH20=Expiratory Tidal < 350 to 400 mls
• Use of accessory muscles
• Abdominal Paradox
• SaO2 < 90% on a CPAP device
• If patient does not improve within 30 minutes of being started on CPAP, consider trial of NPPV
IPAP

- IPAP or Pressure Support level = tidal = ventilation
  - Increasing IPAP (PS) which increases tidal volume which decrease CO2.
  - Decreasing IPAP level (PS) decreases tidal volume which increases CO2.
  - A good starting point is to set the IPAP level 4 cmH20 above EPAP (PEEP) level. Adjust by 2 cmH20 to keep the expiratory tidal volume 350 to 400 ml.
IPAP = PRESSURE SUPPORT (PS) = TIDAL VOLUME

Vivo 40

<table>
<thead>
<tr>
<th>CPAP</th>
<th>10.0 cmH2O</th>
</tr>
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<tbody>
<tr>
<td>Est. Tidal Vol</td>
<td>0.26 l</td>
</tr>
<tr>
<td>Total Rate</td>
<td>32 bpm</td>
</tr>
<tr>
<td>Leakage</td>
<td>30 l/min</td>
</tr>
<tr>
<td>I:E</td>
<td>1.0 : 1.7</td>
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IPAP=TIDAL=CO2
DOUBLE SHAZAM

Vivo 40

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
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<tbody>
<tr>
<td>PSV</td>
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<tr>
<td>Est. Tidal Vol</td>
<td>0.44 l</td>
</tr>
<tr>
<td>Total Rate</td>
<td>26 bpm</td>
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<tr>
<td>Leakage I:E</td>
<td>31 l/min</td>
</tr>
<tr>
<td>Leakage I:E</td>
<td>1.0 : 1.3</td>
</tr>
<tr>
<td>IPAP</td>
<td>16.0 cmH2O</td>
</tr>
<tr>
<td>EPAP</td>
<td>10.0 cmH2O</td>
</tr>
<tr>
<td>Set Rate</td>
<td>12 bpm</td>
</tr>
<tr>
<td>Exp. Trig</td>
<td>2</td>
</tr>
</tbody>
</table>

Press Set Up for more settings

Mode: Set Up, Alarm, Others
FACTORS OF EFFECTIVENESS

- Acceptance and comfort level of the bedside practitioner(s)
- Patient selection
- Patient anxiety & ability to cooperate with care/delivery devices
- Technical Aspects
  - Mask
  - Settings
  - Monitoring
If the patient is ventilating but not oxygenating after all other oxygen delivery devices have been attempted, try CPAP.

If the patient is not oxygenating and not ventilating after attempting CPAP, consider NPPV or intubation.
QUESTIONs?

- Royal United Hospital Bath NHS Trust Guidelines For The Use Of Continuous Positive Airway Pressure (CPAP) Systems
  Author: Julian Hunt
  Job title: Consultant Nurse
  Date: December 2006
  Version: 2.3.1
  Page 16 of 18
  Review date: December 2009

REFERENCE DOCUMENTS
- Peter JV, Moran JL: Noninvasive ventilation in acute resp failure Critical Care Med 2002
- Oakes, Dana: Ventilator Management: A Bedside Reference Guide
- January 2011 JEMS supplement “CPAP: The push for rapid relief” as “Best Practices: CPAP protocols and quality improvement.”
MECHANICAL VENTILATION
MV SO SIMPLE?

- Good Air In
- Bad Air Out
- Allow the patient to breath on their own.
INDICATIONS FOR INTUBATION

- Uncorrectable hypoxemia (pO2 < 55 on 100% NRB) failure on NPPV
- Hypercapnia (Pco2 > 55) with acidosis pH <7.25
- Ineffective respiration resp rate > 35
- Fatigue
- Airway protection
ASSIST CONTROL

**Advantages:**

- Patient can increase ventilatory support
- Reduced work of breathing
- Guarantees delivery of set Tidal Volume
• AC modes is the simplest and most effective means of providing full mechanical ventilation. In this mode, each inspiratory effort beyond the set sensitivity threshold triggers delivery of the fixed tidal volume. If the patient does not trigger the ventilator frequently enough, the ventilator initiates a breath, ensuring the desired minimum respiratory rate.
ASSIST CONTROL

- On AC with a set rate of 12, Tidal Volume of 650 cc if the patient initiates a breath on his/her own, the vent will also deliver the set tidal volume of 650 cc.

- The ventilator rate of 12 means that the patient will be given a minimum of 12 bpm.

- If the patient is breathing spontaneous at a total rate of 30 each and every breath will be totally supported by the vent.
- **Ventilator Rate** (Adult): 10 to 15 breaths/min
  - Peds=12-25
- **Ventilator Tidal Volume** (Adult): 6 to 8 ml/kg. (ideal Body wt)
  - Peds=7-10ml/kg (ideal Body Wt)
- **FiO2**: set to maintain SaO2 of >90%, consider an FiO2 of > 60% as **critical factor**.
- **PEEP**: 5cmH2O- 10 cmH20
• body weight (IBW) rather than actual body weight is used to determine the appropriate tidal volume for patients with lung disease receiving mechanical ventilation.

\[
\text{IBW (kg) Males:} \\
50 + 2.3(\text{height in inches} - 60) \\
or 50 + 0.91(\text{height in cm} - 152.4) \\
\]

\[
\text{IBW (kg) Females:} \\
45.5 + 2.3(\text{height in inches} - 60) \\
or 45.5 + 0.91(\text{height in cm} - 152.4) \\
\]
VENTILATOR MONITORED VALUES

• **FIO2** (fractional inspired oxygen) the amount of oxygen delivered to a patient 21% to 100%. An FiO2 of >60% should be considered as a critical value.

• **PEEP** (positive end expiratory pressure) helps with the recruitment of the smaller airways.

• **Peak Airway Pressure**: measures the “stiffness” of the larger airways in the lung.

• **Mean Airway Pressure**: measures the ‘stiffness of the smaller airways.”
PLATEAU PRESSURE

- The best indicator of alveolar overdistension (or too much pressure from mechanically delivered breaths) is peak alveolar pressure, which can be assessed by measuring the plateau pressure, or the pressure applied to the small airways and alveoli during inspiration.

- The plateau pressure and should be 30 cm H2O or less. If this value is trending upward or exceeds 30 cm H2O over distension is likely, consider alternative lung protective strategies.
REASONS FOR INCREASED PIP AND PLAT

- Increased tidal volume
- Decreased pulmonary compliance
- Pulmonary edema
- Pleural effusion
- Peritoneal gas insufflation
- Tension pneumothorax
- Trendelenburg
- Ascites
- Abdominal packing
- Endobronchial intubation
Suppose the patient's PIP is 35 cm H2O and the plateau pressure is 25 cm H2O. An hour later, the peak pressure is 65 cm H2O, but the plateau pressure is still 25 cm H2O. He isn't in danger of lung damage because the reason for the high PIP is an increase in airway resistance.

This is why PIP doesn't mean much by itself and plateau pressure is the more important ventilator pressure to monitor.
TIDAL VOLUME

- Tidal volume and respiratory rate set the minute ventilation. Too high a volume risks overinflation; too low a volume risks atelectasis.

- Too high a rate risks inadequate expiratory time and auto PEEP.

- Too low a rate risks inadequate minute ventilation and respiratory acidosis.
TROUBLESHOOTING

Decreased Tidal Volume or decreased lung expansion.

- Leak around mask or Patient Valve Tubing.
- Inappropriate tidal volume setting
- Inappropriate inspiratory time setting
- Decreased lung compliance and/or increased airway resistance.
- Airway secretions
Increased Tidal Volume or Increased Chest Expansion.
  • Volume setting too high
  • Increased lung compliance

Pressure Limit Alarm During Inspiratory Phase.
  • Airway blockage,
  • Kinked tubing
CHANGES IN PEAK AIRWAY PRESSURE

- Normal range < 40 cm H2O

- Conditions that may cause an increase:
  - Secretions
  - Bronchospasm
  - Mucus plugs
  - Patient coughing
  - Kinked ETT/trach
INDICATIONS FOR VENTILATOR LIBERATION

- Initial indication for ventilator is resolving.
- Ventilator monitor values improved.
- Sedation weaned to minimal level.
- Ability of the patient to cough and breathe spontaneously.
- Stable cardiovascular status.
- Acceptable ABGs, FiO2 < 60% and PEEP < 10 cmH20, SaO2 > 90%.
- Spontaneous tidal volume > 5ml/kg
- Resp rate > 30 bpm
- RSBI < 105 breaths/min/liter.
VENTILATOR LIBERATION CONTINUED

- Level of consciousness
- Awake and alert/arousal
- Follows commands
- Able to initiate spontaneous breaths
- Acid Base status
- pH between 7.30-7.50 and PaCO2 < 50 mmHg (unless approved by the patient’s physician).
- Core Temperature
- 36-38°C (or 96.8-100.4°F) or no new fevers/hypothermia
VENTILATOR LIBERATION

- Place on pressure support 5 or ATC with PEEP of 5 using current FiO2
- After 5 minutes check the RSBI
- < 100 continue on to a Spontaneous Breathing Trial
- > 100 stop and put back on the ventilator’s previous settings
- Continue on PS or ATC and PEEP off for 30 minutes
- If the RSBI is <100 and the “Weaning Tolerance Criteria” has been met
- Check an ABG (per physician discretion)
- Review “Extubation Criteria” and call the physician
Weaning Criteria
1. Hemodynamically stable: <150 mmHg systolic >90 mmHg diastolic
2. Stable cardiovascular status: HR ≤ 140
3. Mental Alertness: no amount of sedation
4. Secretions: ≤ moderate amount
5. Presence of strong cough & spontaneous breathing
6. Resolution of the process that resulted in the institution of mechanical ventilation and/or control of any infective process
7. If PEEP > 10, decrease every 1-2 hours by 2 cm until PEEP ≤ 10.
8. If FiO2 ≥ 50% wean to keep SaO2 ≥ 90%
9. pH > 7.3 ≤ 7.48

Weaning Parameters
All patients must be on ATC-PEEP 5, Pressure Support 0
1. Spontaneous RR ≥ 5 mls Kg
2. Spontaneous RR < 35 bpm
3. SaO2 ≥ 90%
4. RSI ≤ 100
5. P 0.01 value 3.0-6.0

Start Weaning Trial
ATC—Pressure support 0 & CPAP 5 or P5 of 5 cm and PEEP of 5 cm with ATC

Full Support Vent Settings

Acceptable Parameters

YES

NO

Tolerated for 2, 2 hours.

Stop Weaning Criteria
1. HR > 140 or 20% of baseline.
2. RR > 35
3. BP: > 150 Systolic < 90 Systolic
4. SaO2 < 90% on 60% Fio2
5. Diaphoresis
6. ↑ use of accessory muscles.

Obtain Physician order to Exhale

Full Support Vent Settings

NO

YES
WHEN TO USE A VENTILATOR VS MANUAL BAGGING?
Questions

- References:
- Nursing Made Incredibly Easy! September/October 2009 Volume 7 Number 5
- Weaning and Discontinuing Ventilator Support 2002. AARC Clinical Practice Guidelines
- Oakes Ventilator Management: A bedside Reference Guide: Dana Oakes, Sean Shortall
OBSTRUCTIVE SLEEP APNEA
CAUSE OF OBSTRUCTIVE SLEEP APNEA

• OSA is caused by recurrent partial or complete obstruction of the airway during sleep.

• As a result, ventilation may be decreased (hypopnea) or absent (apnea) for several seconds until upper airway muscle tone increases, allowing the resumption of normal ventilation.

• Hypopneas and apneas may also result in oxygen desaturation of variable degree.
NEWS FLASH !!!
SLEEP APNEA IMPACTS MORTALITY IN PATIENTS WITH COPD AND OSA.

• According to the **American Sleep Apnea Association**, an estimated 22 million Americans suffer from sleep apnea, with 80 percent of moderate and severe OSA undiagnosed. You, like many Americans, may have sleep apnea and not even know it!

• **The COPD Foundation** (*Chronic Obstructive Pulmonary Disease*) estimates OSA occurs in 10 to 15 percent of people with COPD.
WHO IS AT RISK OF SLEEP APNEA?

- Men ~ 2:1 greater likelihood of OSA syndrome than women
  - ~ 5-25% of men
  - ~ 2-9% of middle-aged women
- Increases with age
- Men and women plateau in the 60-70’s
- Higher in women after menopause
- A person's neck circumference is a good predictor of sleep apnea. Obese men with a neck circumference of 17 inches or greater, and women with a neck circumference of 16 inches or greater are more likely to have sleep apnea
Studies have suggested that as many as 25 percent of children diagnosed with attention-deficit hyperactivity disorder may actually have symptoms of obstructive sleep apnea and that much of their learning difficulty and behavior problems can be the consequence of chronic fragmented sleep.

Recent studies show a strong association between pediatric sleep disorders and childhood obesity.
DIAGNOSIS OF OBSTRUCTIVE SLEEP APNEA IN CHILDREN

- Symptoms:
  - Cessation of breathing
  - Cyanosis
  - Enuresis
  - Excessive daytime somnolence
  - Gasping for air
  - Irritability
  - Nighttime awakening
  - Poor academic performance
  - Pulmonary hypertension
  - Snoring
  - Unusual daytime behavior
• Sleep deprivation in the industrialized world is rapidly rising to epidemic proportions. With the pressures of work, family life and recreational pursuits, there is little time left for sleep. And this is dangerous.

• Sleep is as important to a person's health as food or water.
COMMON SIGNS AND SYMPTOMS OF ADULT OSA

- Witnessed apnea
- Snoring
- Gasping
- Coughing
- Choking
- Awakening short of breath
- Erectile dysfunction
- Frequent dreaming
COMMON SIGNS

- Restless sleep
- Loud snoring
- Frequent awakenings
- Excessive Daytime Sleepiness
- Morning headaches
- Difficulty concentrating
- Frequency of urination/Nocturnal
- Insomnia
THE ACUTE PHYSIOLOGICAL CHANGES THAT MAY BE SEEN WITH OSA

- Systemic and pulmonary hypertension (High blood Pressure)
- Heart dysrhythmias
- Reduced cerebral blood flow (can lead to stroke)
- Results of the 20-year follow-up study show that people with moderate to severe obstructive sleep apnea are nearly four times more likely to have a stroke.
- Cardiac (increased fluid retention)
- Diabetes
GOOD SLEEPING HABITS

- Vigorous exercise is best, but even light exercise is better than no activity. Exercise at any time of day, but not at the expense of your sleep.
- Design your sleep environment to establish the conditions you need for sleep. Your bedroom should be cool – between 60 and 67 degrees.
- Your bedroom should also be free from any noise that can disturb your sleep.
GOOD SLEEPING HABITS

• Your bedroom should be free from any light. Check your room for noises or other distractions. This includes a bed partner's sleep disruptions such as snoring. Consider using blackout curtains, eye shades, ear plugs, "white noise" machines, humidifiers, fans and other devices.

• Your body needs time to shift into sleep mode, so spend the last hour before bed doing a calming activity such as reading. For some people, using an electronic device such as a laptop can make it hard to fall asleep, because the particular type of light emanating from the screens of these devices is activating to the brain. If you have trouble sleeping, avoid electronics before bed or in the middle of the night.
The gold standard for OSA diagnosis is overnight polysomnography in a sleep laboratory. This study typically includes monitoring of snoring, pulse oximetry, electrocardiogram (EKG), muscle tone, eye movement activity (to detect REM sleep), electroencephalogram (EEG, to detect sleep stage and presence of cortical arousals), nasal/oral airflow, and chest and abdominal wall movement (to detect respiratory effort).
If you answer "yes" to two or more of the following questions, make an appointment with your doctor to talk about sleep apnea.

S: Do you snore loudly? (Louder than talking or loud enough to be heard through closed doors.)
T: Do you often feel tired, fatigued, or sleepy during daytime?
O: Has anyone observed you stopping breathing during your sleep?
P: Do you have or are you being treated for high blood pressure?

STOP was developed by doctors in Canada (as reported in Anesthesiology, May 2008) to screen patients scheduled for surgery, because sleep apnea makes surgery riskier.
QUESTIONS.

- References:
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  - www.sleepapnea.org/treat/childrens-sleep-apnea.htm
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  - Nursing Made Incredibly Easy !September/October 2009 Volume 7 Number 5
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  - Sleep Deprivation and Diabetes, from About.com June 20,2006