



# Non-invasive ventilation



# BiPAP/NIV definitions

- **Non-invasive ventilation to provide positive pressure ventilation supporting patient's spontaneous breathing.**
- **A higher pressure (Inspiratory Positive Airway Pressure IPAP) for breath in and a lower pressure (EPAP) for breath out:**
  - **↓work of breathing**
  - **Improve oxygenation and ventilation**

# Indications

- Obstructive sleep apnea
- ↑airway resistance e.g. COPD exacerbation.
- Respiratory/accessory muscle distress, fatigue or failure.
- Chest wall deformity or neuromuscular disease.
- Post-extubation ventilatory support.
- Acute Pulmonary Oedema.

# Contraindication

- **Facial trauma/burns**
- **Recent facial, upper airway, or upper gastrointestinal tract surgery**
- **Upper airway obstruction**
- **Inability to protect airway and clear respiratory secretions**
- **Impaired consciousness (GCS<10)**
- **Severe confusion/agitation**
- **Vomiting and risk of aspiration**
- **Untreated pneumothorax**
- **Allergy to mask materials**

# Equipment

1. BiPAP machine
2. Disposable circuit with proximal pressure line and exhalation port (flushes exhaled gas from the circuit)
3. Bacterial filter (low resistance)
4. Total face mask, full face mask or nasal mask
5. Humidifier
6. Distilled water
7. Duoderm for pressure sore prevention.



**BiPAP Vision**

Respironics V60

**PHILIPS**  
RESPIRONICS



**Respironics V60**



**BiPAP Synchrony**



**Smartair BiPAP with internal battery**



**BiPAP with Humidifer**

# Type of Mask



**Total Face Mask**



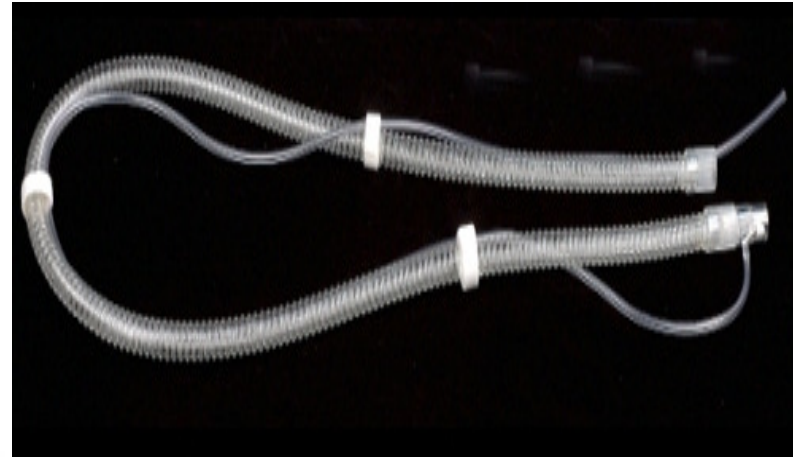
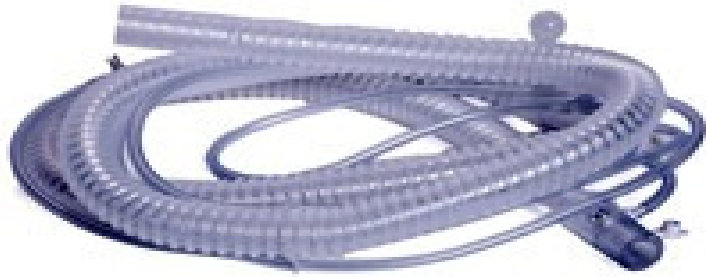
**Full Face Mask**



**Nasal Mask**

# Type of Mask





**Disposable Tubing with Exhalation Port and Pressure Line**



**Humidifier**



**Pressure line**

**Low resistance bacterial filter**

# Common Mode Selection

A patient is lying in a hospital bed, wearing a clear CPAP mask over their nose and mouth. A nurse in white scrubs stands next to a Philips ventilator, which has a large monitor displaying various waveforms and data. The scene is set in a clinical environment with other medical equipment visible in the background.

- CPAP mode

- Spontaneous/Timed (ST) mode



# **CPAP mode (Continuous Positive Airway Pressure)**

- **A constant preset pressure (CPAP) will be delivered continuously either inhalation or exhalation.**
- **No IPAP setting to support patient's inspiratory effort**

# Spontaneous/Timed (S/T) mode

- A bi-level pressure respond and support patient spontaneous inhalation (IPAP) and exhalation (EPAP).
- Once patient do not start inhaling within a set time, device automatically starts inhalation (IPAP).
- After inhalation, device automatically decreases the pressure (EPAP) for exhalation.

# Machine Control Setting

- Mode: CPAP or S/T mode
- FiO<sub>2</sub>: Oxygen (21%~100%)
- RR: Respiratory Rate setting
- IPAP: Inspiratory Positive Airway Pressure
- EPAP: Expiratory Positive Airway Pressure
- T<sub>insp</sub>: Time of inspiratory (0.5~3sec)
- Rise Time: Time from EPAP to IPAP.
  1. Enhances patient-ventilator synchrony
  2. Enhances patient comfort

4 set point: 0.05, 0.1, 0.2, 0.4

# Notes

- **IPAP: Inspiratory Positive Airway Pressure**

1. Supports inspiratory effort, reducing WOB
2. ↑ TV
3. ↑ CO<sub>2</sub> removal

- **EPAP: Expiratory Positive Airway Pressure**

1. Keeps alveoli partially inflated at the end of expiratory
2. ↑ functional residual capacity (FRC)
3. ↑ alveolar gas exchange
4. ↑ oxygenation

# Patient Status Monitoring

- TV: Tidal Volume
- Respiratory Rate: RR
- MV: Minute Volume= $TV \times RR$   
**Example: TV 300ml and RR 30/min**  
 **$MV = 0.3L \times 30 = 9L/min$**
- PIP: Peak Inspiratory Pressure
- Patient leak: Leakage from the mask
- Tot. Leakage: Total leakage from mask + exhalation port if exhalation port test unsuccessful

# Potential Complications

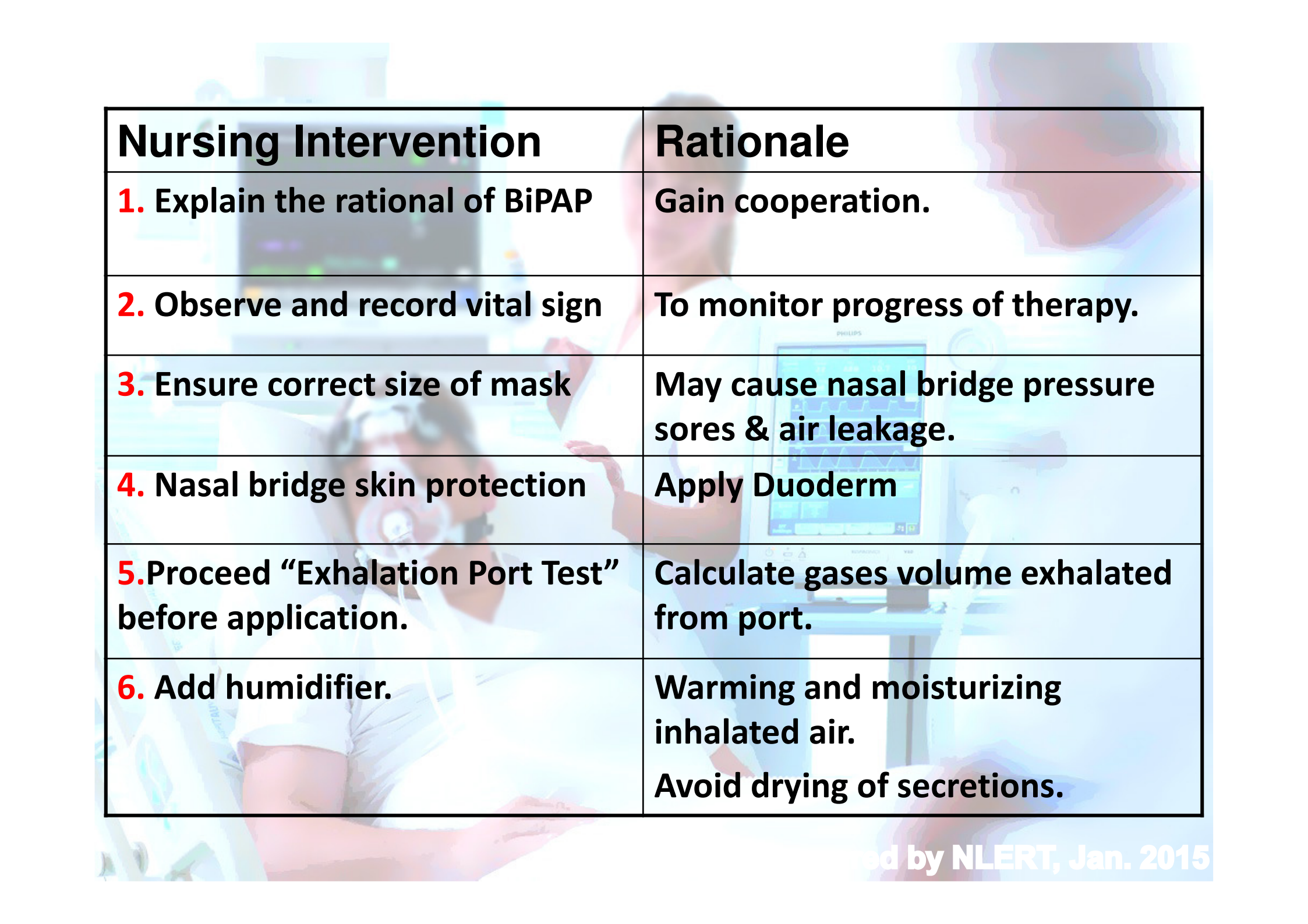
- **Cardiovascular compromise**
- **Skin break down and discomfort from mask**
- **Gastric distention**
- **Risk of aspiration**
- **Pulmonary barotrauma**
- **Risk of sputum retention**
- **Respiratory fatigue, failure or arrest**

# Monitoring Clinical Features

- Vital signs e.g. ECG, RR, BP and SpO<sub>2</sub>.
- Breathing pattern/chest movement
- Patient-ventilator synchronization.
- Accessory muscle recruitment.
- General assessment: sweating /dyspnoeic.
- Auscultation of the chest.
- Patient comfort.
- Coughing effort and risk of sputum retention.
- Neurological status – signs of confusion/tiredness

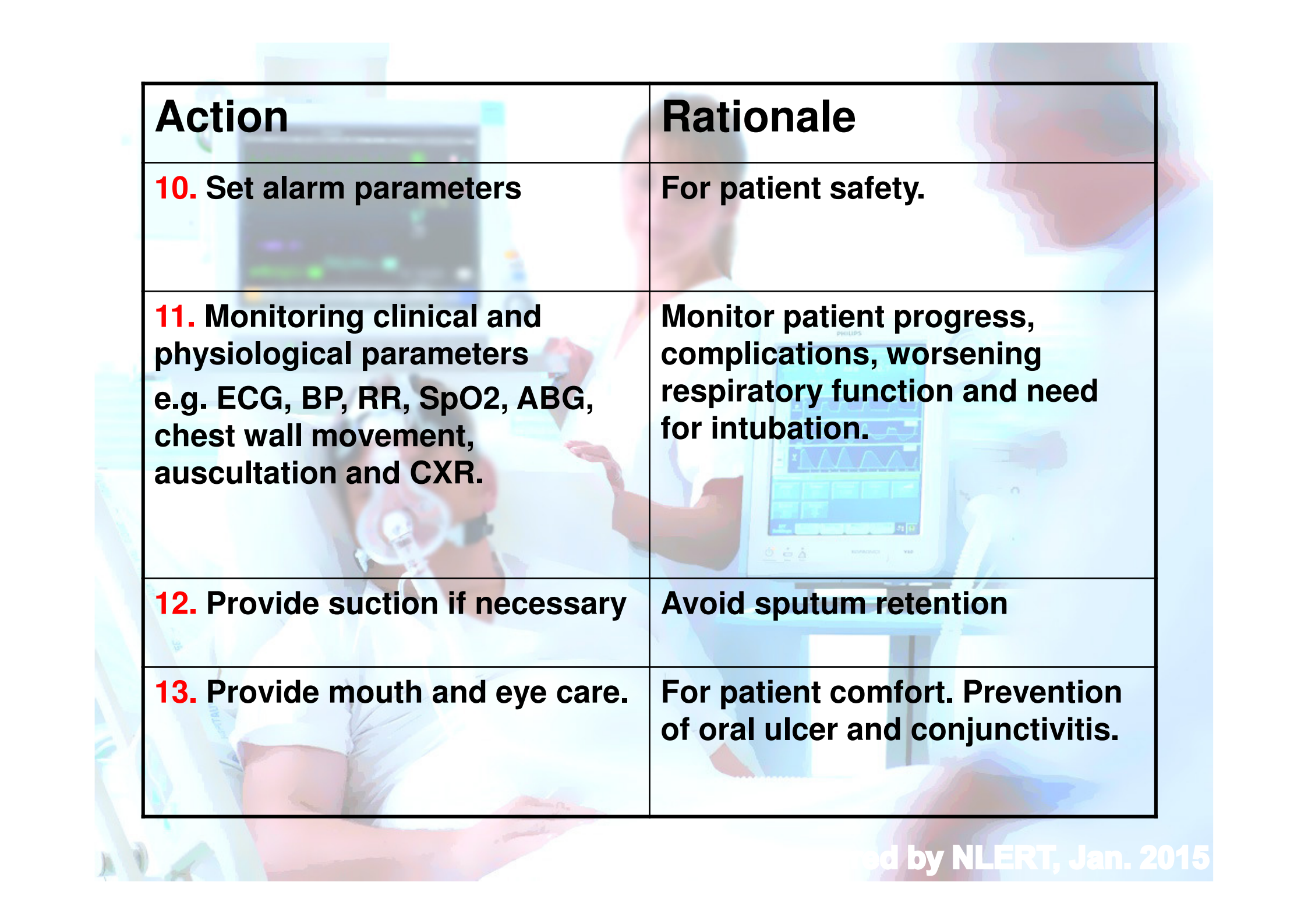
# General nursing Interventions

- Wash hands, standard precaution
- Explain procedure
- Setting comply with physician order
- Place the fitting mask on patient
- Secure mask with head strap. Tighten straps just enough to prevent leaks.  
**(A small leak from mask is allowed)**
- Set alarms appropriately



<b>Nursing Intervention</b>	<b>Rationale</b>
<b>1. Explain the rational of BiPAP</b>	<b>Gain cooperation.</b>
<b>2. Observe and record vital sign</b>	<b>To monitor progress of therapy.</b>
<b>3. Ensure correct size of mask</b>	<b>May cause nasal bridge pressure sores &amp; air leakage.</b>
<b>4. Nasal bridge skin protection</b>	<b>Apply Duoderm</b>
<b>5. Proceed “Exhalation Port Test” before application.</b>	<b>Calculate gases volume exhaled from port.</b>
<b>6. Add humidifier.</b>	<b>Warming and moisturizing inhaled air. Avoid drying of secretions.</b>

<b>Nursing Intervention</b>	<b>Rationale</b>
<p><b>7. Verify the mode and setting.</b> Suggested initial settings: CPAP mode: PEEP 5-10cmH<sub>2</sub>O S/T mode: IPAP 12cmH<sub>2</sub>O EPAP: 5cmH<sub>2</sub>O Resp. rate: 10 bpm. Time of inspiratory: 1 sec Rise Time: 0.1 sec FiO<sub>2</sub> according to patient's requirements.</p>	<p><b>Note</b> Inspiratory pressure support = IPAP-EPAP</p>
<p><b>8. Once commenced BiPAP, stay with patient a moment.</b></p>	<p><b>Psychological support and observe patient response</b></p>
<p><b>9. Make adjustments per physical parameters, doctor's instructions and patient's comfort.</b></p>	<p><b>Inform physician if necessary</b></p>



<b>Action</b>	<b>Rationale</b>
<b>10. Set alarm parameters</b>	<b>For patient safety.</b>
<b>11. Monitoring clinical and physiological parameters</b> e.g. ECG, BP, RR, SpO2, ABG, chest wall movement, auscultation and CXR.	<b>Monitor patient progress, complications, worsening respiratory function and need for intubation.</b>
<b>12. Provide suction if necessary</b>	<b>Avoid sputum retention</b>
<b>13. Provide mouth and eye care.</b>	<b>For patient comfort. Prevention of oral ulcer and conjunctivitis.</b>

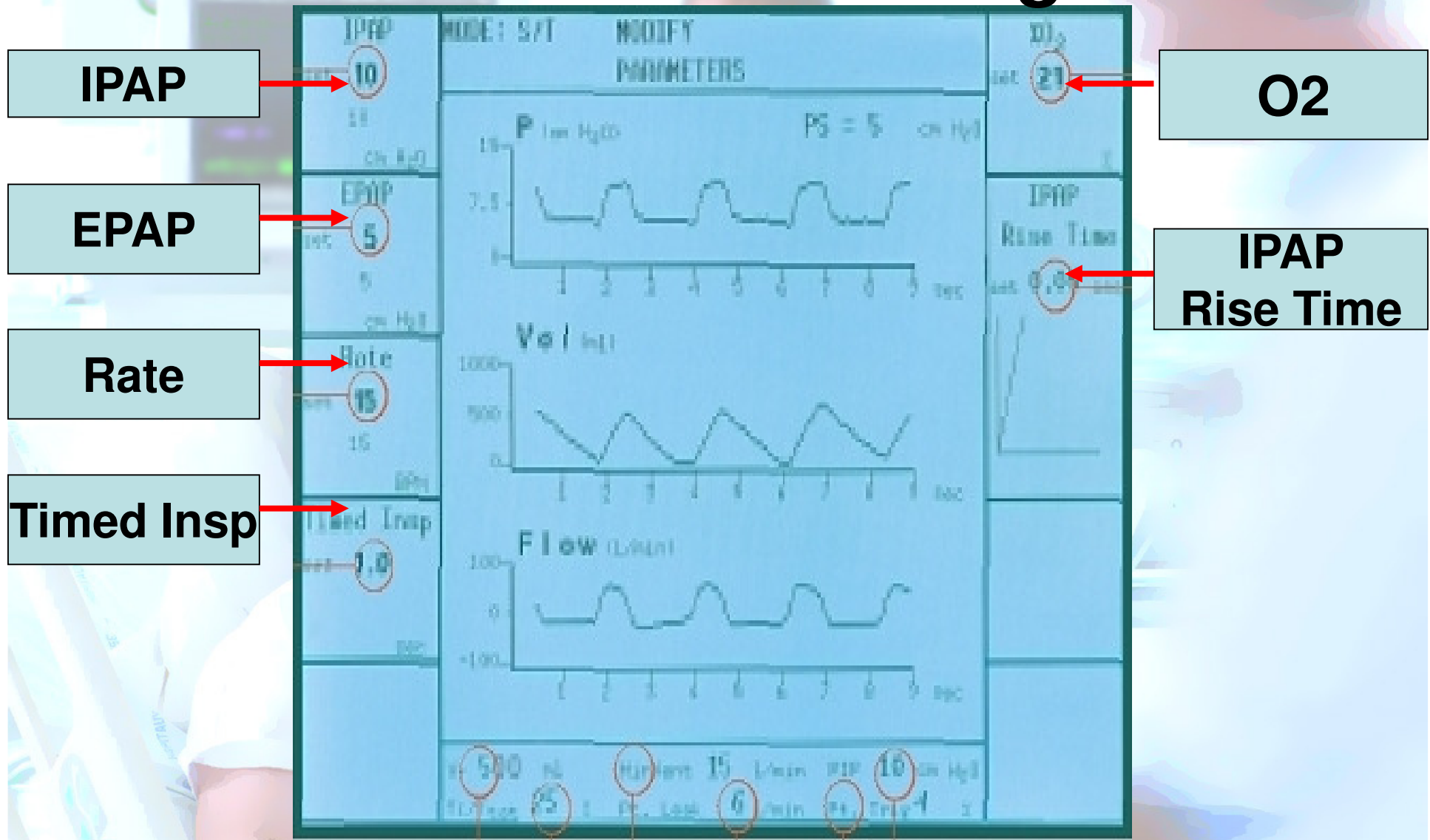
# Trouble Shooting

<b>Low Pressure Low MV</b>	<b>Ensure no leakage, fitting mask, tubing disconnection, appropriate IPAP and RR setting.</b>
<b>High Pressure High MV</b>	<b>Patient-ventilator dysynchrony, avoid occlusion to exhalation port, kinked tubing, sputum retention, inform medical if tachypnoea.</b>
<b>Low RR</b>	<b>Assess conscious level and breathing effort, request medical review, change of mode (S/T mode), ↑RR setting, intubation if necessary.</b>

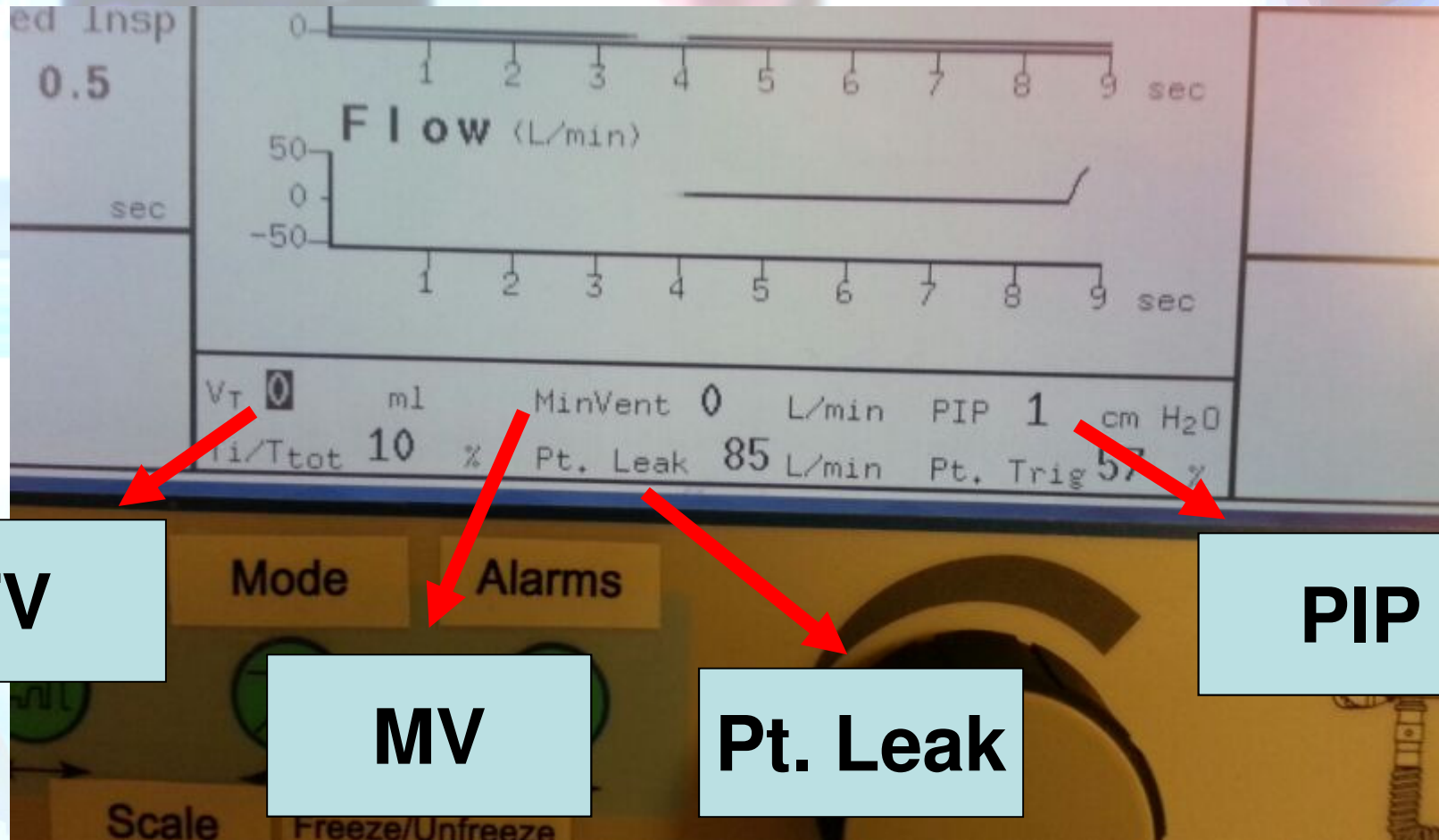
# Trouble Shooting

<b>High RR</b>	<b>Restless, assess chest movement and breathing pattern, request medical review.</b>
<b>Apnea</b>	<b>Rule out respiratory fatigue, check conscious level, vital sign, chest movement, inform medical to ↑RR setting or intubation if necessary.</b>
<b>↓ level of conscious ↑ confusion/agitation</b>	<b>Check ABG and request medical review, BiPAP may no longer appropriate.</b>

# Patient Monitoring



# Patient Monitoring



# Bronchodilators

RELIEVERS	CONTROLLERS	PREVENTERS
<p><b>1. Short-acting <math>\beta_2</math>-agonists</b></p> <p>Asthavent<sup>®</sup> MDI / DP-Haler<sup>®</sup> / Revolizer<sup>®</sup> (Salbutamol)</p> <p>Berotec<sup>®</sup> MDI (Fenoterol)</p> <p>Venteze<sup>®</sup> MDI (Salbutamol)</p> <p>Ventolin<sup>®</sup> MDI / Accuhaler<sup>®</sup> (Salbutamol)</p>	<p><b>Long-acting <math>\beta_2</math>-agonists</b></p> <p>Foratec DP-Haler<sup>®</sup> / Revolizer<sup>®</sup> (Formoterol)</p> <p>Oxis Turbuhaler<sup>®</sup> (Formoterol)</p> <p>Serevent<sup>®</sup> MDI / Accuhaler<sup>®</sup> (Salmeterol)</p>	<p><b>1. Inhaled Corticosteroids</b></p> <p>Alvesco<sup>®</sup> MDI (Ciclesonide)</p> <p>Beclate HFA<sup>®</sup> MDI (Beclomethasone)</p> <p>Budeflam DP-Haler<sup>®</sup> / Revolizer<sup>®</sup> (Budesonide)</p> <p>Budeflam HFA Gentle-Haler<sup>®</sup> (Budesonide)</p> <p>Flixotide<sup>®</sup> MDI / Accuhaler<sup>®</sup> (Fluticasone)</p> <p>Inflammide<sup>®</sup> MDI / Novolizer<sup>®</sup> (Budesonide)</p> <p>Pulmicort Turbuhaler<sup>®</sup> (Budesonide)</p> <p>QVAR<sup>®</sup> MDI (Beclomethasone)</p>
<p><b>2. Anticholinergics</b></p> <p>Atrovent<sup>®</sup> MDI (Ipratropium Bromide)</p> <p>Ipvent-40<sup>®</sup> MDI (Ipratropium Bromide)</p> <p>Spiriva Handihaler<sup>®</sup> (Tiotropium)</p>	<p><b>COMBINATIONS</b></p> <p>DP-Haler<sup>®</sup> / Revolizer<sup>®</sup> (Budesonide + Formoterol)</p> <p>Seretide<sup>®</sup> MDI / Accuhaler<sup>®</sup> (Fluticasone + Salmeterol)</p> <p>Symbicord Turbuhaler<sup>®</sup> (Budesonide + Formoterol)</p>	<p><b>2. Leukotriene receptor antagonist</b></p> <p>Singulair<sup>®</sup> tablets (Montelukast)</p>

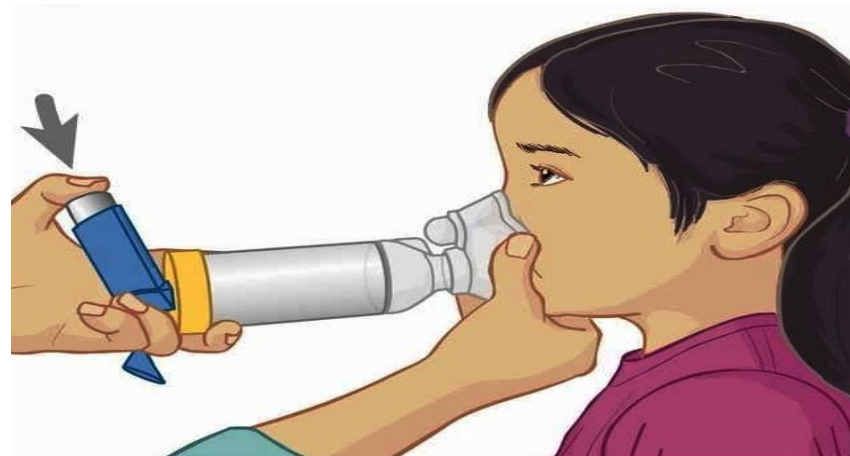
# Given of Bronchodilator



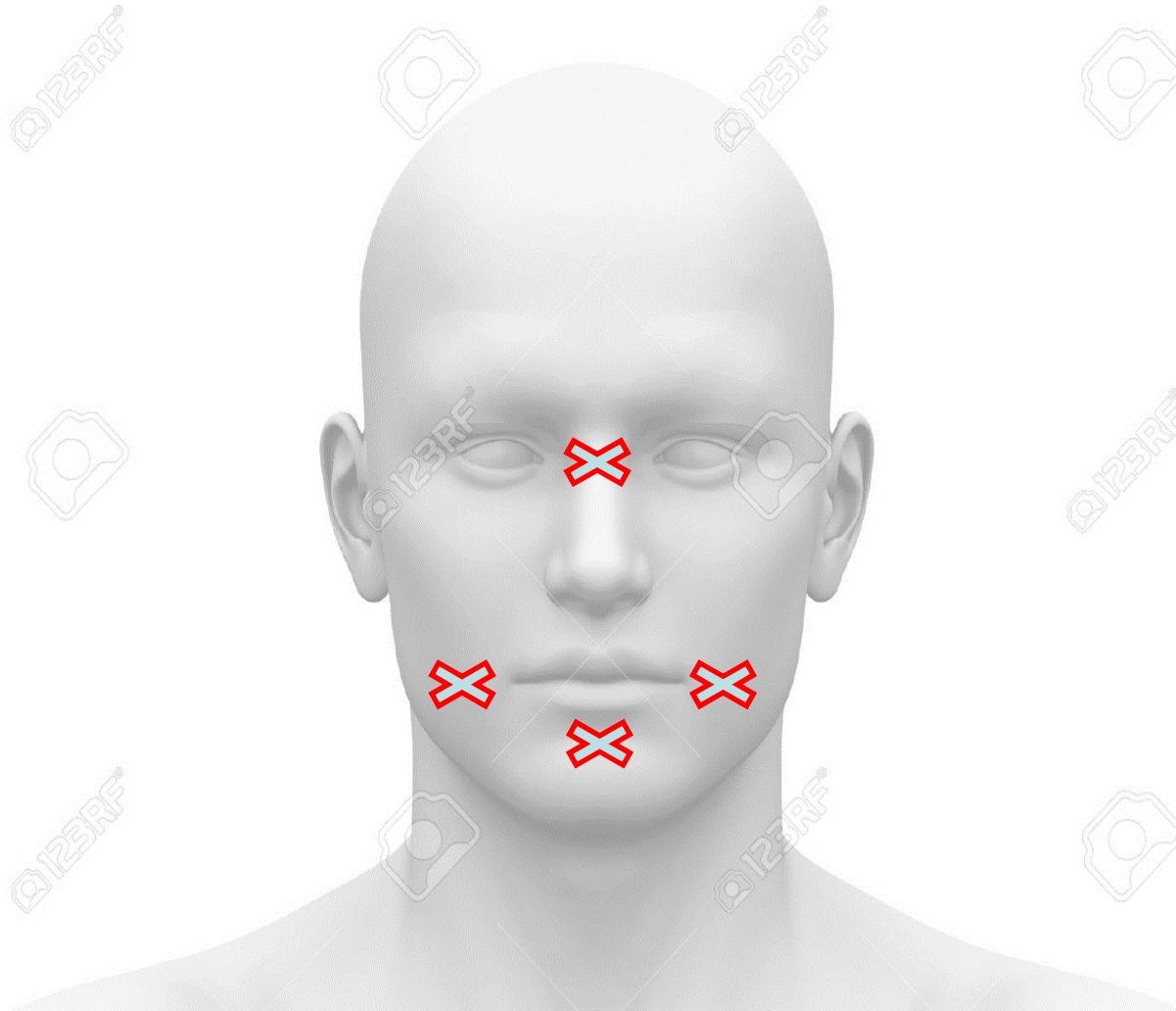
**Metered-Dose  
Inhaler**



**Spacer with mask**



# Mask fitting



# Skin Protection



# Suction and Mouth Care



# Reference

- Irwin RS & Rippe JM 2011 Irwin and Rippe's Intensive Care Medicine (7th edition) Lippincott Williams & Wilkins: Philadelphia
- Domino FJ 2013 The 5-Minute Clinical Consult 21st Edition Lippincott Williams & Wilkins: Philadelphia
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- Simonds AK 2007 Non-invasive respiratory support: a practical handbook (3rd edition). Hodder Arnold: London

*Thank You*