Crisis Management: Anesthetic Emergencies & Complications - What to Worry About

Ralph Harvey, DVM, MS
Diplomate ACVA
University of Tennessee

Case Management to Avoid Complications:
- Recognition of the patient at risk
- Regular inspection & maintenance of equipment
- Appropriate patient monitoring
- Attention to detail

Anesthesia is Intended as a….
- Benign & reversible process, but…
- Potentially lethal drugs
- Injury & debilitating illness

Anesthetic Emergencies & Complications

Early Recognition of Problems & Potential Complications
- “Anesthesia is hours of boredom & moments of sheer panic.”
- Vigilance

Early Recognition of Problems & Potential Complications
- Try to prevent problems rather than treat them
- Direct therapy on changing patient status
- Stay calm and organized
- Think and act quickly
Anesthetic Emergencies & Complications

1. Absolute or relative overdose
2. Injection errors
3. Equipment problems
4. Ventilatory problems
5. Circulatory problems
6. Temperature regulation
7. Electrical problems
8. Delayed recovery

1. Overdose
   - Relative or absolute
   - Miscalculation
   - Narrow therapeutic index
   - Excessive depression-side effects=DEATH

Anticholinergic Overdoses:
- Anticholinergics should be used with caution in patients with heart disease
- Tachycardia can be detrimental to this patient
- Atropine prolongs barbiturate anesthesia
- Severe or fatal cardiac dysrhythmias have been reported with IV administration

Tranquilizer/Sedative Overdoses
- Acepromazine
  - cardiovascular support
- Xylazine or Dexdomitor
  - ventilatory & circulatory support
  - specific antagonists
    - Yohimbine, Antisedan, etc.
  - non-specific stimulants

Antagonism vs. Stimulation
- Receptor specific process
- Not receptor specific

Antagonists:
- Naloxone (Narcan)
- Butorphanol (Torbugesic)
- Yohimbine (Yobine)
- Atipamezol (Antisedan)
- Flumazenil (Romazicon)
**Opioid Overdose**
(rarely a problem - great margin of safety)
- Support ventilation
- Consider antagonists...
  - Naloxone
    - specific antagonist action
    - risk of later “renarcotization”
    - Warning!! Great risk of pain or stress
- Butorphanol (Torbugesic)
  - mixed agonist-antagonist drug
  - reverses some sedation
  - preserves some analgesia
  - Usually a better choice!

**Morphine**
(rare adverse effects)
- Potent analgesia with moderate CNS depression
- Characteristic vomiting/diarrhea/constipation
- CNS side effects: excitement, dysphoria
  - species dependent
  - dose dependent
- Bradycardia in the dog
- Histamine release (rare)
  - avoid rapid IV administration
  - contraindicated with MCT!
- Opioids - a very high margin of safety for most patients!

**Barbiturate Overdose**
- Narrow margin of safety!
- Support ventilation
- Monitor cardiopulmonary function
- IV fluid therapy
- Drug therapy possible - limited circumstances
  - Doxapram (Dopram-V) (2.5-5.0 mg/kg)
  - Bicarbonate (0.5-1.0 mEq/kg)

**2. Injection Errors**
Terrible perivascular injection of barbiturates –
- Not a “practice builder”!
  - Swelling at injection site
  - Pain at injection site
  - Failure to induce anesthesia or a reduced effect
  - Risk of necrosis and slough

**Therapy for Perivascular Injection of Ultrashort Acting Barbiturates**
- Infiltrate generously with lidocaine (without epinephrine) mixed with saline
- Hot pack, hydrotherapy
- +/- steroids, DMSO
To avoid perivascular injection, use an IV catheter.

Principles of Medical Care

3. Problems with Anesthetic Equipment

- Trivial to deadly
- Easily remedied or obscure & difficult
- Regular inspection & maintenance
- Avoid substandard equipment

Anesthetic Gas Machines & Circuits

- Deliver oxygen & anesthetic (in precisely controlled quantities)
- Provide positive pressure ventilation
- Remove carbon dioxide

Common Problems with Equipment

- Empty or disconnected tanks or delivery hoses
- Accidental disconnection of components
- Misconnected breathing circuits
- Leaky tubes, hoses, breathing bags
- Empty or overfilled anesthetic vaporizers
- Vaporizers out of calibration
- Exhausted carbon dioxide absorber
- Unidirectional valves stuck or missing
- Unsafe modification of equipment
The responsibility for a system composed of different manufacturers’ brands of components rests with the person composing the system. The fact that components can be connected does not guarantee their compatibility or a safe performance of the system.

To control the airway use an endotracheal tube

Regurgitation or Regurgitation / Aspiration
Pulmonary aspiration - avoid by routine tracheal intubation
Risk of esophageal erosion and strictures
  check pH
  lavage and suction
  carafate suspension
  Metoclopramide
Risk Factors:
  long duration
  pressure/position
  high dose opioids
4. Ventilatory Complications

Inadequate Delivery of Oxygen

Hypoventilation
   Inadequate Ventilation
   Apnea

Hyperventilation: Tachypnea or panting

Irregular patterns of ventilation

All Anesthetics are Respiratory Depressants

Anesthetic overdose: Relative or Absolute

Direct depression of central respiratory centers

Secondary to circulatory depression

Specific drug actions

Hypoventilation

A consistent problem with anesthesia

Hypercarbia

Hypoxia

Monitor best by capnometry

Support ventilation

Quick!….Put that cat on a ventilator!

Management of Hypoventilation

Endotracheal Intubation

Positive pressure ventilation with oxygen

Identification & correction of cause(s)
   excessive anesthetic
   airway obstruction

Avoid use of doxapram (Dopram) for anesthetic hypoventilation

Hyperventilation & Panting

Inadequate anesthesia

Titrate to effect

Carbon dioxide accumulation
   excess dead space
   machine or breathing circuit problems

Opioid induced panting
   drug specific (oxymorphone, hydromorphone)

Hyperthermia
   less common than hypothermia
5. Circulatory Problems

- Changes in heart rate
- Cardiac arrhythmias
- Changes in blood pressure
- Changes in tissue perfusion

Tachycardia

- Dog > 180bpm
- Cats > 200bpm
- Horse > 60bpm

Decreased efficiency increased work load
Due to pain, fear, inadequate anesthesia,
preanesthetic excitement, hypotension,
specific anesthetic drugs

Compensatory Tachycardia

- Response to hypovolemia & hypotension
- Reduces coronary blood flow
- Increases work load, oxygen demand
- This reflex is usually absent during anesthesia

Ventricular Premature Contraction

Ventricular Tachycardia

- Occasional VPC cause for concern
- Multi VPC’s emergency
- Runs of V-Tach emergency
- Ventricular arrhythmias indicate an irritated,
hypoxic, or diseased myocardium

Management of Ventricular Tachycardia

- Adjust anesthetic dose
- Insure adequate ventilation with oxygen
- Lidocaine 1-2 mg/kg (0.5-1.0 mg/lb) IV
- Other antiarrhythmics
- Correct acid-base or electrolyte imbalances
- Change anesthetics
Bradycardia

Dogs < 65bpm
Cats < 80bpm
Horses < 35bpm
Vagal parasympathetic stimulation
difficult endotracheal intubation
depth abdominal procedures
intraocular Surgeries
direct vagal stimulation or traction
vagotonic anesthetic drugs

Management of Vagal Bradycardia

Discontinue vagal stimulation
Atropine 0.04mg/kg (0.02mg/lb) IM
Atropine 0.02mg/kg (0.01mg/lb) IV
carefully titrated to effect
give slowly to avoid tachycardia

Prevention of Vagal Bradycardia

Atropine 0.04 mg/kg (0.02 mg/lb) IM
Glycopyrrolate 0.01 mg/kg (0.005 mg/lb) IM or IV
Usually unnecessary in horses!
Significant contraindications and adverse effects in
some situations!

Non-Vagal Bradycardia

Anesthetic depression
Hypoxia
Hypothermia
Identify causative factors & correct immediately

6. Temperature Regulation

Hyperthermia
It does occur…

Hypothermia
A very common and clinically very significant problem!

Hyperthermia as a Clinical Problem
(Not the same as "Fever")

Potential causes:
Exercise/environment
Stress/excitement
Anesthetic hyperthermia in
cats - some opioids,
potentially stress, etc.
Insulation – big fuzzy dogs!
Iatrogenic
"Malignant Hyperthermia"
MH-like syndromes are
reported for many species!

Hot Dogs
“Why dogs bite their owners.”
Significance of Hypothermia

Limit and Treat Hypothermia!

The phasic distribution and loss of thermal mass:
Immediate, Insidious, Difficult, Deleterious

Reduce anesthetic time
Warm air blankets
Warm water blankets pads
Warm surgical tables
Insulation
bubble wrap feet
cover patients
reduce conduction
reduce evaporation
Warm fluid therapy

Options for Thermal Support
Recommended Devices - But Not Without Risks!

Warm Water
Warm Air
Amorphous resistance
"Hot Dog" System
IV Fluid Warmers

Iatrogenic Burns with the WRONG Thermal Support:
Please Avoid These!

Consumer Electric Heating Pads
Hot Water Bottles
Water filled Gloves
(These burns occurred even with a terry cloth towel between heat source and patient!)
7. Electrical Problems

Supportive & monitoring equipment
Risk of electric shock, burn, fire

Improper grounding for electrocautery

8. Delayed Recovery from Anesthesia

Anesthetic overdose
Inadequate elimination or metabolism
Hypothermia
Debilitation
Neurological deterioration
  hypoxic episode
  physiologic imbalance
  neurological accident
  ischemia, increased ICP, embolus, stroke

Management of Delayed Recovery

Physiological support
  “SOP” - monitor, evaluate, diagnose, treat
Facilitate elimination or metabolism
Reversal of anesthetics
  Antagonists
    Naloxone
    Yohimbine
    Antisedan
  Stimulant (very rarely indicated)

Thank you for participating in these sessions!

Ralph Harvey, DVM, MS, Diplomate ACVA