**Anesthesia Lectures VET 433C Cardioresp**

## Anesthesia for Cardiac Patients

Drug effects on the cardiovascular system

BP = CO x SV

CO= HR X SV

SVR = Preload, Contractility, Afterload

Premed Drug Overview

| Drug Class | Example | HR | BP | CO | SVR |
|---|---|---|---|---|---|
| **Phenothiazine** | Acepromazine | None | Decrease | None | Decrease |
| **Alpha 2 adrenergic agonist** | Dexmedetomidine | Decrease | Increase then Decrease | Decrease | Increase then Decrease |
| **Benzodiazepine** | Midazolam | None | None | None | None |
| **Opioids** | Morphine | Decrease | Little to none | Little to none | Little to none |
| **Anticholinergic** | Atropine | Increase | Little to increase | Increase | None |

Induction Drug Overview

| Drug | HR | BP | CO | SVR |
|---|---|---|---|---|
| Propofol | Decrease | Decrease | Decrease | Decrease |
| Alfaxalone | Increase: dogs<br>No change: cats | Decrease | Increase to none | Decrease |
| Ketamine | Increase to none | Increase to decrease | Increase to decrease | none |
| Etomidate | None | None | None | None |
| Inhalants | None | Decrease | Decrease | Decrease |

## Disease-Specific Considerations

*Medications should be administered the day of anesthesia **EXCEPT** ACE inhibitors- may result in severe and refractory hypotension during anesthesia

### Myxomatous Mitral Valve Disease

Preoperative considerations: Assess the magnitude of heart changes and regurgitation

Intraoperative considerations: Avoid excessive fluid administration (stick with 3mg/kg/hr)

Avoid increased regurgitation: bradycardia and vasoconstriction

Promote forward flow – decrease afterload

Case Example:

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Approved Premedication: Acepromazine, Midazolam, Hydromorphone + Atropine *should not give an opioid solo

Approved induction: Alfaxalone/Midazolam, Ketamine/Midazolam, Etomidate/Midazolam

*NOT Propofol/Midazolam or Fentanyl/Midazolam due to the bradycardia

## Dilated Cardiomyopathy

Preanesthetic considerations: Correct underlying problem if possible, administer cardio tonic drugs if not already on (pimobendan), administer diuretics/restrict fluids if indicated, avoid excitement

Intraoperative considerations

Avoid bradycardia, tachycardia, hypertension, hypotension, hypovolemia, hypervolemia

Avoid agents that depress systolic function (contractility) and cause vasoconstriction

Administer positive inotropes if indicated

Case Example:

Approved Premedication: Midazolam, Hydromorphone + Atropine

*Not Dexmedetomidine due to the bradycardia or Acepromazine due to the unknown coagulation status and sequestration of RBC in spleen

Approved Induction: Etomidate/Midazolam

Maintenance: Isoflurane/Sevoflurane and CRI of Fentanyl (watch HR), Ketamine, or Lidocaine

*Avoid Dexmedetomidine due to an increase in SVR

## Hypertrophic Cardiomyopathy

Preoperative considerations: Assess severity of disease, assess dynamic outflow tract obstruction, assess arrhythmias if present, avoid excitement, administer beta-blockers if indicated (atenolol) and administer diuretics/restrict fluids if indicated (CHF)

Intraoperative considerations: Avoid hypoolvemia, hypervolemia, and hypotension

Avoid tachycardia/aim for mild or moderate bradycardia (80-100 bpm)

Avoid vasodilation/aim for mild or moderate vasoconstriction

Approved Premedication: Dexmedetomidine, Midazolam or Hydromorphone would also be fine

Avoid atropine because we do not want to increase the hr, avoid acepromazine because we do not want to cause vasodilation

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Approved Induction: Etomidate/Midazolam, Alfaxalone/Midazolam,

## Anesthesia for Patients with Respiratory Disease

Overview: Drug impact on the respiratory system

Ventilation: Decrease respiratory rate, tidal volume, and the patient's response to $CO_2$

Oxygenation: Increased $PaO_2$ with supplemental $O_2$ but decreased ventilatory response to low $PO_2$ leading to V/Q mismatch

Airway dilation

Secretions: Decreased / thickening with anticholinergics and increased with ketamine

Premedications

| Drug | Effect on Respiratory System |
|---|---|
| Acepromazine | Little effect |
| Dexmedetomidine | Little effect; potentiates effects of other drugs |
| Benzodiazepines | Little effect |
| Opioids | Depress ventilation<br>Decreased slope of ventilatory response to $CO_2$<br>Increased apneic threshold |
| Anticholinergics | Bronchodilate (increase dead space)<br>Decrease secretions/increase viscosity |

Induction agents

- Overall impact: Depress ventilation
    - Propofol > Alfaxalone > Ketamine, Etomidate
    - Propofol and alfaxalone may cause apnea
    - Propofol may affect oxygenation
    - Bronchodilation: ketamine > propofol

Inhalents

Impact: Depress ventilation, response to hypoxemia, and mucociliary clearance. May also cause bronchodilation

## Anesthetic Considerations for Pleural Space Disease

Preoperative considerations:

Thoracocentesis, monitor oxygenation and ventilation

NO IPPV if pneumothorax is present, permissive hypercapnia

IPPV is often necessary with other types of effusion

Anticipated Problems

Anesthesia: Hypertension, hypoventilation, hypothermia, bradycardia. If there is a pneumothorax, anticipate worsening of effusion

Disease: Decreased ventilation, oxygenation, respiratory compliance, and potential pain

## Premedication for patients with pleural space disease

Acepromazine: if tranquillization is necessary

Dexmedetomidine: if profound sedation is necessary

Benzodiazepine: combined with an opioid

Opioid

Anticholinergic

## Induction agents for patients with pleural space disease

Propofol: NOT if the patient has a pneumothorax, may cause apnea

Alfaxalone: Caution in patients with pneumothorax, may cause apnea

Ketamine/benzodiazepine

Etomidate/Benzodiazepine

Opioid/Benzodiazepine: NOT in patients with pneumothorax, causes profound hypoventilation

## Maintenance for patients with pleural space disease

Isoflurane or sevoflurane

Additional analgesia if necessary – may use opioids but NOT if a pneumothorax is present

Ketamine

Lidocaine

Local/regional anesthesia

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## Anesthetic Considerations for Lung Disease

Preoperative considerations

Complete evaluation of the extend of involvement of the pulmonary system. Delay surgery if possible. Avoid excitement prior to induction and only use sedatives if necessary.

AVOID atropine in patients with pneumonia or thickened airway secretions

Preoxygenate prior to induction to prevent the usual immediate post-induction hypoxemia

Use high $FiO_2$

Anticipated problems

Anesthesia: Hypotension, hypothermia, hypoventilation, bradycardia, worsening of disease, hypoxemia (particularly if hypoventilation before $O_2$ administration or in recovery once $O_2$ administration has stopped. Caution with profound sedation

Disease: Poor oxygenation, risk for cross-contamination, +/- pain

### Premedication for patients with lung disease

Assess if necessary…

Acepromazine: if tranquillization is necessary

Dexmedetomidine: if profound sedation is necessary

Benzodiazepine: combined with an opioid

Opioid

Anticholinergic AVOID if possible

### Induction agents for patients with lung disease

Rapid to allow for rapid intubation

Propofol +/- benzodiazepine

Ketamine +/- benzodiazepine

Etomidate/Benzodiazepine

Opioid/Benzodiazepine: too slow, do not use

Inhalant: too slow, do not use

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**Maintenance for patients with lung disease**

Inhalant (or propofol infusion)

Balanced anesthesia if needed (analgesia, cardiovascular performance)

High $FiO_2$

Initiate mechanical ventilation early (decrease V/Q mismatch)

## Anesthetic Considerations for the Patient with Airway Disease

Brachycephalic

### Preoperative Considerations

Avoid excitement prior to induction

Select endotracheal tubes with the consideration that these patients typically have a smaller-than-expected glottis (+/- trachea)

Preoxygenation is key

### Induction of anesthesia

This should be rapid and while intubating, an assessment of the oral cavity should be made to help with the anticipation of problems during recovery.

Short-acting anesthetic agents should be used to facilitate a rapid recovery (propofol or alfaxalone, isoflurane)

### Example: English Bulldog Presenting for a TECABO

Goal: Fast and smooth

Induction Drugs: Propofol +/- benzodiazepine, alfaxalone +/- benzodiazepine

Do NOT use inhalants or opioids due to their slower onset

If other comorbidities: Ketamine, etomidate

Maintenance Drugs: Inhalant, opioid CRI

Postoperative analgesia: Opioid, NSAID

### Recovery

Keep patients intubated as long as possible to allow return of control of pharyngeal muscles

Eliminate external stimuli, hold the mouth closed to prevent chewing movements and sporadic head movements, consider sedatives/cough suppressants

If there is a partial obstruction following extubation, extend the head, open the mouth, and pull the tongue. It is also crucial to be prepared to reanesthetize/reintubate. Have drugs, laryngoscope, and ET tubes ready in recovery!

Tracheal Collapse

Preoperative Considerations

Keep patient calm and avoid stress/excitement

Utilize adequate sedation

Preoxygenate unless this is stressful for the patient

Induction of anesthesia

Rapid and smooth induction

Use an adequate tube side to avoid airway irritation

Disconnect the tube when moving the patient

Maintenance: Inhalant

Recovery

Extubate early to avoid irritation and cough due to ET tube

Sedate if needed (acepromazine) and be prepared to reanesthetize/reintubate. Have drugs, laryngoscope, and ET tubes ready in recovery!

Example: Yorkie Presenting for a Periodontal Treatment +/- Extractions

Premedication: Some sedation for a stress-free induction (low dose of Acepromazine), benzodiazepine, opioid, anticholinergic

Goal: Rapid and Smooth induction

Induction Drugs: Propofol +/- benzodiazepine, alfaxalone +/- benzodiazepine

Do NOT use inhalants or opioids due to their slower onset

If other comorbidities: Ketamine, etomidate + benzodiazepine

Maintenance Drugs: Inhalant, opioid CRI

Postoperative analgesia: Opioid, NSAID, regional blocks if extractions are performed