

Anesthetic monitoring- All those BEEPS and NUMBERS!

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Monitoring the critical care patient

- 1- TPR Plus (assessment/mini-physical)
- 2- BLOOD PRESSURE
- 3- ECG
- 4- PULSE OXIMETRY
- 5- END TIDAL CO2
- 6- TEMPERATURE

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Initial Assessment

- Airway
- Breathing
- Circulation

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Airway

- Airway sounds
- Partial/complete obstruction



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Breathing

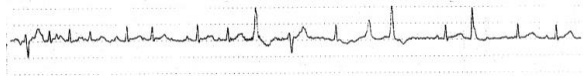
- Breathing Pattern
 - Inspiratory
 - Expiratory
- Rate
- Character
- Auscultation
 - Wheezes
 - Crackles
 - BV sounds
 - Absence of sounds



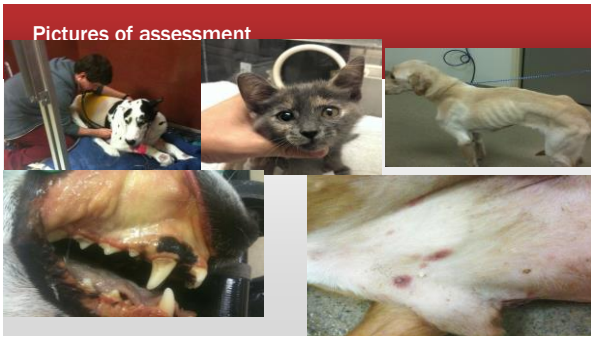
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Circulation

- Pump
 - HR
 - Cardiac output / blood pressure
 - Rate/Rhythm
 - Murmurs/Arrhythmias
- Tubes
 - Pulse quality
 - Pulse rate



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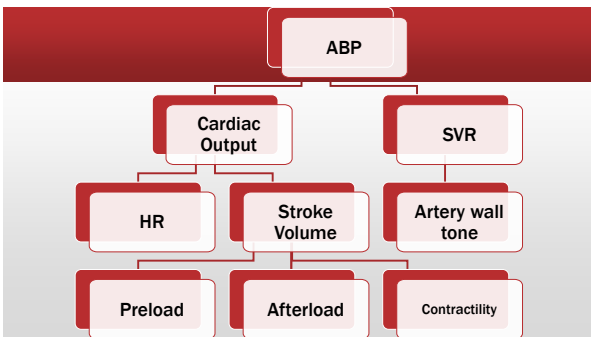


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Blood Pressure

- Macro-perfusion parameter-oxygen delivery to organs
- Very important trend
- Reflects cardiac function AND blood vessel wall strength

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How do we use blood pressure?

- An indirect measure of cardiac function/vascular tone:
 - 1- Enough fluid in vasculature? (preload)
 - 2- Cardiac output sufficient? (stroke volume/HR)
 - 3- Tubes too tight or too dilated? (SVR)

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How can we measure BP?

- 1- Direct
- 2- Indirect
 - Oscillometric
 - Doppler



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Tips and Tricks

- 1- Three major places to get BP
 - Top of rear foot
 - Bottom of rear foot
 - Underneath front paw
- 2- Make sure cuff is correct size
- 3- Repeat for a few readings
- 4- Oscillometric units NOT as reliable as Doppler in critical patients

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ECG's

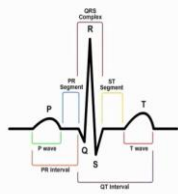
- Arrhythmias are not TOO common in anesthetized patients
- BUT: Have to be able to recognize them
- Common:
 - Sinus Bradycardia- opioids
 - Bradycardia- Second degree AV Block
 - Dexmedetomidine



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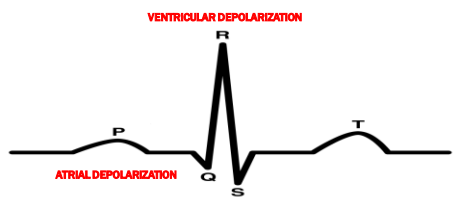
ECG Physiology

- Measures electrical activity of heart
- Should be a predictable/ coordinated pattern
 - SA node
 - AV node
 - Bundle of His
 - Bundle Branches
 - Purkinje fibers

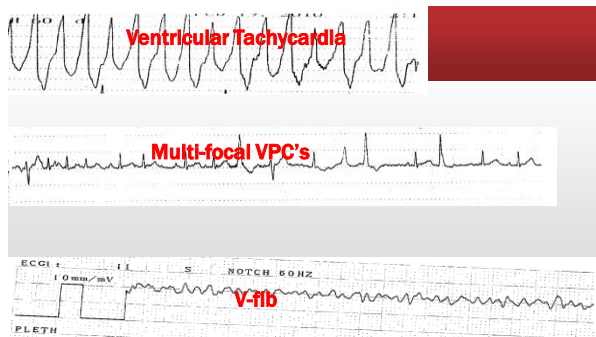


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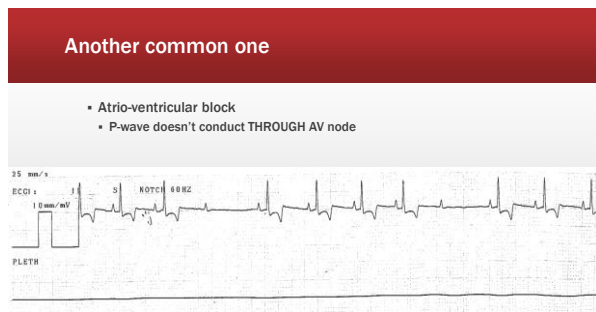
Normal ECG



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Oxygenation/Ventilation

- Oxygenation: Passive diffusion of O₂ into capillaries
- Ventilation: Active process of clearance of CO₂
- Measured differently

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Pulse oximetry

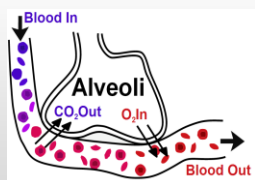
- Saturation of hemoglobin
- Light is sent through an artery and is detected on the other side
- Observes oxyhemoglobin wavelengths if present
- Correlates to dissolved O₂ gas in blood stream



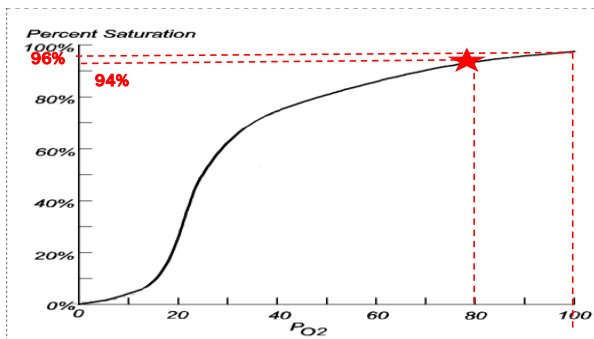
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Oxygenation physiology

- 1- We take in a breath
 - 2- Oxygen molecules fall down into our alveoli
 - 3- Blood coming TO lungs = NO O₂
 - 4- O₂ is diffused into capillary
- HOW MUCH O₂ enters is dependent on:
- Inspired O₂ concentration
 - ROOM AIR = 21%
 - ANESTHESIA = 100%
 - AMOUNT OF O₂ = Partial pressure of oxygen (PaO₂)




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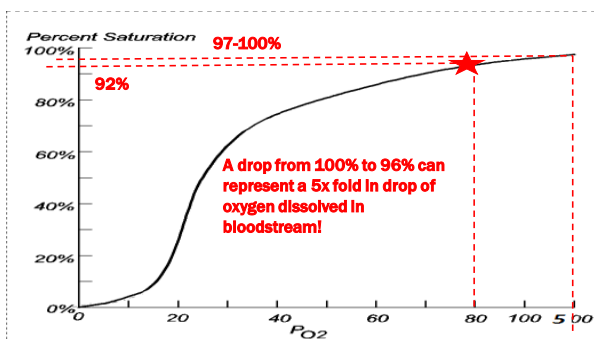
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Important info

- Arterial oxygen level (PaO2) SHOULD be 5x inspired O2 (FiO2)
- So if breathing 100% oxygen (inspired O2 = 100%):
 - FiO2 = 1
- PaO2 SHOULD BE:
 - 500 PaO2 (mmHg)



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Case Example

- 8y Newfoundland is tachypneic in her run
- History of heart disease and IMHA
- Pulse Ox reads 92%
 - Is that adequate for this patient on room air?
- Arterial blood gas = PaO2 = 71 mmHg
- Hmm....?

- Room air = 21% O2
- So PaO2 SHOULD be $5 \times \text{FiO}_2 = 110\text{mmHg}$
- ~~71~~ **110**

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Ventilation

- Chest wall compliance/movement
- CO2 levels (arterial or venous)



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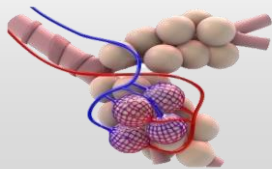
Measuring ventilation

- CO2
 - Arterial blood gas
 - End-tidal CO2
- End-Tidal CO2 monitor important tool in anesthesia

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End-Tidal CO2 monitoring

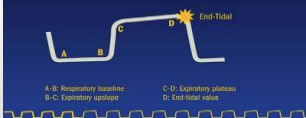
- Measures the CO2 at END-expiration
- Closely correlates with alveolar (and arterial) CO2



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Normal waveform/values

Figure 1: Normal Capnography Waveform



- Values are lower than arterial CO2
- Normal is about:
 - 30-40 mmHg
- ETCO2 < 30 = hyperventilation
- ETCO2 > 40 = hypoventilation

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Measurement

- Done at END-exhalation to simulate alveolar/arterial CO2 levels
- CO2 is balance between metabolism and PERFUSION
 - Adequate metabolism, NO PERFUSION
 - NO METABOLISM/Perfusion



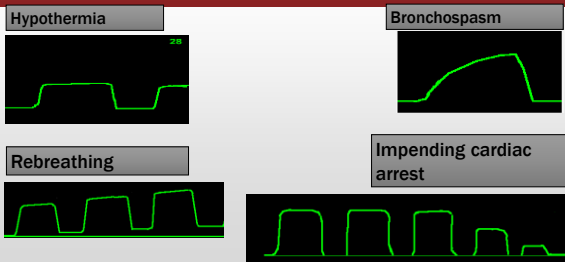
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Abnormal ETCO2 values



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Some abnormal waveforms



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SOMETHING COOL!



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