Non-invasive ventilation

BiPAP/NIV definitions

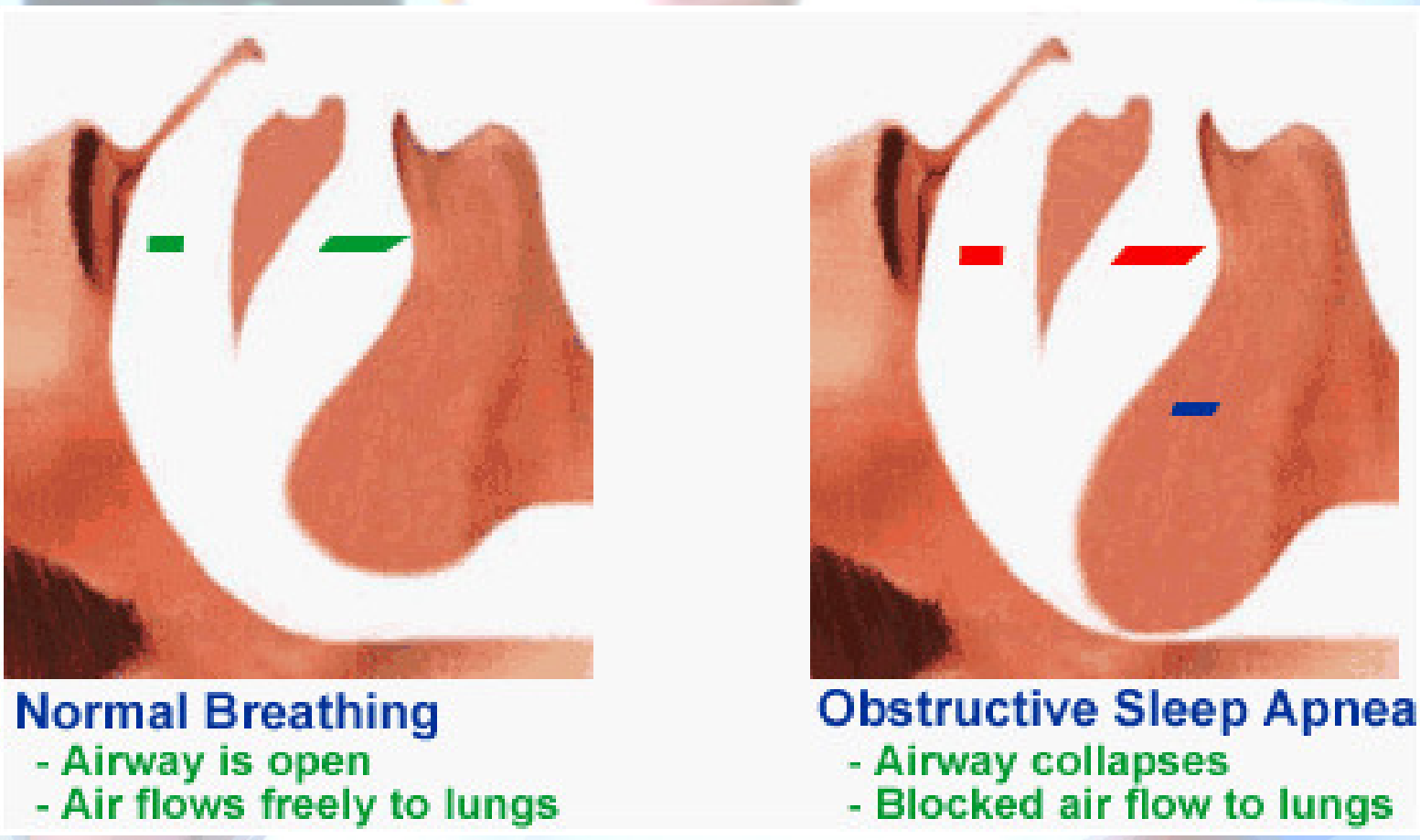
- Bi-level Positive Airway Pressure is a type of non-invasive ventilation to provide positive pressure ventilation supporting patient's spontaneous breathing.
- A higher pressure (IPAP) for breath in and a lower pressure (EPAP) for breath out in order to:
  - ↓work of breathing
  - Improve oxygenation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

Indications

- Decompensate obstructive sleep apnea with hypercapnia.
- ↑airway resistance e.g. COPD exacerbation.
- Respiratory/accessory muscle distress, fatigue or failure.
- Acute-on-chronic hypercapnic respiratory failure due to chest wall deformity or neuromuscular disease.
- Post-extubation ventilatory support.
- Acute Pulmonary Oedema.

Nursing assessment

Obstructive Sleep Apnea



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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
- Allergy or sensitivity to mask materials

Equipment

1. BiPAP machine
2. BiPAP disposable circuit with disposable proximal pressure line and exhalation port (flushes exhaled gas from the circuit)
3. Low resistance bacterial filter
4. BiPAP Total Face Mask, Full Face Mask or Nasal Mask plus head strap.
5. Disposable Humidifier
6. Distilled water
7. Duoderm for skin protection.

BiPAP Vision

Respironics V60

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BiPAP Synchrony

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Smartair BiPAP with internal battery

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BiPAP with Humidifer

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Type of Mask

Total Face Mask

Full Face Mask

Nasal Mask

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Type of Mask

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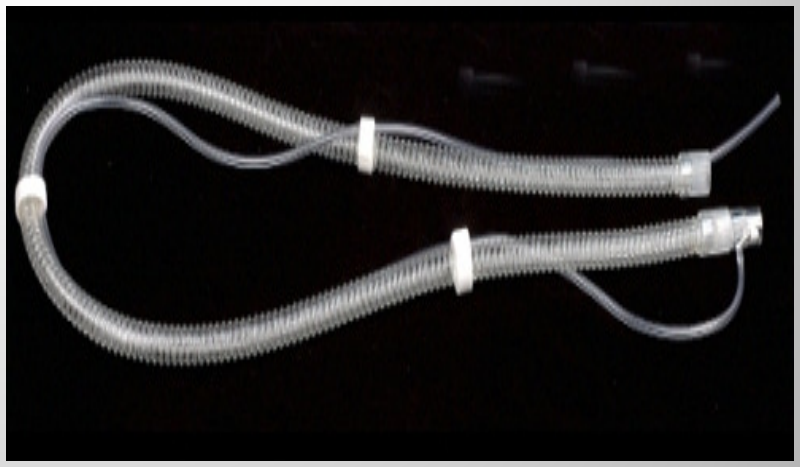

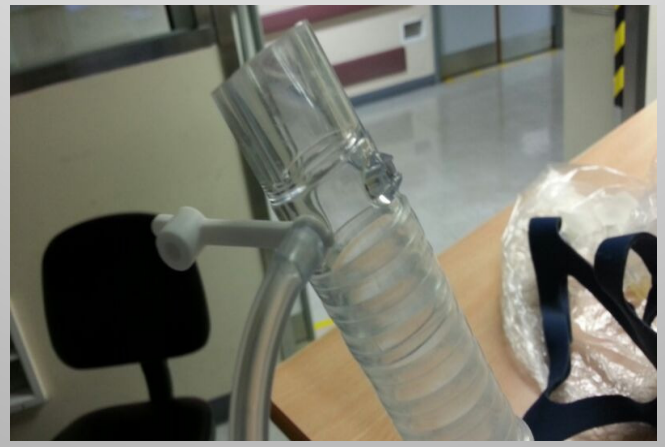

Disposible Tubing with Exhalation Port and Pressure Line

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Humidifier

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Pressure line and low resistence bacterial filter

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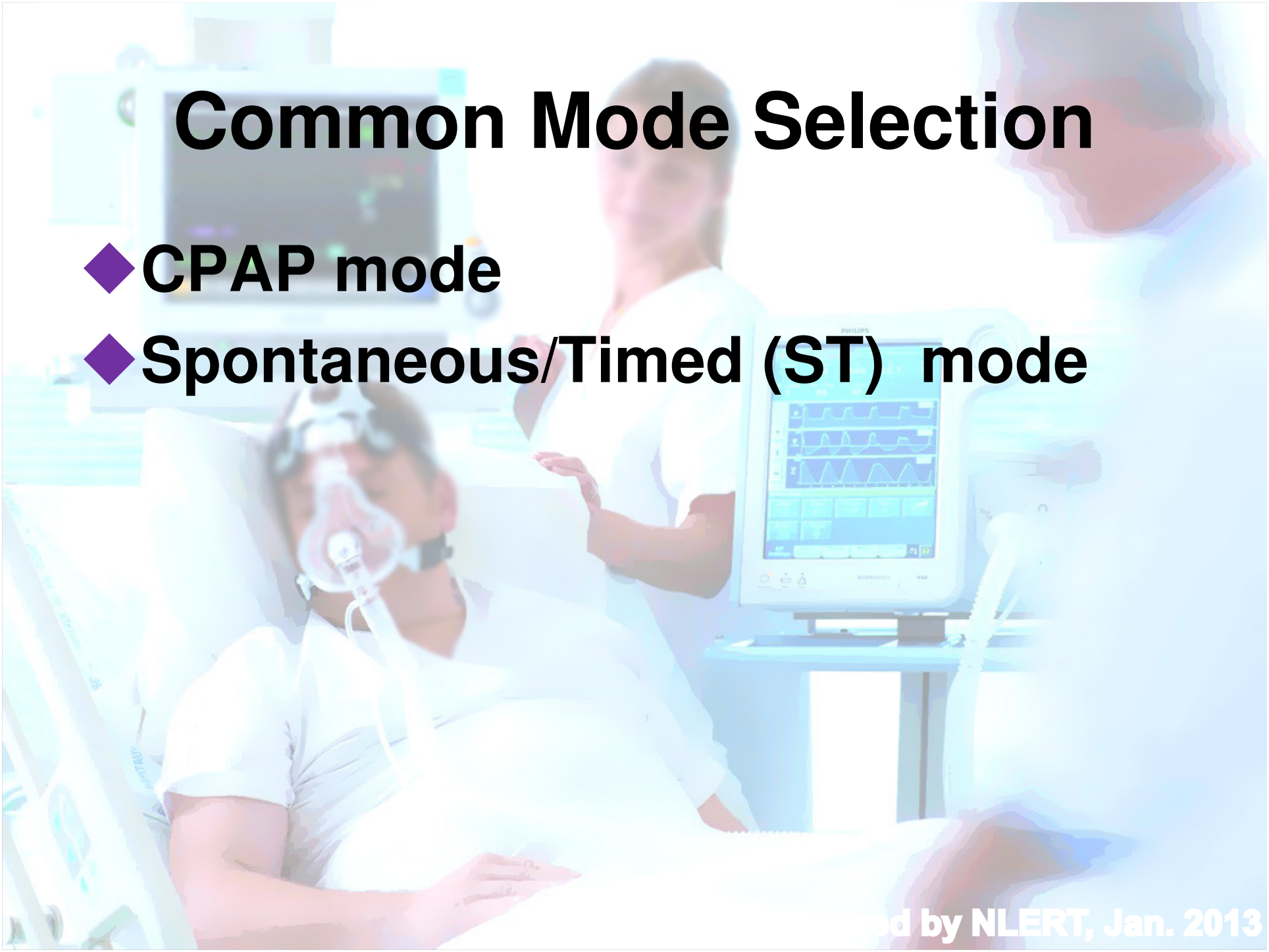
Common Mode Selection

- CPAP mode
- Spontaneous/Timed (ST) mode



CPAP mode
(Continuous Positive Airway Pressure)

- There is no automatic delivery of a breath if patient do not inhale.
- A constant preset pressure (CPAP) will be delivered continuously either inhalation or exhalation.
- No IPAP and EPAP setting.

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 patient exhalation.

Machine Control Setting

- Mode: CPAP or S/T mode
- FiO2: Oxygen (21%~100%)
- RR: Mandatory RR setting
- IPAP: Inspiratory Positive Airway Pressure
- EPAP: Expiratory Positive Airway Pressure
- Tinsp: 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 (Max. 40cmH2O)

1. Supports inspiratory effort, reducing WOB
2. ↑ TV
3. ↑ C02 removal

- EPAP: Expiratory Positive Airway Pressure (Max. 20cmH2O)

1. Keeps alveoli partially inflated
2. ↑ lung volume, ↑ functional residual capacity (FRC)
3. ↑ alveolar gas exchange
4. ↑ oxygenation

Patient Status Monitoring

- Vt: Tidal Volume
- Respiratory Rate: RR
- MV: Minute Volume=TV x RR
- 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. cardiac monitoring, RR, BP and SpO2.
- Breathing pattern/chest movement
- Patient-ventilator synchronization.
- Accessory muscle recruitment.
- General assessment: sweating /dsypnoeic.
- 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

Nursing Intervention	Rationale
1. Explain the rational of BiPAP to patient.	Patient need to understand and gain cooperation.
2. Record baseline haemodynamic parameters.	To monitor progress of therapy.
3. Ensure correct size of mask	Unfitting mask can cause nasal bridge pressure sores, air leakage and conjunctivitis
4. Skin protection for the prevention of pressure sore	Assess regularly and apply Duoderm especially on the bridge of nose.
5.Turn BIPAP machine on, a quick self-test will occur and then run “Exhalation Port Test”.	Calculate gases volume exhalated from port in different pressure.

Nursing Intervention	Rationale
6. Verify the mode and setting. Suggested initial settings: CPAP mode: PEEP 5-10cmH2O S/T mode: IPAP 12cmH2O EPAP: 5cmH2O Resp. rate: 10 bpm. Time of inspiratory: 1 sec Rise Time: 0.1 sec FiO2 according to patient's requirements.	Note Inspiratory pressure support = IPAP-EPAP 
7. Once commenced BiPAP, stay with patient a moment.	Psychological support and observe patient response
8. Make adjustments per physical parameters, doctor's instructions and patient's comfort.	Inform physician if necessary

Action	Rationale
9. Set all alarm parameters including apnoea, high and low pressure, and respiratory rate.	To ensure safe practice.
10. Monitoring clinical and physiological parameters e.g. Cardiac monitoring, BP, RR, SpO2, ABG, chest wall movement, auscultate chest and CXR inspection.	To monitor patient progress, and to detect complications, worsening respiratory function and need for intubation.
11. Provide suction if necessary and add a humidifier.	Avoid sputum retention and drying of secretions.
12. Provide mouth and eye care.	For patient comfort. Prevention of oral ulcer and conjunctivitis.

Treatment failure in NIV

- Is the treatment optimal?
  - Check medical treatment prescribed.
  - Consider physiotherapy for sputum retention.
- Have any complications developed?
  - Vital sign frequently observe.
  - Consider a pneumothorax, aspiration pneumonia etc.
- Is there excessive leakage or ↑PaC02?
  - Fitting of mask.
  - Consider other type of mask.
- Is the patient on too much oxygen?
  - Adjust Fi02 in appropriate level.

Treatment failure in NIV

- **Is ventilation inadequate/low TV?**
  - **Observe chest expansion**
  - **↑ IPAP**
  - **↑ inspiratory time**
  - **↑ RR (to increase MV)**
  - **Consider other mode of ventilation**
- **PaCO2 improves but PaO2 remains low**
  - **↑ Fi02**
  - **Consider ↑ EPAP**

Trouble Shooting

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

Trouble Shooting

High RR	Find out the cause e.g. leakage, restless, assess chest movement and breathing pattern, request medical review.
Apnea	Rule out respiratory fatigue, check conscious level, vital sign, chest movement, inform medical to ↑RR setting or intubation if necessary.
↓ level of conscious ↑ confusion/agitation	Check ABG for hypercarbia and request medical review, BiPAP may no longer appropriate.

Instructions

1. Connect oxygen and power cord.
2. Plug the tubing from outlet to humidifier.
3. Plug the tubing from humidifier to patient
4. Switch on the machine.
5. Press “Test Exhalation Port” button and follow the procedure. Then waiting “Test Complete” to appear on the screen.
6. Press “Monitoring” to begin operation.

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Instructions

1. Press “Parameters” button and control knob to select different setting.
2. Change mode setting with “mode” button and confirm with “Activate New Mode” button
3. Change the alarm setting with “Alarm” button.
4. Place the fitting mask on patient.
5. Stay with patient for a moment to ensure tolerate the machine and setting.

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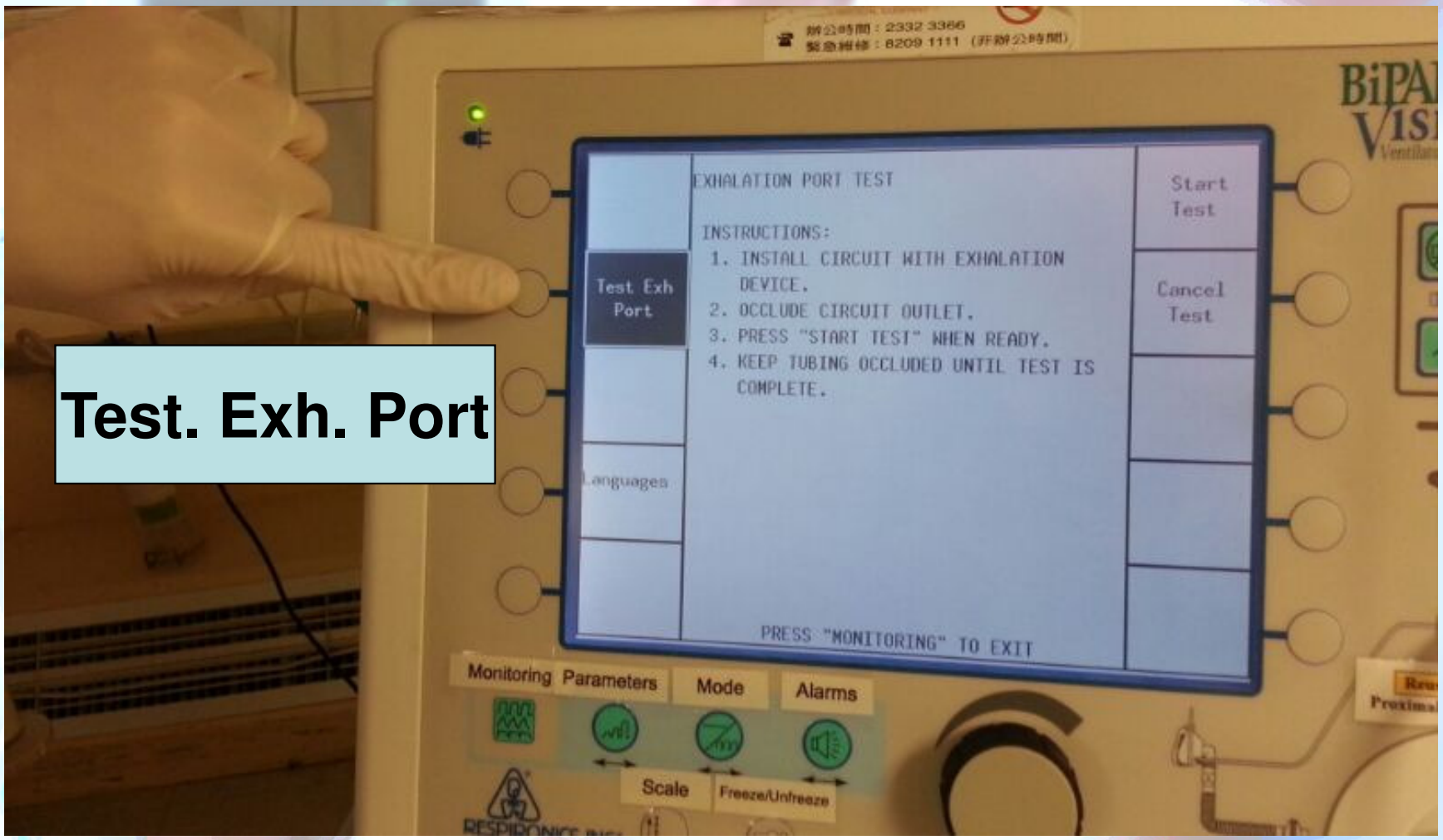
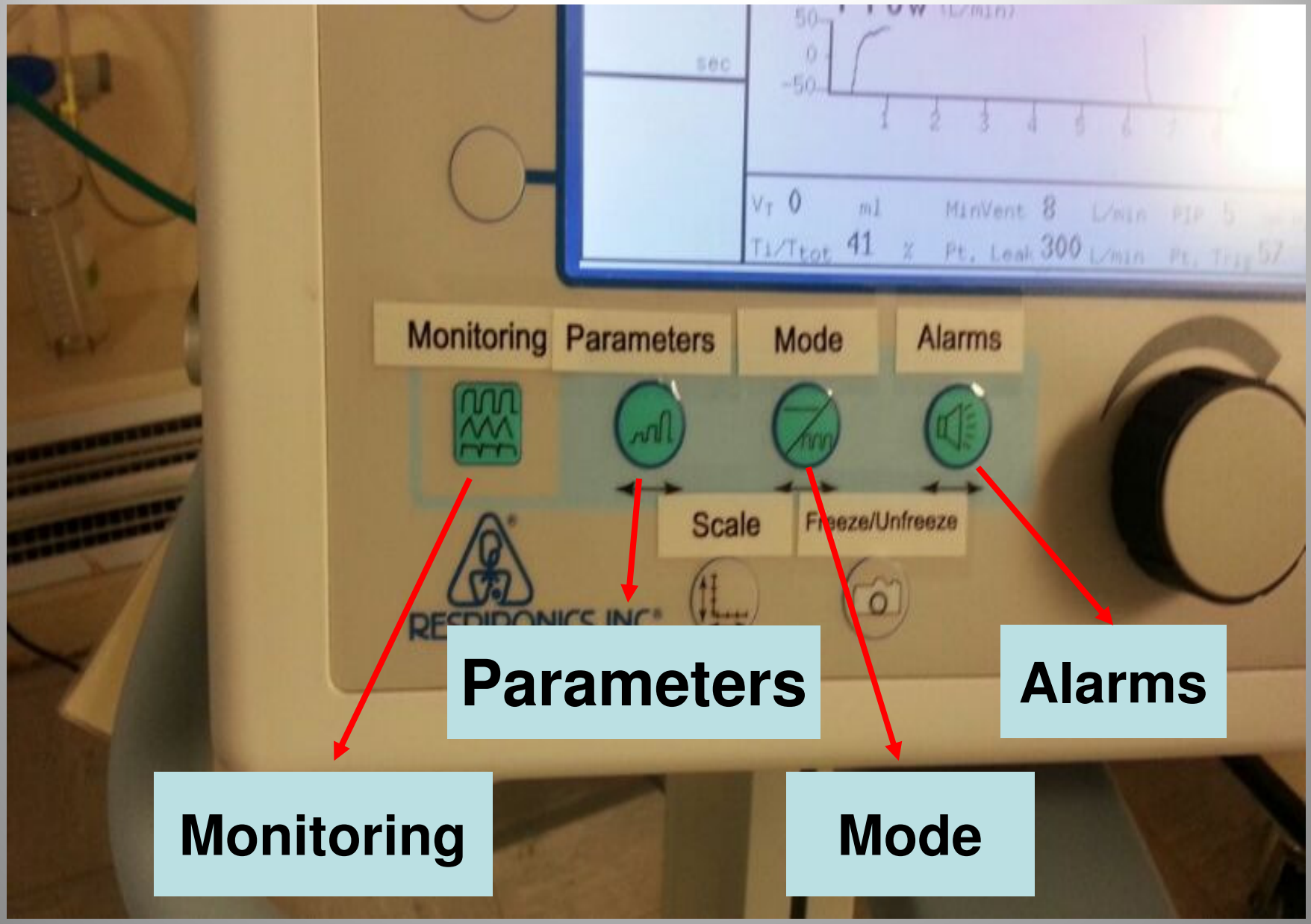
Test Exhalation Port





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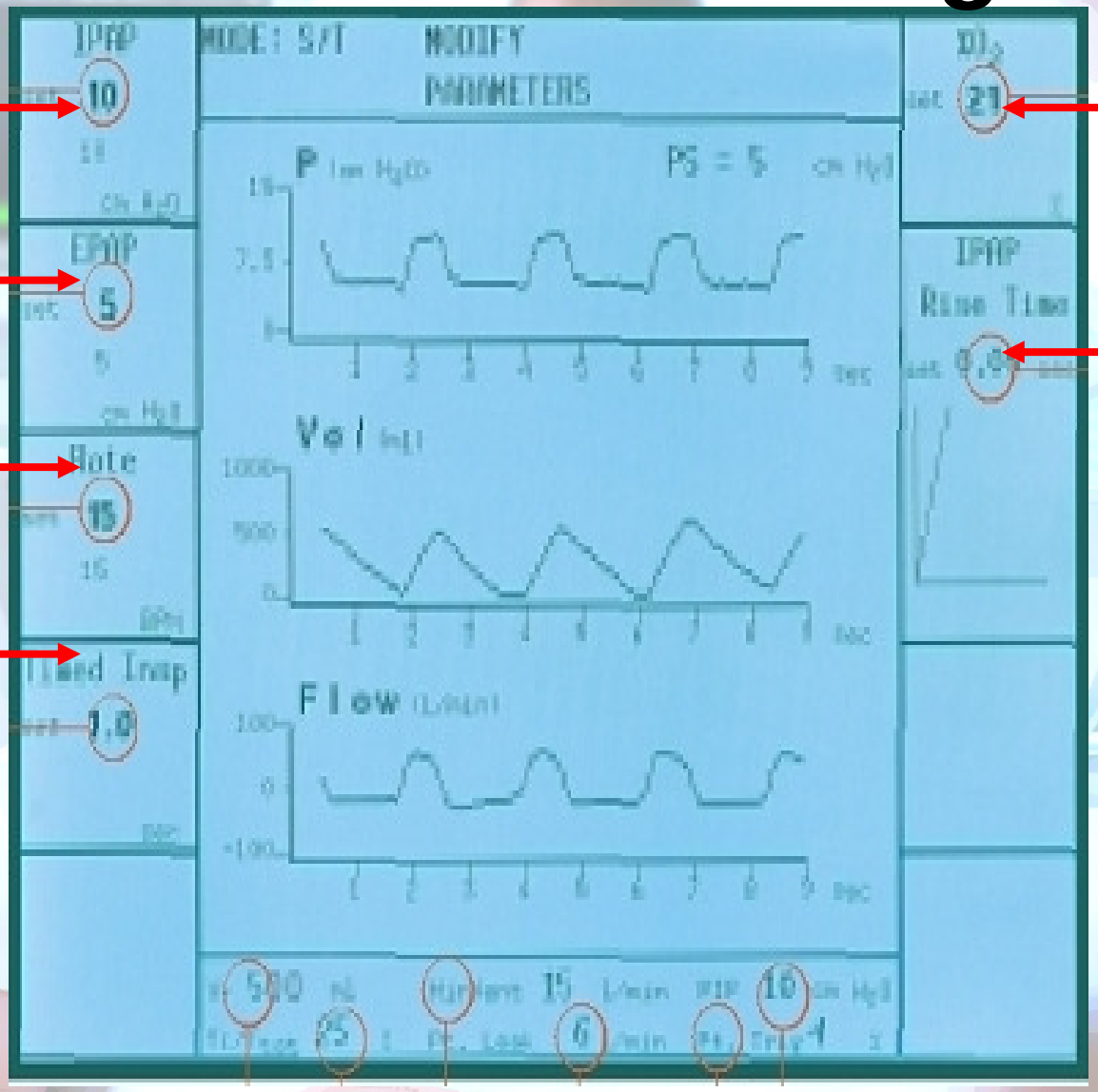
Patient Monitoring



IPAP

EPAP

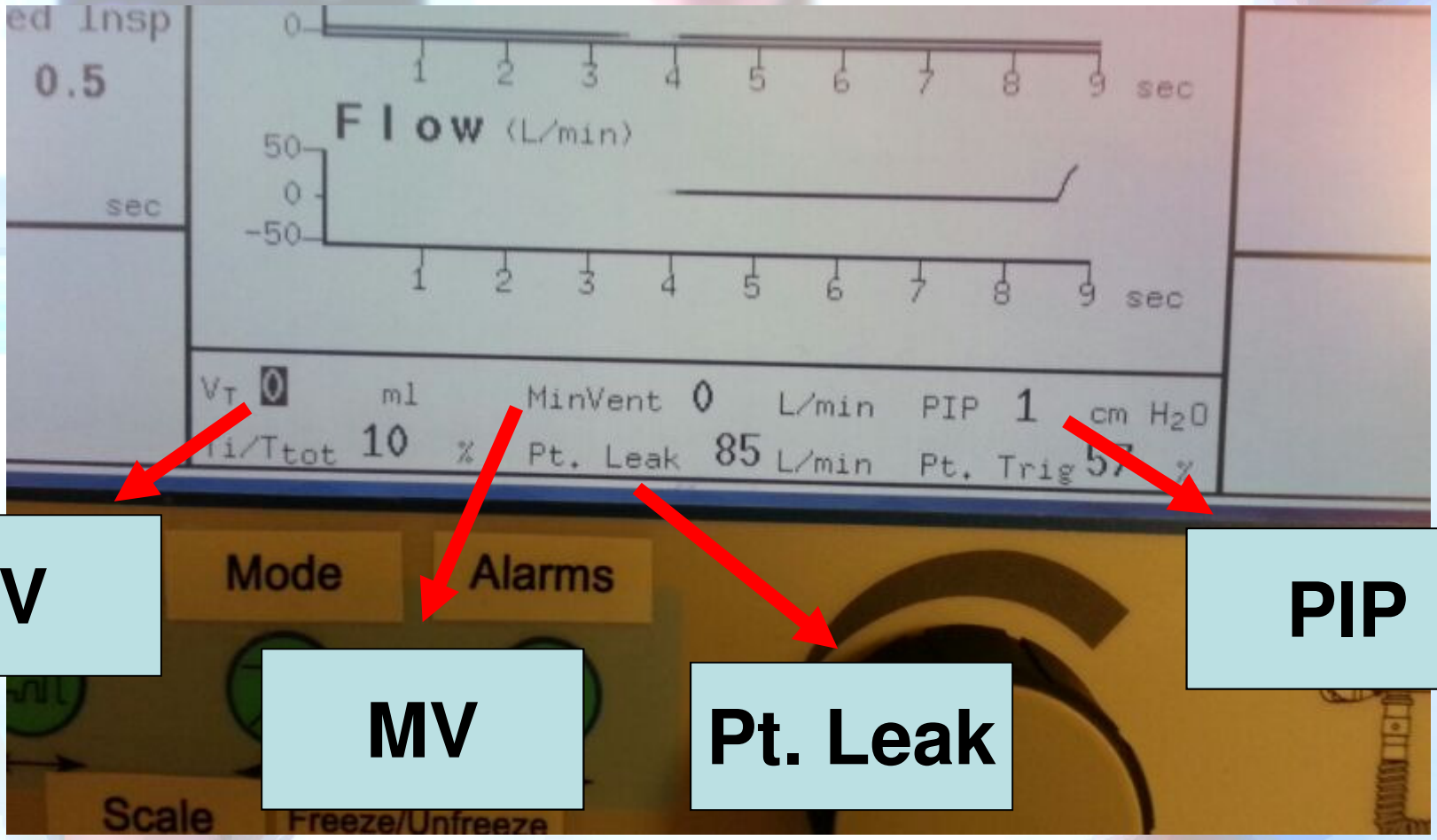
Rate

Timed Insp

O2

IPAP
Rise Time

Patient Monitoring



TV

MV

Pt. Leak

PIP

Demonstration

- Set up the device and plug the tubing.
- Exhalation Port test
- Fitting mask
- Skin protection
- Technique of Bronchodilator given
- Integrate nursing procedure

Given of Bronchodilator

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Skin Protection

Note

Small leakage is allowed

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Suction and Mouth Care

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Kwong Wah Hospital Department of Surgery NIV patient chart							Patient Gum Label					
Date on BiPAP support:							Remark:_____					
BiPAP Device Setting												
Date												
Shift/Time	N		A		P		N		A		P	
Mode												
FiO2 (0.21 to 1.0)												
RR setting (BPM)												
CPAP(cmH2O)												
IPAP(cmH2O)												
EPAP(cmH2O)												
Time of Inspiratory(TI) in sec.												
Rise Time in sec.												
Humidifier checked												
Alarm setting checked												
RN (Name in block letter)												
Patient Current Status												
Time	0A	4A	8A	12N	4P	8P	0A	4A	8A	12N	4P	8P
CPAP(cmH2O)												
IPAP (cmH2O)												
EPAP(cmH2O)												
Exp.TV (ml)												
RR (bpm)												
Minute Volume (L/min)												
Air leakage (L/min)												
PIP (cmH2O)												
SpO2 (%)												
#Sputum (colour, nature, amount)												
RN (Name in block letter												

# Y=Yellow L=Loose S=Scant
G=Green T=Thick M=Moderate
W=White B=Blood Stained C=Copious

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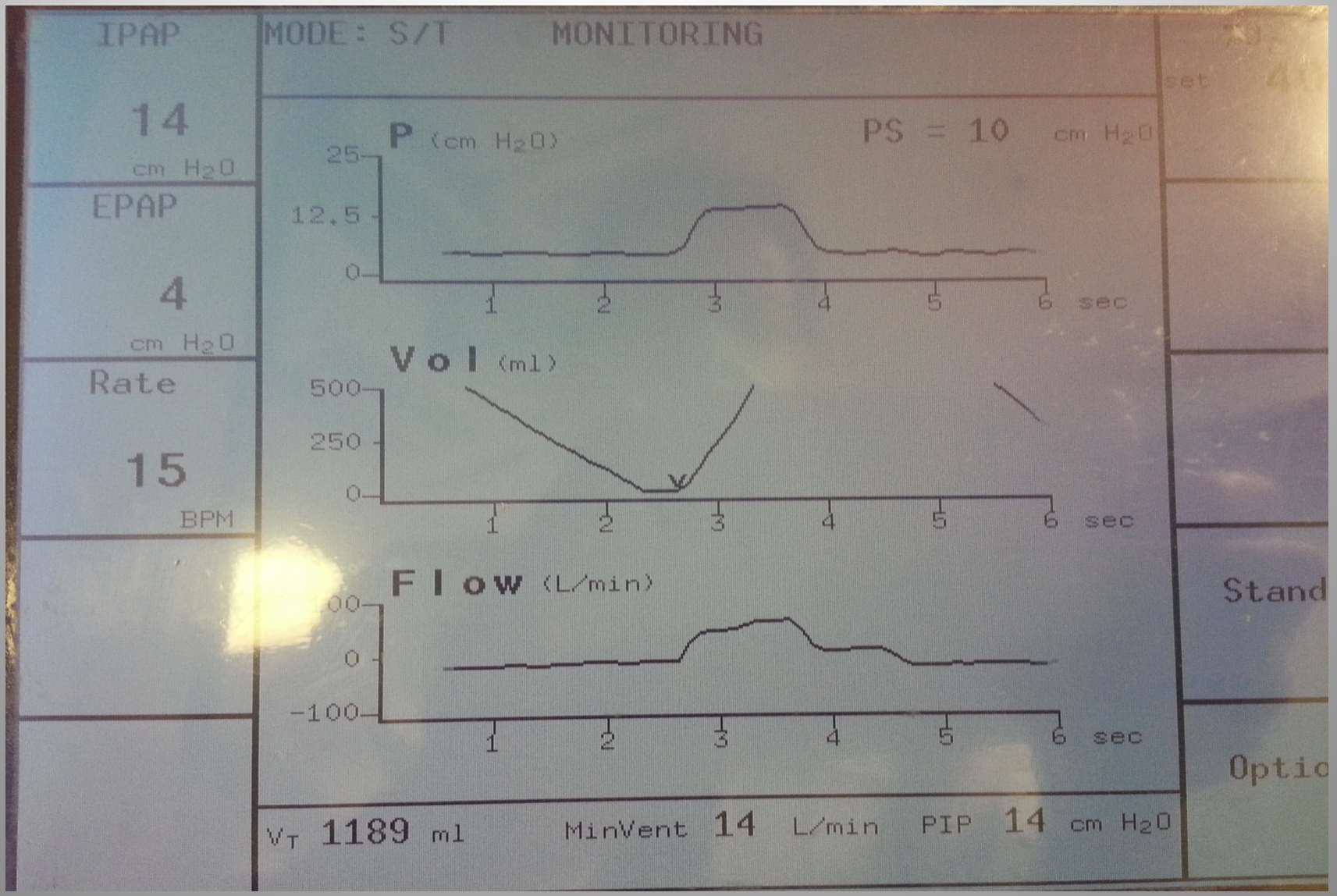

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Thank You