The AAHA Anesthesia Guidelines in Practice
January 16 – 29, 2012
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AAHA gratefully acknowledges Abbott Animal Health for their sponsorship of this webcast.

AAHA Task Force Team Members
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Anesthesia is intended to be a benign & reversible process, but…

We give potentially lethal drugs.
In the face of injury & debilitating illness.

Goal of the Guidelines:
"Improving patient care across all veterinary practices"

Anesthesia is a real concern for all informed parties.

Veterinarians and their staff desire to make anesthesia successful in all regards, not just immediate survival and recovery.

Our clients do worry about anesthesia. They want to know that "Everything is OK". Their anxiety is real and it is fully justified!

We all worry about anesthesia – and we should!

Risk of anesthetic mortality ~0.1-0.24%
Most recent report: ~ 1.35% mortality! (in humans ~0.02-0.05%)

greater risk in extremes of age and weight
greater risk in sicker patients
greater risk during the recovery phase of anesthesia
greater risk in cats than dogs
greater risk with poor airway management in cats

AVMA Professional Liability Insurance Trust claims involving anesthesia – (2005-2010) 4.3% for dogs and 6.0% for cats
“Anesthetic Concerns Drive Anesthetic Management”

- Age, breed, sex
- Trauma
- Fear / Stress
- Debilitation
- History
- Pain
- Organ Failure

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“Problem-Based” Anesthesia

“Problem-based” anesthetic management serves as the framework for our individualized patient care.

Choices of anesthetic medications, monitoring, and supportive care are all based on recognition of the individual patients needs.

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“Anesthetic Concerns”

- Appropriate patient evaluation provides for the recognition of anesthetic risks and/or anesthetic concerns for that specific patient and procedure.

- Focused monitoring and patient evaluation lead to individualized patient care.
How Risky? - ASA Physical Status 1-5

ASA Physical Status Category - With examples of each category:

- **ASA 1 Normal healthy patients**
  - No discernable disease; ovariohysterectomy, ear trim, castration, or castration

- **ASA 2 Patients with mild systemic disease**
  - Skin tumor, simple fracture, uncomplicated hernia, cryptorchidectomy, localized infection, compensated disease

- **ASA 3 Patients with severe systemic disease**
  - Fever, dehydration, anemia, cachexia, or moderate hypovolemia; co-morbidity influencing anesthesia

- **ASA 4 Patients with severe systemic disease that is a constant threat to life**
  - Uremia, toxemia, severe dehydration and hypovolemia, anemia, cardiac decompensation, emaciation, or high fever

- **ASA 5 Moribund patients not expected to survive with or without operation**
  - Extreme shock and dehydration, terminal malignancy or infection, or severe trauma

Concerns / Problems Guide Anesthetic Care

- Every patient has individual needs.
  Choose from among your favorites to meet those needs and cover those concerns.

- What “anesthetic concerns” can we identified for this patient, at this time?

- “100 things are missed due to not looking for every 1 thing that is missed due to not knowing”.

Patient Evaluation: Diagnostics

Identification of co-morbidities —

Preanesthetic physical examination, diagnostic imaging, and laboratory analyses are also individualized.

The "minimum data base" for any given patient is based on evaluated history and the recognition of risk factors.
Patient Evaluation - Temperament

- Fear, Excitement, Stress, Aggression, Pain
- Stress and fear preclude a thorough exam and often limit our options.
- Risk factors - for patient and for personnel
- Increased challenges for the patient and for staff
- Fortunately, many solutions are available.

Patient Evaluation - Pain

AAHA Pain Management Standards:

"Pain assessment using a standardized scale or scoring system is recorded in the medical record for every patient evaluation."

Patient Evaluation & Pain Behaviors

- There are species-specific variations in the typical behaviors indicative of pain.
- Behavioral differences are often observed when the patient is removed from its normal environment.
- Client / owner input should be always considered.
- Reassessment after treatment should be made by the same individuals with the same scoring system.
Pain

Neuroendocrine changes
- Increased cortisol
- Catecholamines
- Hyperglycemia
- Catabolism

Central processing changes
- Tachycardia, hypertension, tachypnea
- Remission, anaplexy
- Anxiety, fear

Immunosuppression, risk of infection
- Infection, impaired wound healing
- Thrombosis
- Respiratory compromise
- Altered locomotion, guarding, licking, self-mutilation
- Pulmonary function, alveolar

"Mal-Adaptive" Pain and The Stress Response:
If left untreated, pain can lead to deleterious physiological changes that result in:
- Delayed healing
- Immunosuppression
- ↓ GI motility
- Retention of Na⁺ and H₂O
- ↓ Ventilation & ↓ Oxygenation
- Chronic Pain Conditions
- Increased Morbidity
- Increased Mortality

Principles of Pain Management:
1. Preemptive analgesia
2. Balanced analgesia
3. Dose to effect
Anesthesia Plan Development

- Based on the individual patient's needs:
  - ASA patient status
  - Known and recognized co-morbidities
  - Temperament
  - Pain, stress, catecholamine release
  - Procedures planned & anticipated needs
- A robust plan is flexible and dynamic.
- Goals - BALANCED ANESTHESIA and Problem-Based Case Management

Balanced Anesthesia

- Low doses of multiple drugs to achieve:
  - Hypnosis
  - Amnesia
  - Analgesia
  - Muscle relaxation
  - Control of reflexes
- Lower doses of multiple drugs → fewer dose-dependent negative side effects.

Anesthesia Plan Development

- Knowledge of specific and underlying disease
- Functional status of cardiopulmonary system
- Response to preoperative stabilizing measures
- Knowledge of drugs and effects
All Anesthetics Depress Ventilation!
- Anesthetic overdoses - Relative or Absolute
- Direct depression of central respiratory centers
- Secondary to circulatory depression - Danger!

Specific drug actions of:
- Opioids, Ketamine, Telazol, Propofol, Inhalants

Anesthesia Plan Development
Address all phases of anesthesia
- Drugs
  - Sedation/tranquilization
  - Induction
  - Pain management
  - Cardiovascular support
- Supportive care
  - Fluid resuscitation
  - Thermal support
  - Positioning
- Monitoring

Phases of Anesthesia & Goals for Each Phase:

**Intake/ history/ patient evaluation** – What makes this patient unique? What creates any special need or risk factors?

**Preanesthesia and Premedication** – Calm, as comfortable, pain-free, and stress-free as possible or practical

**Induction** – Transition to airway control & responsibility for life

**Maintenance** – Physiological stability, homeostasis, challenges

**Recovery** – Return of normal reflexes, transfer the gauntlet of responsibility for homeostasis, maintain comfort, and healing!
PRIOR to Anesthesia...

- Patient evaluation
- Individualized plan development
- Owner instructions for night before/day of anesthetic event
- Informed consent
- Equipment inspection

Client Communications

Obtain written informed consent:
Discuss: Patient assessment, risks, proposed anesthetic plan, and available alternatives with the client.
Informed consent may also be guided by local and state regulatory agencies.

Prior to the day of surgery, communicate about preparation:
Discuss any changes in administration of medications.
Preanesthetic fasting - access to food and water
Solicit remaining client questions and concerns.

Equipment Concerns

Deliver oxygen & anesthetic (in precisely controlled quantities)
Provide for positive pressure ventilation
Remove carbon dioxide
Regular inspection & maintenance
Avoid substandard equipment!
Equipment Checklists – Pilots use them, so should we!

- IV catheter placement
- Hemodynamic stabilization
- Pre-induction monitoring
- Premedication/sedation
- Preoxygenation with open mask

Patient Preparation

- IV catheter placement
- Hemodynamic stabilization
- Pre-induction monitoring
- Premedication/sedation
- Preoxygenation with open mask

Premedication Strategy

- Allows lower doses of induction and maintenance agents
- Provide preemptive analgesia
- Decrease patient stress
- But some premeds are contraindicated in compromised patients
Options for Preanesthetic Medication or for Temporary Restraint and Sedation:

- There are many useful options for an infinite variety of clinical situations.
- What are some of your favorites?
- Balanced, multi-modal, and individualized

Anesthetic Techniques – A Few Choices to Consider:

- Acepromazine (tiny doses, not usually for “out-patients”)
- Acepromazine & Opioid of choice… better than ace alone
- Valium or Versed & Opioid of choice… gentle effects
- Valium & Ketamine or Versed & Ketamine (safety)
- Telazol & Opioid (some prolonged recoveries)
- Dexmedetomidine (Dexdomitor) & Opioid of choice… powerful
- Chamber induction (Avoid it, only for very occasional use!)
- Opioid +/- Sedative/Tranquilizer, followed by:
  - Ketamine + Propofol co-induction (a favorite)
Anesthesia Monitoring

Vigilant monitoring, properly-functioning equipment, and well-trained and attentive staff are essential for interpreting monitoring data, identifying and responding to changes in patient physiologic status.

Why monitor?

- Is the patient adequately anesthetized and immobilized?
- Is the patient’s pain adequately managed?
- Is the autonomic response adequately subdued?

Why monitor?

- What are the current physiologic consequences of anesthesia?
- Are observed abnormalities serious enough to warrant treatment?
Why monitor?

Only Horses Live Under Stable Conditions...

Recommendations for Monitoring Anesthetized Veterinary Patients:

ACVA Monitoring Guidelines Update, 2009
http://www.acva.org/Index

These guidelines were approved by the Diplomates of the ACVA in December of 1994, and first published in the Journal of American Veterinary Medical Association on April 1, 1995. (JAVMA, Vol. 206, No. 7, 936-937.

Monitoring Anesthetized Patients:

- Continuous evaluation of oxygenation, ventilation, tissue perfusion, cardiac rate and rhythm, adequacy of anesthetic depth, muscle relaxation, body temperature, and analgesia

- Record patient parameters at 5-10 minute intervals, or more frequently if sudden changes in physiologic status occur.
General Monitoring Principles

- “Monitoring” ≠ “record keeping”
- Watch for trends.
- Be a critical thinker!
- First response for most common complications is turning down the inhalant.

Anesthesia Monitoring Tools:

- Physical Observations
  - Visualization (e.g., eye position, mucous membranes, chest excursion, blood loss, breathing bag inflation/deflation, equipment function)
  - Palpation (e.g., pulse quality, jaw tone, palpebral reflex)
  - Auscultation (heart, lungs)

- Electrocardiogram (ECG)
- Pulse oximeter ($\text{SpO}_2$)
- Arterial blood pressure monitor
  - Non-invasive BP (Doppler or oscillometric monitor)
  - Direct intra-arterial BP
- Thermometer
- Capnometry / Capnography ($\text{CO}_2$ in the exhaled breath)
- Anesthetic gas analyzer (concentration of inhalants in the airway)

Electrocardiogram (ECG)

- Displays electrical activity of the heart
- No information on mechanical activity of the heart
- Assess patient’s rate and rhythm
- Know normal
- Know abnormal
- Treat if warranted
ECG Monitoring

- A fundamental component and the first monitor used by many
- Arrhythmias were more common with the earlier generation anesthetics.
- Rate, rhythm, warning signs of myocardial hypoxia
- Electrolyte abnormalities - especially hyperkalemia

Respiratory Monitoring: Basic

- Rate and pattern
- Respiratory volume – spirometry
- Tidal volume and minute volume or minute ventilation
- Auscultation and percussion
- MM Color

Respiratory Monitoring: Advanced

- Arterial Blood Gas analysis
- Pulse Oximetry
- Capnometry / Capnography

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<th>ACID-BASE STATUS</th>
<th>P CO2</th>
<th>HCO3</th>
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<tr>
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<td>37.1 mm Hg</td>
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<th>Na+</th>
<th>K+</th>
<th>Cl-</th>
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<tr>
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<td>156 mmol/L</td>
<td>3.9 mmol/L</td>
<td>130 mmol/L</td>
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<tr>
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<tbody>
<tr>
<td></td>
<td>37.1 °C</td>
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</table>
Pulse Oximetry (SpO\textsubscript{2})

- Noninvasive measure of hemoglobin saturation with oxygen
- Inexpensive, informative, continuous audible pulse and saturation signal
- Monitors with a waveform display are much more meaningful than those with just a light bar display.

Oxygen-Hemoglobin Dissociation Curve

Capnometry and Capnography

- Infrared spectroscopy
- Measurement and graphic display of expired CO\textsubscript{2} in mmHg or %
- Interaction between pulmonary, cardiovascular and metabolic systems:
  - Metabolism → CO\textsubscript{2} in tissues → blood → lungs → exhaled CO\textsubscript{2}
- "Mainstream" or "Side-stream"
Interpretation

- CO₂ present
- Interpret number relative to waveform
- Lack of ETCO₂
  - Inappropriate intubation
  - Decreased cardiac output
  - Cardiac arrest

Blood Pressure Monitoring

- Maintain adequate perfusion pressure & oxygen delivery to tissues
- Ensure autoregulation of blood flow
  - Kidneys
  - Brain

Autoregulation of Blood Flow

![Graph showing autoregulation of blood flow](image)

- MAP (mmHg)
- Q
- 60
- 160
Indirect Blood Pressure Monitoring

Noninvasive methods:
- Doppler ultrasound (SAP only)
- Oscillotonometry (SAP, MAP, and DAP; also often HR)
  - New software, predictive algorithms
- Related methods
- Accuracy variable & dependent on:
  - Patient size & conformation
  - Cuff size & placement

Direct Arterial Blood Pressure Monitoring

Most commonly heard:
“This monitor probably just isn’t working right. The pressures can’t really be THAT low!”
- Gold standard for blood pressure monitoring
- Catheter in distal artery
- Connected by fluid filled tubing to manometer or electronic monitor
- Real-time indicator of hemodynamic status

Monitoring Equipment is Not “smart”!

- The anesthetist using these tools must be smart!
- The best advance in anesthetic monitoring is the well-trained and dedicated anesthetist.
- Proper application, proper function, (calibrated and verified equipment), and appropriate interpretation of the data obtained are essential.
- Otherwise, you are misled, and the patient…
Targeted Anesthetic Support

- Problem based patient care
- Care plan individualized to meet the needs
- Attention to risk factors and any anticipated complications
- Dynamic & Flexible

Do sweat the “small stuff”!

Intraoperative Hemodynamic Support: It’s all about OXYGEN DELIVERY!

Oxygen delivery to tissues
- Not measurable
- To increase oxygen delivery, must increase cardiac output and/or arterial oxygen content

$$DO_2 = CO \times CaO_2$$

- $DO_2$ = oxygen delivery
- $CO$ = cardiac output
- $CaO_2$ = arterial oxygen content

Intraoperative Hemodynamic Support: It’s all about OXYGEN DELIVERY!

- Hypotension is common during anesthesia
  - Hemorrhage
  - Vasodilatation
  - Decreased cardiac contractility

- Circulatory volume support:
  - A variety of fluids are available
  - Usually not this complicated!
  - Crystalloids / Colloids / Hypertonic / etc.
  - Blood, blood products, and substitutes
Intraoperative Hemodynamic Support: It’s all about OXYGEN DELIVERY!

- Vaso-active agents
  - Support blood pressure, cardiac output, tissue perfusion
  - Dopamine, Dobutamine, Vasopressin, Ephedrine, etc.

- Balanced anesthesia supports blood pressure
  - Lower doses of multiple drugs → fewer dose-dependent negative side effects, better blood pressure and tissue perfusion

Fluid Therapy for Patient Support

Many patients receive insufficient fluid volumes

But others... receive too much!

Metabolic and Endocrine Support

- Needed by some at-risk patients
  - Immaturity or disease states

- Inadequate glycogen storage or availability

- Excessive physiological demands
  - Injury, illness, anesthesia, surgery, hospitalization

- Specific endocrinopathies:
  - Diabetes
  - Adrenal insufficiency
  - Many others
Hypothermia - an almost universal problem
- Increases O₂ demand
- Vasoconstriction
- Poor perfusion
- Hypoxia
- Acidosis
- Delayed recovery
- Increased morbidity and mortality

Thermal Support & Patient Warming
But… the risks of thermal burns are very great with some older heating strategies.
- Please don’t use:
  - Consumer electric heating pads
  - Warm water in gloves, bags, bottles
  - Microwaved heat sources

Fortunately, there are safe and effective systems to provide thermal support and patient warming.

Recommended Methods To Prevent / Treat Hypothermia
Patient warming with decreased risk of burns!
- Warm Water
- Warm Air
- Dispersed Resistance Electric Systems
- IV Fluid Warmers
Delayed recovery from anesthesia is commonly encountered due to:

- Inadequate elimination or metabolism
- Anesthetic overdose
- Debilitation
- Neurological crisis
- Hypothermia

Support for Delayed Recovery

- Physiological support – Continued care!
- “SOP” – monitor… evaluate… diagnose… treat
- Facilitate elimination or metabolism
- Reversal of anesthetic drugs, but only when appropriate…

Recovery Phase of Anesthesia and Post-operative Patient Support

- Intensive monitoring and support continue beyond anesthesia and surgery.

“Vigilance!”
The motto of the ASA

Anesthetic deaths most often occur during the recovery phase of anesthesia.
Protecting Our Personnel & Our Practice -
Management of Waste Anesthetic Gases

- Employers and employees should be aware of the potential effects of workplace exposure to waste anesthetic gases and be advised to take appropriate precautions.

"...In the United States, OSHA requires individual veterinary hospitals and practices to maintain a system to prevent waste gases from building up in the area of use ..."


ACVA Commentary and recommendations on waste anesthetic gases in the workplace
http://www.acva.org/docs/Waste_Gas

Waste Anesthetic Gas Scavenger Systems

- Scavenging must be accompanied by good techniques to reduce exposures.
- Scavenging removes waste gases from pop-off (APL) valve only, not from leaks or technical errors.
- Activated charcoal canisters typically retain 50 grams of volatile anesthetic – weigh the canisters and discard appropriately.
- Avoid mask/chamber inductions!

Implementation of these AAHA Anesthesia Guidelines

The AAHA Implementation Toolkit is a key resource!
Success in Anesthesia is Achieved Through Planning, Preparation, and Dedication:

- Anesthetic concerns identified
- Problem-based and individualized care
- Attention to detail
- Vigilance
- Use the tools
- Use the training

Resources for Safety and Success in Small Animal Anesthesia

Your coordinated and balanced infrastructure:

- Professional team in your hospital
- Skills and knowledge base updated regularly
- Facilities that you have carefully developed
- Equipment for monitoring and support
- Perioperative critical care if / as needed
- Specialist consultation or referral if needed

We strongly emphasize the importance of trained staff.

The most important thing you can do to improve anesthetic outcomes is to engage well-trained, dedicated staff.
Web sites for more information:

<table>
<thead>
<tr>
<th>Group</th>
<th>Web URL</th>
<th>Resources available</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Society of Anesthesiologists (ASA)</td>
<td><a href="https://www.asahq.org/">https://www.asahq.org/</a></td>
<td>Public information</td>
</tr>
<tr>
<td>American College of Veterinary Anesthesiologists (ACVA)</td>
<td><a href="http://www.acva.org">www.acva.org</a></td>
<td>Small Animal Monitoring Guidelines; Position statements</td>
</tr>
<tr>
<td>Veterinary Anesthesia &amp; Analgesia Support Group (VASG)</td>
<td><a href="http://www.vasg.org">www.vasg.org</a></td>
<td>Wealth of info &amp; tools</td>
</tr>
<tr>
<td>American Animal Hospital Association (AAHA)</td>
<td><a href="http://www.aahanet.org">www.aahanet.org</a></td>
<td>AAHA-AAFP Pain Management Guidelines for Dogs &amp; Cats; AAHA Senior Care Wellness Guidelines</td>
</tr>
<tr>
<td>International Veterinary Academy of Pain Management</td>
<td><a href="http://www.ivapm.org">www.ivapm.org</a></td>
<td>Many analgesia resources</td>
</tr>
<tr>
<td>Colorado State University</td>
<td><a href="http://www.cvmbs.colostate.edu/dmcl/wing/emdrughp.htm">www.cvmbs.colostate.edu/dmcl/wing/emdrughp.htm</a></td>
<td>A custom emergency drug list with dosages printed for each patient</td>
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Where Are We Now in Anesthesia and Pain Management for Dogs and Cats?

Room for improvement, but we stand on the shoulders of giants!

Success through:
Ambition
Innovation
High Expectations

AAHA Anesthesia Guidelines for Dogs and Cats, November 2011

“There are no safe anesthetic agents; there are no safe anesthetic procedures; there are only safe anesthetists.”

Robert Smith
Questions?

Questions to the Speakers

Please email your questions to webconference@aahanet.org by Sunday, February 5, 2012.

Dr. Harvey and Kim will provide written responses to all of the questions and they will be posted on AAHA’s website by Friday, February 17, 2012.

Instructions for CE Certificate

1. To complete the evaluation, please go to the following website:

   http://www.keysurvey.com/survey/406770/e673/

2. After completing the evaluation, you will automatically be linked to the Continuing Education Certificate. The CE certificate can only be accessed after the evaluation is completed.

3. Download the CE Certificate (in PDF format) to your computer and print enough copies for those persons viewing the web conference with you.