

Airway Management and Ventilation



CPAP

- What is it?
- What does it do?
- How may it help patients?
- Which patients may benefit from it in the emergency setting?
- Has any one seen it or tried it?

- To maintain a continuous level of positive airway pressure in a spontaneous breathing patient
 - Baseline pressure is higher than atmospheric pressure
 - Similar to PEEP though the pressure is during inspiration and expiration versus just during the expiratory phase with PEEP
- Pt still able to inspire/expire normally
- Decreases the work of breathing by expanding the alveoli and increasing compliance
- May cause over distention if too much CPAP is applied decreasing compliance

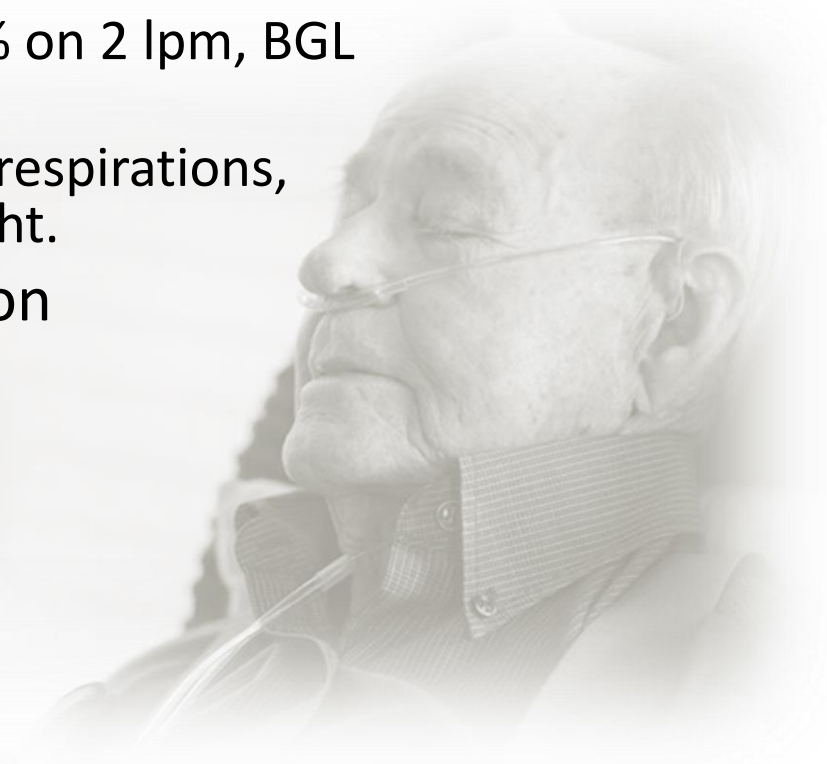
Out-of-Hospital Continuous Positive Airway Pressure Ventilation Versus Usual Care in Acute Respiratory Failure: A Randomized Controlled Trial

Presented at the International Congress of Emergency Medicine, June 2006, Halifax, Nova Scotia, Canada.

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- 72 y/o M SOB
- Worsening for 5 hrs
- PMHx includes COPD, CHF, HTN, DMII, GERD.
- O/E:
 - SBP 160, HR 100, RR 40, Sats 82% on 2 lpm, BGL 11, Temp 38.
 - Alert, protecting airway, gasping respirations, too SOB to talk. Sitting bolt upright.
- Crackles and wheezes diffusely on auscultation.
- Approach?
 - Role for CPAP?
 - Indications?
 - Contraindications?



- Indications:
 - Patent A/W
 - Cooperative patient (not altered)
 - Must be able to follow directions
 - Acute SOB with evidence of CHF, COPD, Asthma, Pneumonia, etc...
- And...
 - Any 2 of the following:
 - RR > 24
 - SpO₂ < 90%
 - Skin signs
 - Adventitious sounds



- Contraindications:
 - Unconscious or GCS < 12
 - SBP < 90
 - Hypoventilation
 - Chest trauma
 - Facial trauma/deformity/burns that inhibit proper mask fit
 - High risk aspiration or active vomiting
 - Tracheostomy
 - Pneumothorax

- Application:
 - Explain procedure to pt and obtain consent
 - Place pt in high fowlers position, monitor, SpO₂
 - Ensure appropriate amount of oxygen in tank prior to starting
 - Place mask on face and attach straps ensuring a proper seal
 - Initiate CPAP with 15 lpm (3 - 4 cmH₂O)
 - Coach pt on breathing (in through nose out through mouth)
 - Titrate up to max of 25 lpm (8.5 – 10 cmH₂O)
 - Watch for non-tolerance, respiratory failure or change in LOC
 - BP should be assessed q5 mins

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REVIEW

- What are our options for airway management?
- What about a combination?
- How do you choose?
- How much FiO_2 does each deliver?

High Flow Nasal Prong (HFNP)?

- What happens if you combine HFNP with NRB or BMV?
- How many liters can you administer?



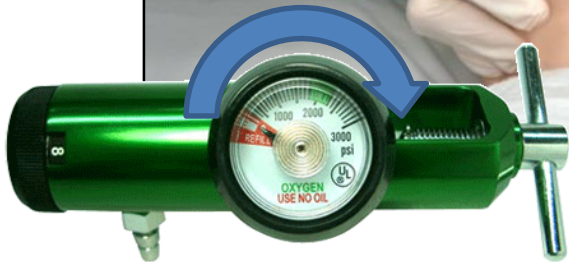
- Optimizing Oxygenation with 2 Sources
- Insert OPA/NPA and apply 2 sources of high flow O₂ (+ maintain jaw thrust)



2 Sources/minimize RA entrainment



- Insert OPA/NPA AND apply high flow O₂
- Maintain jaw thrust +/- assisted oxygenation/ventilation



THE NEW ENGLAND JOURNAL OF MEDICINE

EDITORIAL



Saving Lives with High-Flow Nasal Oxygen

Michael A. Matthay, M.D.

The New England Journal of Medicine

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This is the most optimal
method of providing
oxygen using BLS
maneuvers!

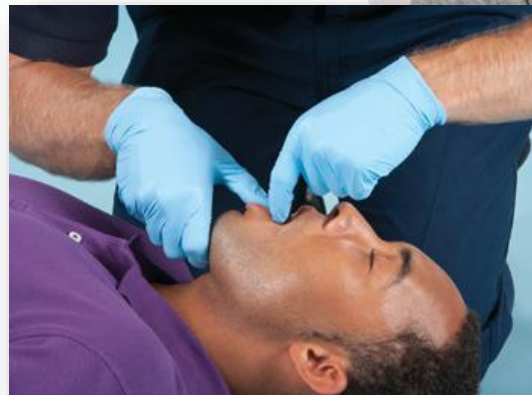
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FOREIGN BODY

- You are called out for a 55 y/o F who is choking on a piece of steak.
- As you are pulling up to the scene, you review your approach.
- How does it differ if the patient is sitting up coughing?
 - If she is silent/unable to cough?
 - If she is unconscious in the floor?
 - When do you attempt to remove a FB from an airway?

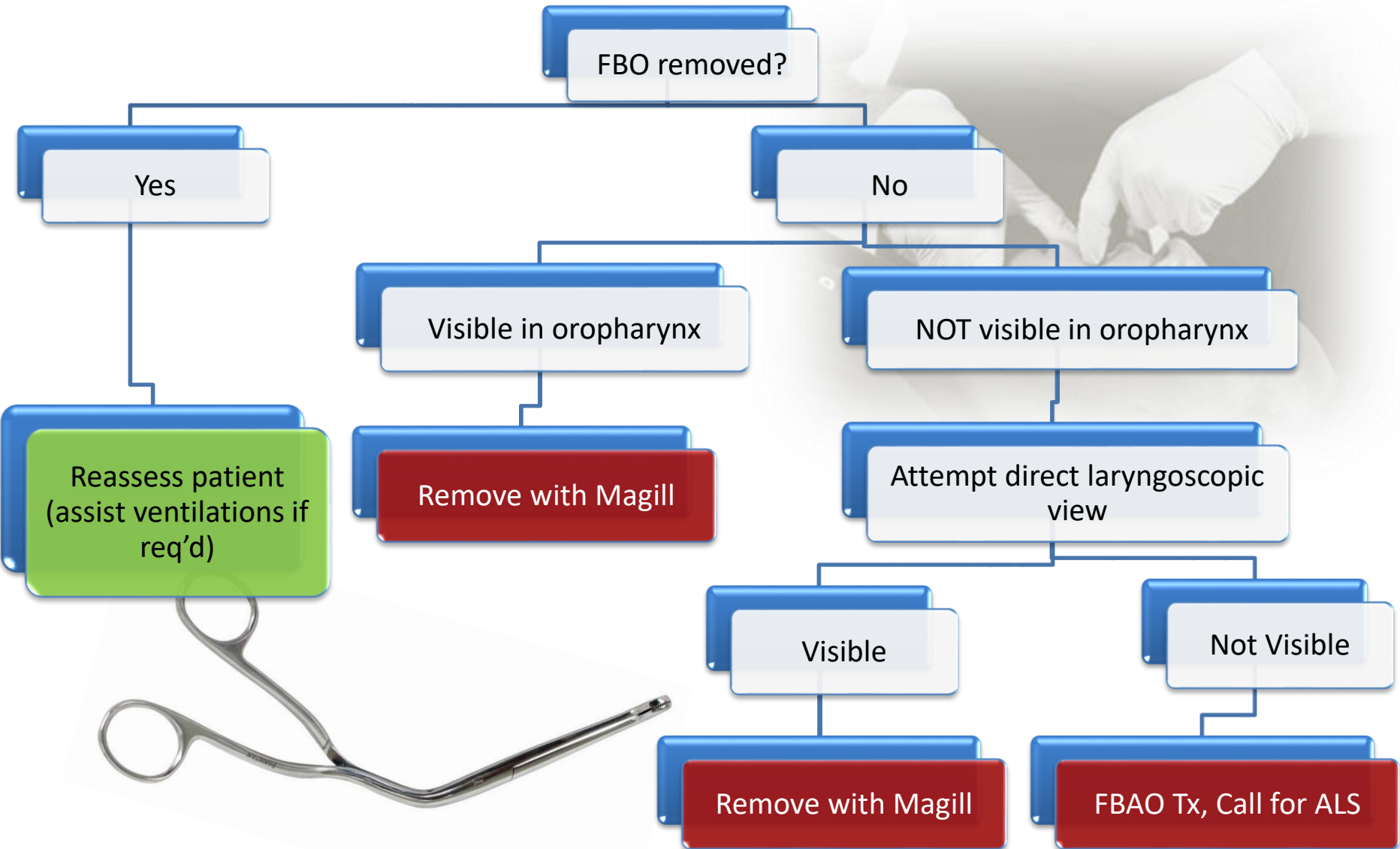


Foreign Body Removal



- Initiate treatment measures for FBO
- Check to see if the obstruction was relieved.
- If obstruction is not relieved consider the following...

Foreign Body Removal



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NON-INVASIVE MONITORING

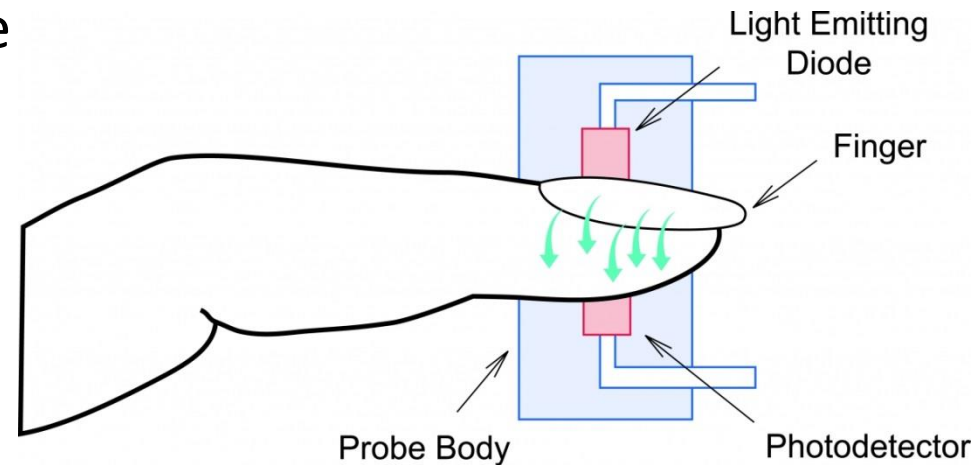
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PULSE OXIMETRY

- Pulse Oximetry is a method to measure hemoglobin saturation in arterial blood



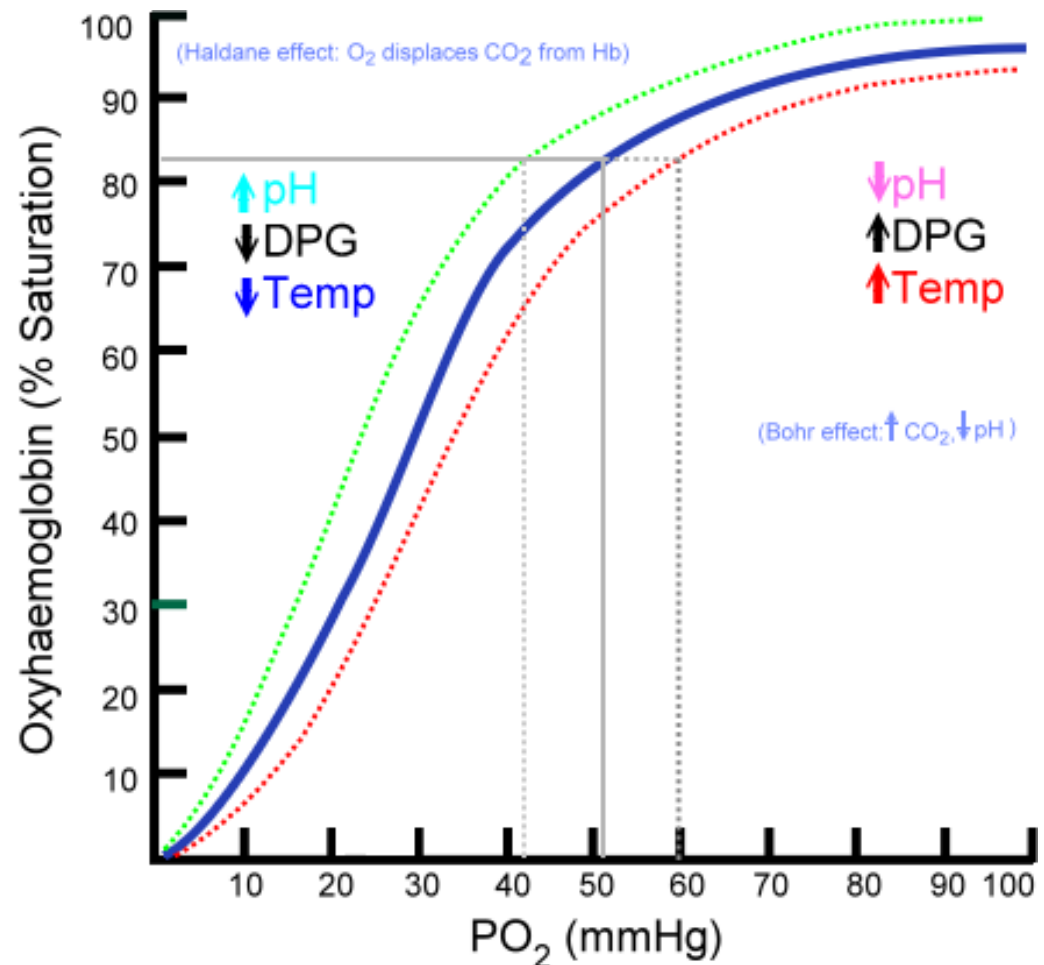
- Sensor can be placed on finger, toes or earlobes
- Light emitting diode (LED) containing red and infrared wavelengths passed from one side to the other
- Changing absorbance of each of the two wavelengths is measured, allowing determination of the absorbance due to the pulsing arterial blood.
- Ratio of changing absorbance of the red and infrared light given as a percentage.
- Measures the amount of saturated versus unsaturated hemoglobin



- What is it saturated with?



- What is the difference?
 - Hypoxia
 - Hypoxemia
 - Cyanosis



- Hypoxemia
 - Lack of oxygen in the blood
 - May be caused by
 - CO₂ Poisons
 - Infections (gangrene)
 - ↓O₂ in atmosphere
 - COPD
 - Hypoperfusion (MI, CHF...)
 - Hypovolemia (anemia, blood loss...)
 - Hypothermia

- Hypoxia
 - Lack of oxygen to the tissue caused by hypoxemia
- Cyanosis
 - The external sign of hypoxia characterized by the appearance of 'blue' tissue

- Conditions that affect the readings
 - Lack of hemoglobin
 - COPD
 - Hypovolemia
 - Anemia
 - CO, CO₂
 - Hypothermia
 - Bright light
 - Vasoconstriction (↑ cap refill)
 - Fingernail polish

- Use SpO₂ as a guide
- Use clinical judgment/patient presentation as a more accurate guide to need for supplemental oxygen

Treat the patient, Not the monitor!

- SpO₂ and SaO₂ are only accurate when compared to ABG's

- Is it possible to show 100 % SpO₂ and still be hypoxic?



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CAPNOGRAPHY

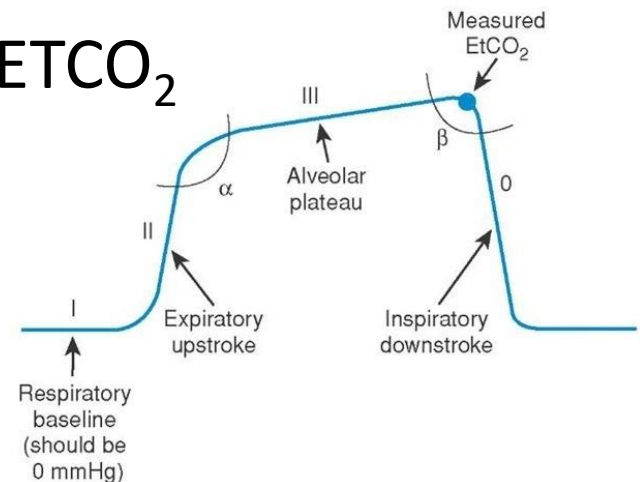
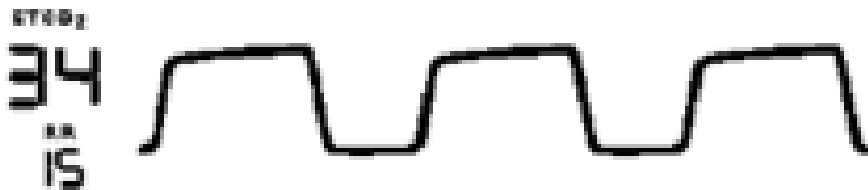
- Capnography is the vital sign of ventilation
- Tracking the CO₂ in a patient's exhaled breath, capnography enables paramedics to objectively evaluate a patient's ventilatory status (and indirectly circulatory and metabolic status)
- A capnograph measures how much carbon dioxide is present in the patients breath

- Capnography
 - Measurement of CO₂ in exhaled breath
- Capnometry
 - Measurement of partial pressure of expired CO₂
- Capnometer
 - Numeric measurement of CO₂

ETCO₂
34 **RR**
15

- Capnogram

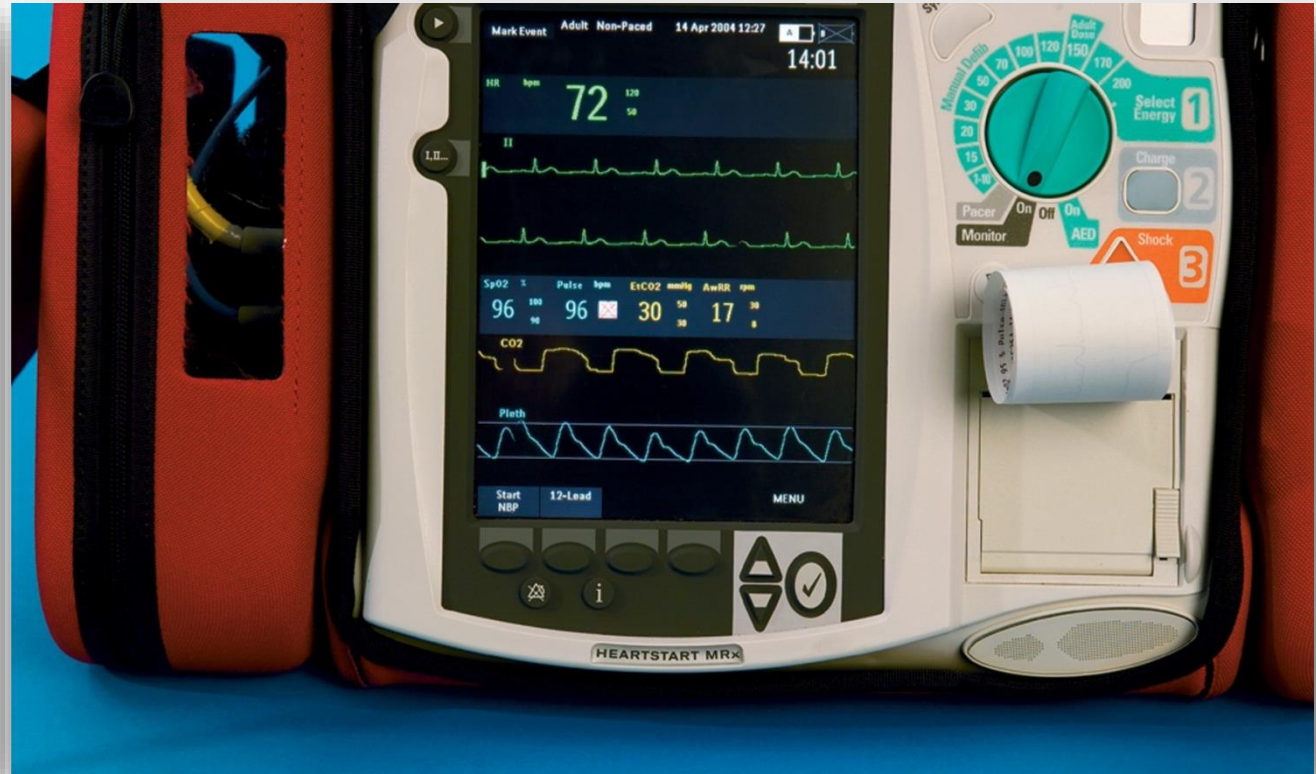
- “Real-time” visual waveform of ETCO_2



- End Tidal CO_2 (ETCO_2 or $\text{P}_{\text{ET}}\text{CO}_2$)

- Level of (partial pressure of) carbon dioxide released at end of expiration

- Normal value: 35 – 45 mmHg



- Disposable
- Detect exhaled CO_2 with litmus paper
 - H^+ ions in CO_2 cause change in color
 - of paper
 - Color change present between each breath
 - Manufactured in protective plastic housing
 - Placed between vent circuit and endotracheal tube
- Not useful in detecting hyper/hypocarbica

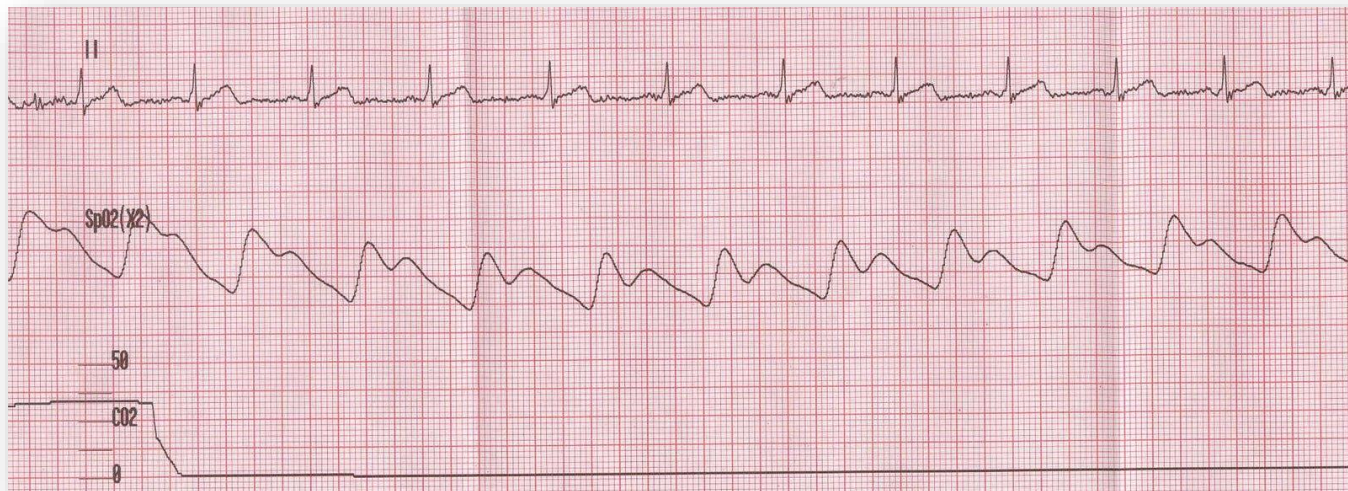


- CO₂ absorbs light at specific wavelength
 - Allows for measurement
- Can be qualitative or quantitative
 - Qualitative
 - Detect presence of CO₂
 - Quantitative
 - Determine how much CO₂ is present



- Oxygenation
 - Oxygen is inhaled into the lungs where gas exchange occurs at the capillary-alveolar membrane
 - Oxygen is transported to the tissues through the blood stream
 - Pulse oximetry measures oxygenation
- Ventilation
 - CO₂ is carried back through the blood and exhaled by the lungs through the alveoli
 - Capnography measures ventilation

- Capnography provides an immediate picture of patient condition.
- Pulse oximetry is delayed.
- Capnography will show immediate apnea, while pulse oximetry will show a high saturation for several minutes.



- Capnography is a direct measurement of ventilation in the lungs, it also indirectly measures metabolism and circulation
 - Increased metabolism will increase the production of carbon dioxide increasing the $ETCO_2$
 - Decrease in cardiac output will lower the delivery of carbon dioxide to the lungs decreasing the $ETCO_2$
 - $ETCO_2$ reflects changes in cardiac output and pulmonary blood, not ventilation