

Animal Dental Care  
& Oral Surgery

# Anesthetic Monitoring

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## Anesthesia Plans: Disclosures

- No financial relationships



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## Patient Monitoring: Goals for today

- Understand the importance of monitoring
- Know what parameters to monitor
- Know the goals or acceptable range for each parameter

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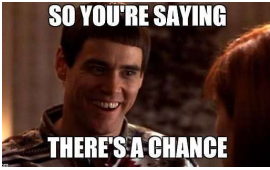
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### Patient Monitoring: Anesthesia & Risk

- Complications???
- 1.3-63% of patients  
(Dyson et al. 1998, Redondo et al. 2007)
- Anesthetic related mortality???
- 0.17-4.77%  
(Gaynor et al. 1999, Brodbelt et al. 2008, Bille et al. 2012, Matthews et al. 2017)
- Age
- Weight
- ASA status
- Procedure
- Monitoring (Matthews et al. 2017, Brodelt 2009)



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### Patient Monitoring: Maintenance

- Isoflurane
- Sevoflurane



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### Patient Monitoring: Why?

- MAXIMIZE safety of the patient
- Maintain normal homeostasis
- Maintain an adequate depth
- Clinical decisions



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**Patient Monitoring:**  
**AHAA Monitoring Guidelines**

- Monitoring → early detection of complications
- **"Blood pressure, heart rate/rhythm, mm color, & SpO2 best indexes of cardiovascular function"**
- Anticholinergics:
  - HR & **blood pressure**
- **Blood pressure** monitoring & patients with comorbidities:
  - Renal disease
  - Cardiac disease



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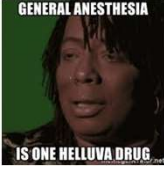
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**Patient Monitoring:**  
**Overview**

- No absolute correlation between depth & physiologic impairment
- Cardiovascular & respiratory systems
- No one monitor is perfect



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**Patient Monitoring:**  
**What are we going to watch???**

- Physical signs
- TPR
- % SpO2
- Blood pressure
- End tidal CO2
- ECG
- Use ALL the information!!!
- Use ALL your senses!!!



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### Patient Monitoring: When to monitor?

- Pre induction!!!
- Induction period
- Maintenance phase
- Do NOT forget about recovery!!!



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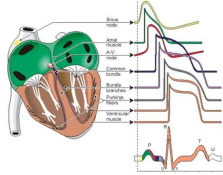
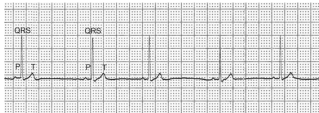
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### Patient Monitoring: ECG

- Place **before** induction
- Electrical activity **ONLY!!!**
  - No information about cardiac output
  - NEED other monitors!!!
- Goal?
  - Normal sinus rhythm\*
  - Rate?
    - Dog?
    - Cat?

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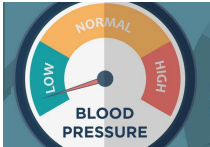
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### Patient Monitoring: Blood Pressure

- Place **before** induction
- Mean arterial pressure (MAP) → Perfusion
  - Perfusion → O<sub>2</sub> delivery
- Goals under anesthesia???
- +/- 20% of awake MAP
- Healthy: MAP ≥ 70 mm Hg\*
- MAP < 65 mm Hg → Need Tx!!!
- Why do we care?



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### Patient Monitoring: Blood Pressure Measurement

- Oscillometric
- Doppler
- Frequency?
  - At least every 5 minutes
- Accuracy?
  - Cuff width
    - ~40% limb circumference
  - Cuff placement
    - Proximal limb
    - Appropriate contact



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### Patient Monitoring: Oscillometric NIBP

- **Advantages:**
  - Automated reading of SAP, MAP, and DAP
  - Easy to operate
  - Non-invasive
  - Eliminates many sources of operator error
- **Disadvantages:**
  - Non-continuous
  - Poor performance with extreme HR & blood pressures
  - Cost
  - Will miss rapid changes
  - Small patients?
- **GOAL: MAP > 65 mm Hg**



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### Patient Monitoring: Doppler NIBP

- **Advantages:**
  - Lower cost
  - Portable
  - Non-invasive
  - Continuous HR
  - More accurate for patients hypotensive or  $\leq 10$  kg  
(Small Animal Critical Care Medicine, 2009)
- **Disadvantages:**
  - Only one number
  - Non-continuous pressures
  - Operator error
  - Cautery interference
- **GOAL: SAP > 90 mm Hg**



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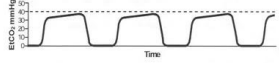

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### Patient Monitoring: Induction Period

- Patient is already equipped with ECG & NIBP
- Pre-oxygenate with mask
- Push induction drug to effect
- Intubate
- *What monitor should be connected next???*
- **End Tidal CO<sub>2</sub> !!!**



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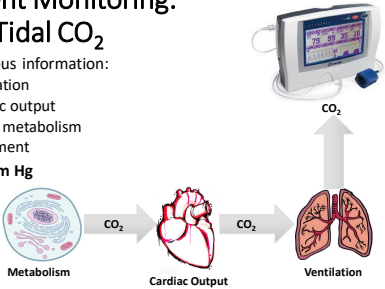
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### Patient Monitoring: End Tidal CO<sub>2</sub>

- Continuous information:
  - Ventilation
  - Cardiac output
  - Tissue metabolism
  - Equipment
- **35-45 mm Hg**



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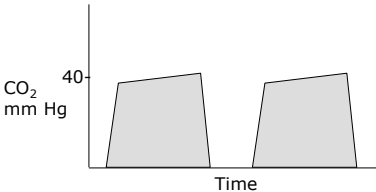
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### Patient Monitoring: End Tidal CO<sub>2</sub>

- Normal CO<sub>2</sub> : 35-45 mm Hg
- Induction period???



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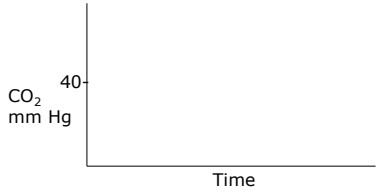
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### Patient Monitoring: End Tidal CO<sub>2</sub>

- What's going on here???



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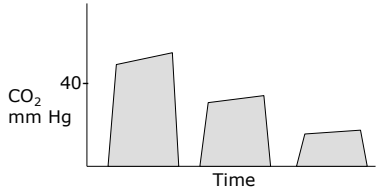
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### Patient Monitoring: End Tidal CO<sub>2</sub>

- Impending Doom



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### Patient Monitoring: Oxygen Saturation

- Pulse oximeter
  - Placed at/during induction
  - Anywhere it works
  - What does it need to work?
- **Goal:** %SpO<sub>2</sub> ≥ 95%
- Induction & Recovery most critical



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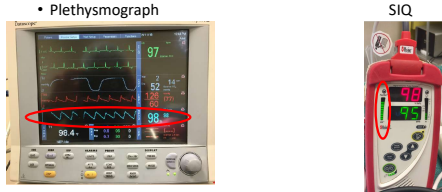
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### Patient Monitoring: Pulse Oximetry Troubleshooting

- Is the %SpO<sub>2</sub> real???
- Heart rate match?
- Signal quality?
  - Plethysmograph



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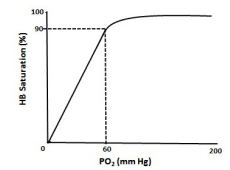
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### Patient Monitoring: Limitations of Pulse Oximetry

- Artifact???
- Poor perfusion
- Venous pulsations
- Ambient light
- IV dyes
- Other hemoglobins
- 100% Oxygen →
  - Arterial blood gas



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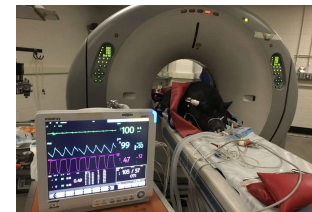
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### Patient Monitoring: Maintenance Phase

- "Cruising Altitude"
- Now what???



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### Patient Monitoring: Physical Signs

- Eye position
- Ocular reflexes
- Jaw tone
- Pulse
- Respiratory rate & character
- MM color
- CRT



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### Patient Monitoring: Temperature

- 98-100 F
- Hypothermia
  - Infection
  - Delayed wound healing
  - Impaired coagulation
  - Increased fluid/transfusion requirements
  - Slowed drug metabolism
  - Prolonged recovery
  - Shivering



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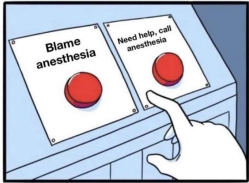
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### Patient Monitoring: Recovery

- **Post-Op Monitoring**
  - Mentation
  - Temperature
  - Pulse rate
  - Respiratory rate & character
  - Pain score
  - Frequency???
  - Duration???
  - Keep a record!!!



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## Patient Monitoring: Recovery

- Anesthetic related mortality
  - 0.17-4.77%  
(Gaynor et al. 1999, Brodbelt et al. 2008, Bille et al. 2012, Matthews et al. 2017)
  - Guess when it happens???



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## Patient Monitoring: Recovery

RESEARCH PAPER

**The risk of death: the Confidential Enquiry into Perioperative Small Animal Fatalities**

Brodbelt et al. *Vet Anesth Analg* 2008

The postoperative period was the most common time for dogs, cats and rabbits to die. Over 60% of cats and rabbits and nearly 50% of dogs died during this time period (Table 5). Most postoperative deaths occurred within 3 hours of termination of the procedure ( $p = 0.034$ ).

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## Patient Monitoring: Recovery

**Factors associated with anesthetic-related death in dogs and cats in primary care veterinary hospitals**

Matthews et al. *JAVMA* 2017

In the study reported here, the postoperative period was the most common time of death for dogs (81/115 [70%]) and cats (46/89 [52%]), with the large-

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**Patient Monitoring:  
The Anesthesia Record**

- Need recordings every 5 minutes
- Use notes!!!
- Don't forget about recovery!!!
- *"If it is not written down, then it never happened"*
- **DEDICATED ANESTHETIST!!!**



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**Patient Monitoring:  
Remember!!!**

*"There are no safe anesthetic drugs;  
There are no safe anesthetic procedures;  
There are ONLY safe anesthetists"*

– Robert Smith MD



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**THANK YOU!!!**

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