Minimizing Anesthetic Complications
Tamara Grubb DVM, PhD, Dip. ACVAA
Assist. Professor Anesthesia & Analgesia
Washington State University

Sponsorship
Thanks to Zoetis for sponsoring tonight's VETgirl webinar!

Introduction
Garret Pachtinger,
VMD, DACVECC
COO, VETgirl

Introduction
Justine A. Lee, DVM,
DACVECC, DABT
CEO, VETgirl

VETgirl…On-The-Run
• The tech-savy way to get online veterinary CE!
• A subscription-based podcast and webinar service offering veterinary RACE-approved CE

VETgirl ELITE
50-60 podcasts/year plus 24+ hours of webinars!
• $199/year
• 30+ hours of RACE-CE
VETgirl TEAM memberships!
- Up to 5 members: $599/year
- Up to 10 members: $999/year
- > 10 members: Ping us

Easier playback, less buffering – better!

Download our iTunes podcasts free!

Social media and our blog!

Logistics: CE Certificates
- No need to raise your hand!
- Type in questions
- Emailed to you 48 hours after the webinar
- Active participation = no quiz
- Watching video later, must complete quiz
  - ELITE members only
- Email / contact with ANY questions
  - garret@vetgirlontherun.com
  - justine@vetgirlontherun.com
Call in from Smart Phone!

Dr. Tammy Grubb, PhD & Diplomate of ACVAA
- A&M University, BS, Texas, 1985
- A&M University, DVM, Texas, 1989
- University of Illinois, MS, 1996
- Diplomate, CAVA, 1996
- University of Illinois, Residency in Anesthesia, 1992-1995
- Swedish Agricultural University, PhD, 2013

Four Phases of Anesthesia

- **Preanesthesia**
  - Patient preparation for anesthesia
  - Stabilize; Sedate, start analgesia

- **Induction**
  - Achieve unconsciousness smoothly & rapidly – titrate TO EFFECT

- **Maintenance**
  - Dose to effect; Readress analgesia; SUPPORT & MONITOR

- **Recovery**
  - Readress analgesia; may need sedation; SUPPORT & MONITOR

Complications in the Postoperative Care Unit

- pain
- nausea and vomiting (PONV)
- agitation/dysphoria
- hypothermia, shivering
- upper airway obstruction
- Hypotension, circulatory events
- respiratory depression
- drug allergies.

When Do Complications Occur?

- **Preanesthesia**
  - Nausea/vomiting

- **Induction**
  - Airway trauma

- **Maintenance**
  - Excessive anesthetic depth; cardio-respiratory issues; hypothermia; pain

- **Recovery**
  - Pain; dysphoria; nausea/vomiting; prolonged recovery; hypothermia; cardiorespiratory issues; airway issues

Let’s Take the Offensive!

“An ounce of prevention is worth a pound of cure.”
— Benjamin Franklin
Complications in the Postoperative Care Unit

- Patients who died within 24 hours of anesthesia
  - most underwent emergency surgery or were ASA III-V,
  - death was attributed to anesthetic factors in about one third,
  - usually because of inadequate pre-anesthetic preparation and assessment and post-anesthetic care.

Critical Patient

- Female intact Golden Retriever 7-yrs old
- Obtunded, dehydrated, tachycardic, tachypneic
- Abdominal palpation & radiographs confirm diagnosis of closed-cervix pyometra
- Surgery required

Four Phases of Anesthesia

- **Preanesthesia**
  - Patient preparation for anesthesia
  - Stabilize; Sedate, start analgesia

- **Induction**
  - Achieve unconsciousness smoothly & rapidly – titrate TO EFFECT

- **Maintenance**
  - Dose to effect; Readdress analgesia; SUPPORT & MONITOR

- **Recovery**
  - Readdress analgesia; may need sedation; SUPPORT & MONITOR

When Do Complications Occur?

- **Preanesthesia** Nausea/vomiting
- **Induction**
- **Maintenance**
- **Recovery**

Anesthesia Risk Factors for DEATH

- Increasing from 1-2 to 3 and from 3 to 4-5 increased risk of death 3-6 fold
- Decreasing ASA status could greatly improve odds of survival

Risk of Death by ASA Status

<table>
<thead>
<tr>
<th>PATIENT</th>
<th>ASA</th>
<th>Risk of Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>1-2</td>
<td>0.05%</td>
</tr>
<tr>
<td>Dog</td>
<td>3-5</td>
<td>1.33%</td>
</tr>
<tr>
<td>Cat</td>
<td>1-2</td>
<td>0.11%</td>
</tr>
<tr>
<td>Cat</td>
<td>3-5</td>
<td>1.40%</td>
</tr>
</tbody>
</table>
Premeds Improve Anesthetic Safety

- Do these patients need sedatives and analgesic drugs?

Opioids: Advantages

- Most potent class of analgesic drugs
- Should be considered anytime that pain occurs, especially when pain is moderate to severe
  - This includes surgical, medical and traumatic pain whether acute or chronic
- High safety margin
- REVERSIBLE!!
- Main adverse effect: VOMITING

Vomiting

- Neurokinin (NK)-1 receptors involved in emesis
- Prevent with NK-1 antagonist

Maropitant Label

- For prevention of vomiting following administration of emetogenic medications in dogs
- For treatment of vomiting in cats
- 1 mg/kg 45-60 mins prior to administration of the emetogenic meds

Consequences of pain


- Vomiting was significantly decreased and then prevented when maropitant was administered to dogs 15 and 30 minutes before hydromorphone.
- However, signs of nausea were significantly decreased only when the dosing interval was 60 minutes.

- Maropitant 8 mg total PO
- Reduced morphine and dexmedetomidine-induced emesis by 10-fold, when administered as early as 18 h in advance to healthy cats.

Sedation
- Opioids
  - YES! Minimal to no serious adverse effects; reversible
  - Maybe an option. Safe but not much sedation. Use with opioid.
  - Maybe. Long term calming can be good.
- Benzodiazepines
- Acepromazine
- Alpha-2 agonists
  - Maybe. Not for critical patients but often ideal for excited emergency patients

Four Phases of Anesthesia
- Preanesthesia
  - Patient preparation for anesthesia
- Stabilize; Sedate, start analgesia
- Induction
  - Achieve unconsciousness smoothly & rapidly – titrate TO EFFECT
- Maintenance
  - Dose to effect; Readress analgesia; SUPPORT & MONITOR
- Recovery
  - Readdress analgesia; may need sedation; SUPPORT & MONITOR

When Do Complications Occur?
- Preanesthesia
- Induction
  - Airway trauma
- Maintenance
- Recovery

Be careful with the ET tube! (Brodbelt 2009)
Risk Factors
- poor health status (ASA classification),
- extremes of weight,
- increasing procedural urgency and complexity,
- duration of the procedure…
- and use of inhalant anesthetics alone
- endotracheal intubation,
- WHY? Easy to damage the larynx and trachea

- Mouth gags identified as a potential risk factor for cerebral ischemia and blindness in cats.


- Maxillary arteries are the main source of blood supply to the retinae and brain in cats.
- Mouth gags cause occlusion of artery

Induction
- Propofol
- Alfaxalone
- Ketamine/diazepam
- Telazol
- Etomidate
- Inhalants

- YES! Easy to titrate to effect; cleared by multiple routes; CV & respiratory depression - DOSE
- YES! Easy to titrate to effect; less respiratory impact?
- Maybe. Not ideal if patient has ventricular arrhythmias but has multiple advantageous effects.
- VERY potent; use with caution.
- Reasonable. Use sedatives. Not in sepsis?
- NO! Dangerously bad idea.

Four Phases of Anesthesia

- Patient preparation for anesthesia
- Stabilize; Sedate, start analgesia

Induction
- Achieve unconsciousness smoothly & rapidly – titrate TO EFFECT
- Dose to effect; Readdress analgesia; SUPPORT & MONITOR

Maintenance
- Readdress analgesia; may need sedation; SUPPORT & MONITOR

Recovery
- Excessive anesthetic depth; cardio-respiratory issues; hypothermia; pain

Anesthetic Risk Study (Brodbelt)
- The only factor that reliably reduced risk of death?
- MONITORING!
- Only monitoring of pulse and pulse oximeter were evaluated
  - Each decreased the risk factor
  - Greatest decrease occurred when BOTH were used

When Do Complications Occur?

- Preanesthesia
- Induction
- Maintenance
- Recovery

Have the right monitor
- If you could have only ONE monitor, what would it be?
  - A good technician!
Monitors
- ECG
- Blood pressure, Doppler
- Blood pressure, oscillometric
- Pulse oximeter
- End-tidal CO2
- Myocardial electrical activity, EASY!
- Systolic blood pressure, can hear blood flow
- MAP, SAP, DAP, EASY!
- % Hemoglobin saturated with oxygen, EASY! Cheap
- Exhaled CO2, real monitor of ventilation

The most under-utilized class of analgesic drugs
- Effective, easy to use, inexpensive
- Blockade of painful impulses to dorsal horn neurons of spinal cord
  - Total pain relief from blocked nerves for duration of block
    - Decrease the inhalant dose!!!!
  - Increased anesthetic safety
  - Overall decreased sensation of pain once block has worn off
  - Decreases chance that pain pathway will become sensitized

Local/Regional Analgesia
  - can provide the most effective postoperative analgesia for the duration of the block,
  - small effect in reducing blood loss during major joint arthroplasty
  - reduced incidence of respiratory and infective complications
### Lidocaine CRI
- MANY benefits
  - Analgesic
  - Anti-arrhythmic
  - Anti-inflammatory
  - Anti-endotoxin
  - Improves GI motility
- ONLY lidocaine – no other locals
- Controversial in cats

### Ketamine CRI
- Ketamine is an N-methyl-D-aspartate receptor antagonist
  - Role is to prevent / treat ‘wind-up’ or central sensitization
  - Not a true analgesic
  - Use as part of multimodal therapy

### The early and delayed analgesic effects of ketamine after total hip arthroplasty: a prospective, randomized, controlled, double-blind study.

- **CONCLUSIONS:**
  - Ketamine had a morphine-sparing effect after THA, even when morphine was combined with multimodal systemic analgesia.
  - It also facilitated rehabilitation at 1 month and decreased postoperative chronic pain up to 6 months after surgery.

### Maropitant Surprise: Analgesia
Effect of maropitant, a neurokinin-1 receptor antagonist, on anesthetic requirements during noxious visceral stimulation of the ovary in dogs.

- Two studies – both with CRI delivery.
- One mg/kg followed by 30 μg/kg/h
  - Decreased sevoflurane MAC to 1.61 ± 0.4% (24% decrease)
  - 5 mg/kg followed 150 μg/kg/h, IV
  - MAC to 1.48 ± 0.4% (30% decrease)
  - Similar study in cats

### Is Hypothermia Really a Problem?
- Side Effects from cold
  - Decreased need for anesthetic drugs
  - PROLONGED RECOVERY from anesthesia
  - Impaired metabolism (adds to prolonged recovery)
  - Immune system depression
  - Coagulation dysfunction, sludging of blood
  - Decreased cardiac contractility, arrhythmias
  - Increased oxygen consumption (shivering)
  - Respiratory impairment
  - Etc…
Support Body Temperature
• Maintain body temperature
  ▪ Prevention easier than rewarming
  ▪ Temperature starts dropping AT INDUCTION
• Forced air blanket most effective
• Warm patient’s environment
  ▪ Surgery room, recovery cage, etc…
• Use warm fluids, warm scrub solution (and MINIMAL scrub solution), warm lavage solution, etc…
• MINIMIZE ANESTHESIA TIME

Maintenance – Inhalants
• Advantages
  ▪ Easy to change anesthetic depth
  ▪ Minimal metabolism compared to injectable drugs
• Disadvantages
  ▪ Need a lot of equipment
  ▪ DOSE-DEPENDENT cardiovascular and respiratory depression
  ▪ Dose to effect

Four Phases of Anesthesia
Preanesthesia
• Patient preparation for anesthesia
  ▪ Stabilize; Sedate, start analgesia
Induction
• Achieve unconsciousness smoothly & rapidly – titrate TO EFFECT
Maintenance
• Dose to effect; Readress analgesia; SUPPORT & MONITOR
Recovery
• Readress analgesia; may need sedation; SUPPORT & MONITOR

When Do Complications Occur?
Preanesthesia
• Pain; dysphoria; nausea/vomiting; prolonged recovery; hypothermia; cardiorespiratory issues; airway issues
Induction
• Maintenance
• Recovery

When did we get into trouble?
• Main cause for cardiorespiratory depression postoperatively?
  ▪ Excessive anesthetic depth intraoperatively
  ▪ Duration of surgery
• Main cause for hypothermia
  ▪ Duration of surgery

Oxygen-hemoglobin curve
**Best use of pulse oximeter**
- Recovery
  - Keep in place when extubating any patient with airway dysfunction
- Critical care
- More reflective of patient’s status on room air or oxygen <100%

**Pain or Dysphoria?**
- REALLY, we can’t always tell
- Even if we have been preventing pain, it still might be pain
- Re-dose opioids if any chance it is pain
- Microdose of alpha-2 agonist if unsure or if opioid not enough or if recovery BAD
  - 1-3 microg/kg IV 3-5 microg/kg IM
  - High end of dose with excitement and/or in cats


- The prophylactic administration of intravenous dexmedetomidine reduces the incidence of postanesthetic shivering in patients undergoing general anesthesia.


- Incidence of post-anesthetic AP was 0.17%
  - Low, but devastating
- Drugs: Hydromorphone at induction
- Procedures:
  - Laparotomy, upper airway surgery, neurosurgery, thoracotomy and endoscopy.
- Patient factors: megaesophagus, history of pre-existing respiratory or neurologic disease
- Decrease vomiting!

**PONV in OUR patients?!?!?!**
- Feed your pet a small meal the night after surgery
- Your pet may not want to eat the night after surgery
- Your pet may be nauseous the night after surgery

**Maropitant Surprise: Return to Normal**

- Dogs for OHE that received maropitant
  - Returned to normal feeding sooner than placebo dogs
  - Had a better quality of recovery (as measured by decreased aimless movements, vocalization and panting) than placebo dogs
Sarah
- Premedication
  - 0.1 mg/kg hydromorphone IV
  - 1 mg/kg maropitant IV
- Induction
  - 0.2 mg/kg midazolam + propofol to effect
- Maintenance
  - LOW inhalant
  - CRI or epidural
  - MONITOR & SUPPORT
- Recovery
  - Continue CRI or bolus opioids
  - Continue monitoring and support

SUMMARY
- Use a flow plan for anesthesia
- Know which complications are most common for each phase of anesthesia
- Treat/prevent
  - Nausea/vomiting
  - PAIN
  - Cardiorespiratory issues
  - Hypothermia
- Don’t lose focus in recovery!

#CPRwheel

Check out our 2015 upcoming VETgirl appearances!

Dr. Justine Lee
- IVS, Fiji, Feb 2016
- WVC, March 2016
- AAHA, March 2016
- AVMA, July 2016

Dr. Garret Pachingter
- NAVC, Jan 2016
- WVC, March 2016
- AAHA, April 2016
- SWVC, Sept 2016

Questions?
Thanks to Zoetis for sponsoring tonight’s VETgirl webinar!