



PATIENTS, PROCEDURES AND PROTOCOLS SYMPOSIUM

WHAT YOU NEED TO KNOW

THINGS YOU NEED TO KNOW ABOUT...

ANESTHESIA & ANALGESIA FOR CATS WITH CHRONIC RENAL INSUFFICIENCY

Tamara Grubb, DVM, PhD, DACVAA

Veterinary Clinical Sciences

Washington State University, Pullman, WA, USA

1 The goal of the anesthetist is to support renal blood flow (RBF), glomerular filtration rate (GFR) and other renal functions through support of renal oxygen delivery, which is a component of cardiac output and arterial oxygen content.

2 The International Renal Interest Society (IRIS) has developed stages to describe the severity of CKD based on the degree of azotemia with sub-staging based on the urine protein:creatinine ratio and systolic arterial blood pressure. These stages can be used to guide stabilization and physiologic support of the patient.

3 The kidneys receive an extraordinarily high percentage of the cardiac output (20%) but most of this volume perfuses the renal cortex and medullary flow is only about 2% of total renal blood flow (RBF). Thus, any state that causes decreased oxygen delivery could induce medullary ischemia.

4 All anesthetic drugs are likely to decrease RBF and GFR, primarily by causing decreased cardiac output but also through direct changes. Autoregulation is responsible for controlling renal blood flow within a range of mean arterial blood pressure of 50-150 mmHg, which is also the goal of the anesthetist.

5 Pain is a tremendous stressor and can initiate/exacerbate the sympathetic nervous system stress response leading to a further decrease in renal perfusion.

6 Balanced anesthesia is critical and the needs of the patient must be addressed in all four phases of anesthesia: Preanesthesia, induction, maintenance and recovery.

a. Preanesthesia: STABILIZATION is key to success! Use the IRIS stages to determine need for both long and short term stabilization. The goal is to decrease the American Society of Anesthesiologists (ASA) risk status for anesthetic complications.

b. Induction: Induce rapidly with propofol or alfaxalone and intubate as quickly as possible so that the airway is protected from potential aspiration if the patient is vomiting and so that supplemental oxygen delivery begins as soon as possible.

c. Maintenance: Inhalants (isoflurane, sevoflurane) at LOW DOSE to minimize dose-dependent inhalant-induced hypotension and hypoventilation. Analgesic drugs MUST be part of the anesthetic protocol in order to achieve this.

d. Recovery: Continued support with fluids and reassessment of analgesic needs. If necessary, the effects of alpha-2 agonists can be reversed with a dose of atipamezole.

7 Local anesthetic blocks are an excellent addition to the protocol and should be utilized whenever possible. Patients with uremia may be more likely to have clotting abnormalities so local injections should be utilized with caution.

8 Although preoperative hypertension is common, hypotension can occur during anesthesia. Blood pressure can be supported with inotropes such as dopamine and dobutamine. ♦

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ANESTHESIA & ANALGESIA FOR CATS WITH CHRONIC RENAL INSUFFICIENCY

ASA STATUS	ASA I-II	ASA III	ASA IV
IRIS STAGE	No renal disease or IRIS 1	IRIS 2-3	IRIS 3-4
STABILIZATION	No long term stabilization necessary	If possible, send home for several weeks of CKD treatment prior to anesthesia	If possible, send home for several weeks of CKD treatment prior to anesthesia
		If stable	If not stable
PREOPERATIVE STABILIZATION	Begin IV fluids at induction. Maybe 1-2 hours preop for IRIS 1	Begin IV fluids 2-12 hours prior. Correct K ⁺ deficits prior to anesthesia	Begin IV fluids 12-24 hours prior. Correct K ⁺ deficits prior to anesthesia
PREMEDICATION	Opioids +/- low dose alpha-2 agonist or acepromazine	Opioids +/- low dose acepromazine	Opioids +/- benzodiazepine*
INDUCTION	Propofol or alfaxalone 'to effect'	Propofol or alfaxalone "to effect"	Propofol or alfaxalone "to effect"
MAINTENANCE+ ANALGESIA	LOW DOSE sevoflurane or isoflurane; CRIs of opioids, lidocaine +/- ketamine; local/regional block	LOW DOSE sevoflurane or isoflurane; CRIs of opioids +/- lidocaine; local/regional block	LOW DOSE sevoflurane or isoflurane; CRIs of opioids at low end of dose; local/regional block
SUPPORT	Normal fluid rate, typically 10 ml/kg first hour, 5 ml/kg each additional hour, depending on hydration, blood pressure & ongoing losses	Moderate fluid rate, typically 10-20 ml/kg first hour, 10 ml/kg each additional hour, depending on hydration, blood pressure & ongoing losses	High fluid rate, typically 20+ ml/kg first hour, 10-20 ml/kg each additional hour, depending on hydration, blood pressure & ongoing losses
RECOVERY	Stop the fluids at the end of surgery or 1-2 hours postop for IRIS 1; Readdress pain; Expect urine output to be low but to rebound within 1-2 hours	Continue fluids for 1-4 hours postop; Readdress pain; Expect urine output to be low but to rebound within 1-2 hours	Continue fluids for 4+ hours postop; Readdress pain; Expect urine output to be low but to rebound within 1-2 hours

*Can cause paradoxical excitement in healthy patients.

THINGS YOU NEED TO KNOW ABOUT...

CANINE PATIENTS WITH HEPATIC DISEASE

Ralph Harvey, DVM, Diplomate ACVAA
College of Veterinary Medicine
University of Tennessee, Knoxville, TN USA



ANESTHETIC TECHNIQUES

1 Patients with clinically significant liver disease often have reduced requirements for anesthetic depressants. A gentle approach to CNS depression will be rewarded with improved outcome in most situations. It is remarkably easy to overdose these patients.

2 Patients with clinically significant hepatic disease rarely require the use of sedatives. If they do, a sedative that can be reversed, especially the alpha-2 agonist dexmedetomidine would be a reasonable choice. Dramatically reduced doses in combination with an opioid will often have a profound effect.

3 Opioids are generally a safe option to provide a mild preanesthetic sedative contribution as well as for the relief of pain. If reduced conjugation and elimination occurs, the duration of action increases, rather than an increase in the magnitude of action. Extended dosing intervals may be warranted and would typically be based on patient response and altered pharmacokinetics. We do see some patients demonstrate evidence of residual opioid mediated sedation even into the next day after drug administration. Our doses of favored opioid agonist medications including fentanyl,

hydromorphone, methadone, morphine, or oxymorphone are not typically reduced in hepatic patients, but each patient should be evaluated for a persistence of effects. In a patient with extremely limited hepatic function, consider the very rapidly cleared opioid remifentanyl, which is eliminated by nonspecific plasma esterases rather than by hepatic conjugation. If necessary to manage persistent undesirable opioid mediated effects, the option of the opioid reversal agent, such as naloxone, or more commonly a partial reversal using low doses (0.05mg/kg, IV) of butorphanol.

4 Propofol or alfaxalone are very suitable as IV induction anesthetics for hepatic patients and either can be used in a controlled rate infusion (CRI) along with other injectables and/or inhalants to maintain anesthesia. The metabolic clearance exceeds hepatic perfusion and there is no cumulative effect, even with hepatic dysfunction.

5 Either Isoflurane or sevoflurane may be used in hepatic patients. Contemporary inhalational anesthetics are not hepatotoxic. Lower vaporizer settings and lower inhaled doses are favored for these patients in order to maintain better arterial blood pressure and better hepatic perfusion in the face of existing liver disease or dysfunction.

ANESTHESIA

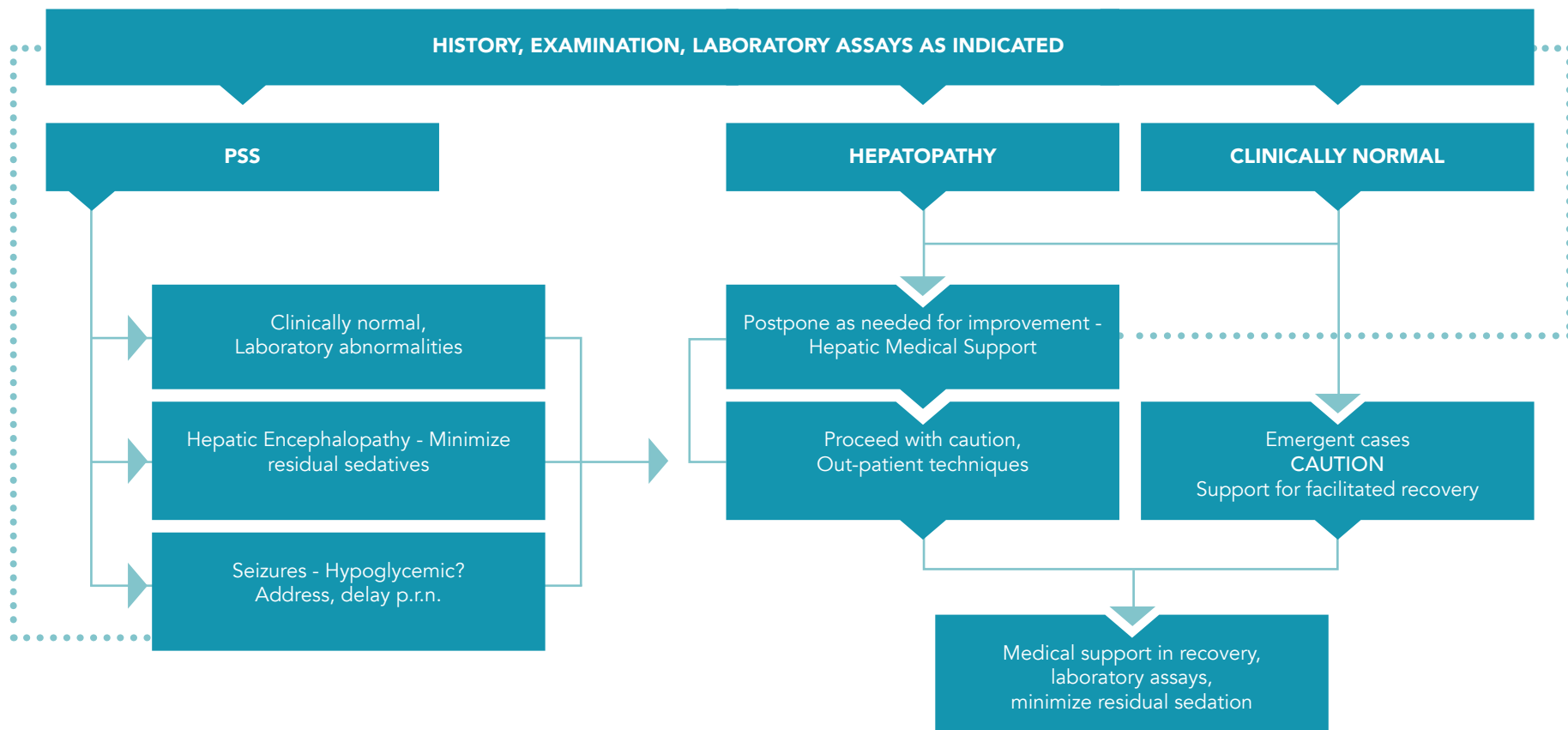
1 Reduced clearance of drugs: An impaired liver limits conjugation and/or biliary excretion of many medications, including anesthetic drugs. Fortunately, little hepatic function is required to achieve near normal conjugation. And if clearance is impaired, an increase in the duration of drug action is the result, rather than an increase in the magnitude of drug action.

2 Hypoproteinemia/hypoalbuminemia: Reduced oncotic pressure results from lower than normal production of plasma albumin. There is a substantial risk of compounding these problems by excessive fluid therapy. Reduced protein binding of many medications results in an increase in the active form and fractions of drugs and thereby a relative overdose of anesthesia and excessive active concentrations of many drugs that are normally protein bound.

3 Seizures: Both hypoglycemia and hepatic encephalopathy contribute to an increase in seizure activity in hepatic patients. Emergency management with either intravenous dextrose or specific anti-seizure medication should be based on differentiation of the precipitating etiology. Excessive administrations of benzodiazepines or their use in the patient with seizures that are due to hypoglycemia are to be carefully avoided. ♦

THINGS YOU NEED TO KNOW ABOUT...

ANESTHESIA FOR CANINE PATIENTS WITH HEPATIC DISEASE



THINGS YOU NEED TO KNOW ABOUT...

ONCOLOGICAL PAIN MANAGEMENT IN THE DOG AND CAT

Carlos O. Rodriguez, DVM, PhD, DACVIM (Oncology)
PETS Referral Center, Berkeley, CA, USA

1 The first step to treating pain is to recognize it!

2 Many elderly dogs and cats suffer from chronic comorbidities such as osteoarthritis, dental disease, and back pain that create conditions where cancer-related pain is amplified. Thus, in order to treat pain effectively in this setting, we employ a broad range of tactics (pain cocktails/ balanced analgesia, acupuncture, radiation therapy) in an effort to improve the animal's and the owner's quality of life.

3 The clinical hallmarks of sensitization of the pain system are hyperalgesia and allodynia. Hyperalgesia is an exaggerated and prolonged response to a noxious stimulus, while allodynia is a pain response to a low-intensity, normally innocuous stimulus such as light touch to the skin or gentle pressure. Hyperalgesia and allodynia are a consequence of peripheral and central sensitization.

PAIN TYPES

a. Inflammatory pain is classically acute postoperative pain that lasts until the wound has healed. It has a rapid onset and, in general, rapid resolution once the affected tissues heal. However,

if a focus of ongoing inflammation persists, then pain will persist. This scenario is the case in many of the elderly pets with those chronic inflammatory comorbidities such as arthritis, otitis, gingivitis, dermatitis, back pain and cancer. Their systems are often primed to over react to what should be minor painful procedures due to chronic inflammation.

b. Neuropathic pain is defined as pain caused or initiated by a primary lesion within the peripheral nervous system or central nervous system. The lesion ultimately causes changes in the nervous system that causes it to develop exaggerated responses to both inflammatory and normally innocuous stimuli. Neuropathic pain is commonly recognized in humans; (post-amputation phantom limb pain and post-herpetic neuropathy are two classic examples). We identify neuropathic pain (phantom limb) rarely in veterinary medicine; this may be due to lack of its recognition; and this form of pain is notoriously NSAID/opioid resistant!

c. Cancer pain often displays characteristics of both inflammatory and neuropathic pain.

d. Consider bone pain to be the most formidable foe, frequently encountered in primary (osteosarcoma) and metastatic bone tumors, oral tumors, and in nasal tumors. For most hospice

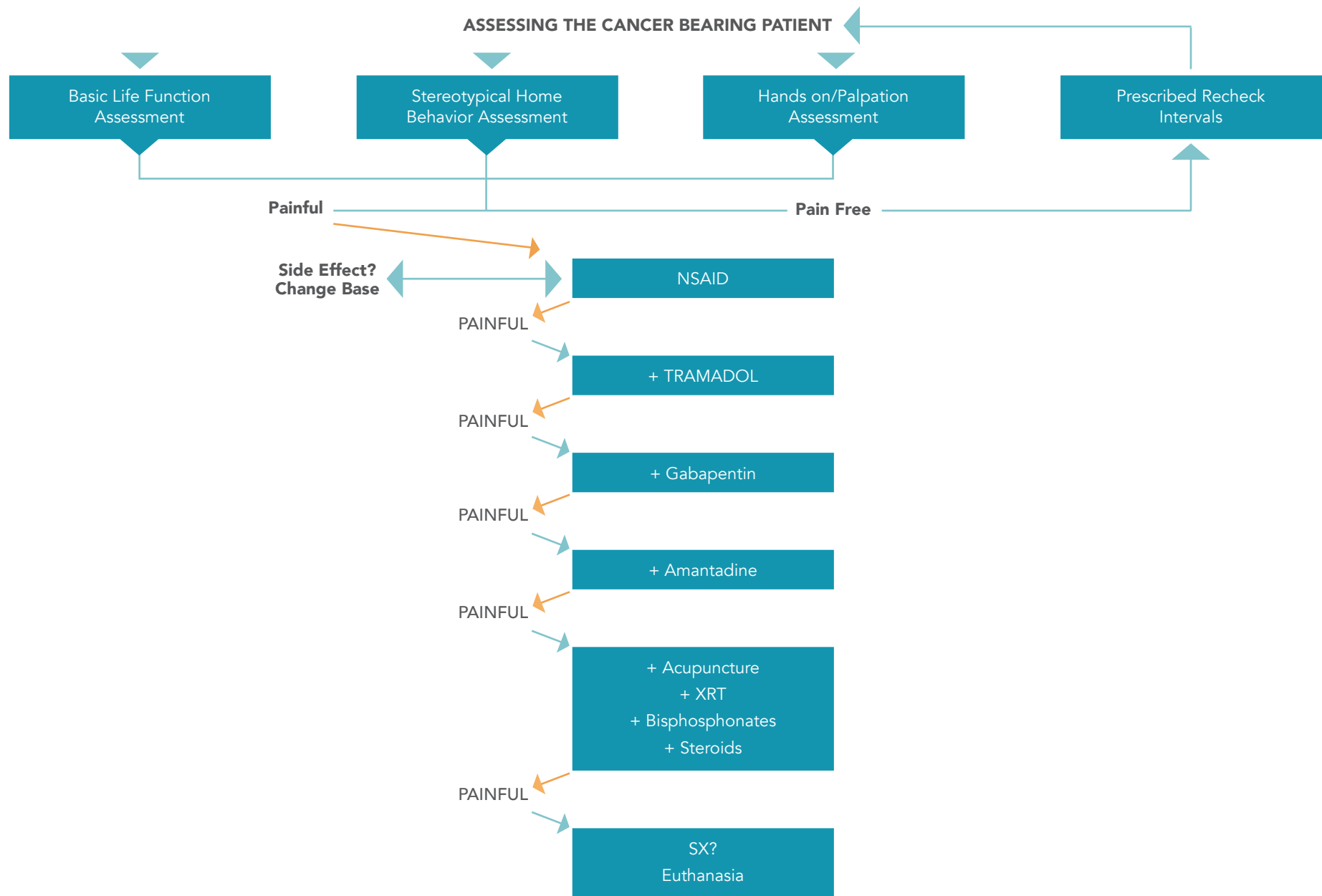
patients (particularly cats) start subcutaneous fluids when beginning to treat bone pain.

e. Radiation therapy is often used for bone pain.

f. A body of work was developed showing the effects of acupuncture as neuro-modulation. From this evidence a logical and rational approach to treatment can be made, utilizing point locations that are based upon known neuro-anatomy and effects measured through fMRI, chemical changes, and microscopic deformation of soft tissue structures. While these points often occur in the same locations as the meridian points, the rationale for their use is often different when approaching acupuncture from an evidence-based perspective, and has been shown to be more effective and repeatable between practitioners. Acupuncture is based on a metaphysical framework that involves moving invisible energy, called chi or xi. This approach has added to the clinical expertise of acupuncture treatment for pain, but cannot be corroborated by research, as chi is, by definition, immeasurable. ♦

THINGS YOU NEED TO KNOW ABOUT...

ONCOLOGICAL PAIN MANGEMENT IN THE DOG AND CAT



THINGS YOU NEED TO KNOW ABOUT...

ANESTHESIA PROTOCOLS IN CHALLENGING CASES - SMALL CHANGES, BIG RESULTS

Andre Shih, DVM, DACVA

College of Veterinary Medicine

University of Florida, Gainesville, FL, USA

CANINE DEGENERATIVE VALVE DISEASE (MITRAL REGURGITATION)

1 One of the most common cardiac diseases in dogs is degenerative valvular disease.

2 The objective of anesthesia for patients with MR is to promote forward blood flow and to reduce regurgitation fraction. Thus drugs that promote bradycardia, vasoconstriction, pulmonary hypertension and reduction of cardiac output are all contraindicated.

Premedication

a. Administration of anticholinergics, such as atropine and glycopyrrolate, can be a good option since they will reduce the chance of bradyarrhythmias intra operative.

b. Heart rhythm and blood pressure (if possible) should continue to be monitored for about three hours after general anesthesia as this is the most likely period in which anesthesia-related fatalities will occur; significant bradyarrhythmias should be treated.

FELINE HYPERTROPHIC CARDIOMYOPATHY (HCM)

1 One of the most common cardiac diseases in cats, (HCM) is characterized by stiffness of the left ventricle with poor diastolic function.

2 A recent epidemiological study reported that 13% of healthy cats have HCM, although they do not have clinical signs and are normal on physical examination. It is speculated that a good percentage of anesthesia deaths in routine cases may be secondary to undiagnosed cardiac disease.

a. The main concern during premedication is stress and a sudden burst of catecholamines. Administration of anticholinergics such as atropine and glycopyrrolate should be avoided because of the potential for tachycardia and increased myocardial work and oxygen demand.

b. Stress, pain, hypothermia and hypovolemia can all lead to catecholamine release, resulting in increased myocardial oxygen demand and promoting dynamic outflow obstruction and malignant arrhythmias. ♦

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ANESTHESIA PROTOCOLS IN CHALLENGING CASES - SMALL CHANGES, BIG RESULTS

Felines with Hypertrophic Cardiomyopathy (HCM) patients:

1. Check preoperative blood work and cardiac consult before surgery.
Evaluate if patient is in congestive heart failure before surgery.
Continue cardiac medications up to the day of surgery.

2. Healthy HCM Cat with No Cardiac Signs

Pre op	Intra op	Post op
Premedication with: Butorphanol IM or Buprenorphine IM Dexmedetomidine IM Maropitant IV	Induction with: Propofol IV Endotracheal intubation Maintain with isoflurane Fluid therapy (2-5 ml/kg/hr) Regional anesthesia technique	Oxygen supplement Continue monitor Pulse oxymeter, ECG and BP

3. Sick HCM Cat with Signs of Cardiac Disease

Pre op	Intra op	Post op
Pre clip and scrub sx area (use warm scrub) Get accurate body weight Pre oxygenate Place IV catheter and basic monitoring Maropitant IV Premedication with: Butorphanol IV or Methadone IV (depending on pain level)	Induction with: Propofol IV or Alfaxalone IV Endotracheal intubation Sevoflurane or Isoflurane (low dose) Fentanyl CRI 1 ug/kg/min Dopamine CRI ug/kg/min if low BP Fluid therapy (2 ml/kg/hr)	Oxygen supplement Continue monitor Pulse oxymeter, ECG and BP

Canines with Degenerative Valve Disease (Mitral Regurgitation or MR) patients:

1. Check preoperative blood work and cardiac consult before surgery.
Evaluate if patient is in congestive heart failure before surgery.
Continue cardiac medications up to the day of surgery.

2. Healthy MR Dog with No Cardiac Signs

Pre op	Intra op	Post op
Premedication with: Buprenorphine IM Atropine IM Acepromazine IM Maropitant IV	Induction with: Propofol IV Endotracheal intubation Maintain with isoflurane Fluid therapy (5 ml/kg/hr) Regional anesthesia technique	Oxygen supplement Continue monitor Pulse oxymeter, ECG and BP

3. Sick MR Dog with Signs of Cardiac Disease

Pre op	Intra op	Post op
Pre clip and scrub sx area (use warm scrub) Get accurate body weight Pre oxygenate Place IV catheter and basic monitoring Maropitant IV Premedication with: Butorphanol IV or Methadone IV (depending on pain level)	Induction with: Propofol IV or Alfaxalone IV Endotracheal intubation Sevoflurane or Isoflurane (low dose) Fentanyl CRI 1 ug/kg/min or Lidocaine CRI 50 ug/ kg/min Dopamine CRI 5 ug/kg/min if low BP Fluid therapy (2 ml/kg/hr)	Oxygen supplement Continue monitor Pulse oxymeter, ECG and BP

THINGS YOU NEED TO KNOW ABOUT...

USING SEDATION WITHOUT HESITATION IN A FEAR FREESM PRACTICE

Marty Becker, DVM
North Idaho Animal Hospital, Sandpoint, ID, USA



1 What dramatically changed the education, understanding and usage of anxiolytics and sedatives? Simple. The understanding that in veterinary medicine what was practiced was causing repeat, severe, psychological damage to pets. Thus creating compelling reasons to start looking after both the physical and emotional wellbeing of pets.

2 Building on the bedrock of boarded veterinary behaviorists, over 170 pet health experts came together to develop FEAR FREESM education, training and certification.

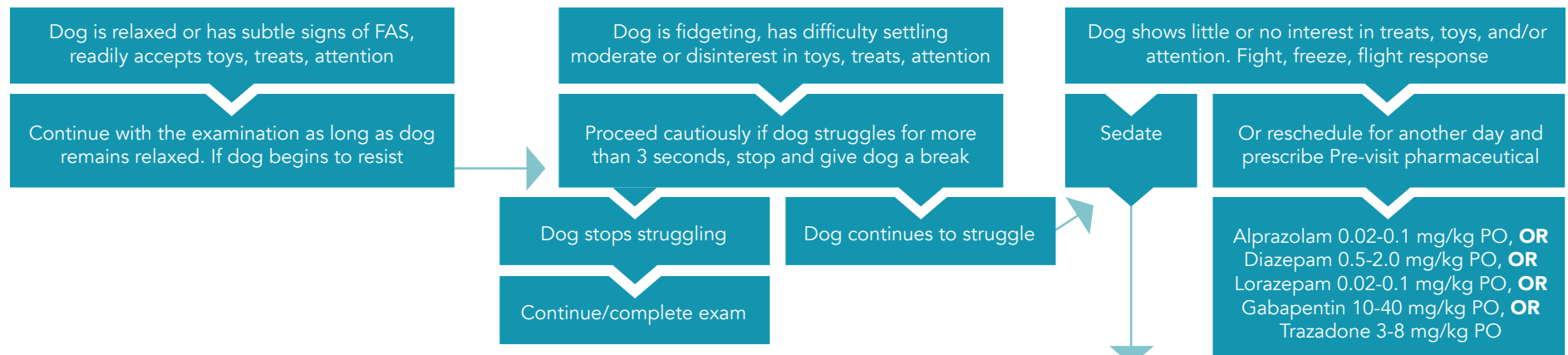
3 When first started, the initial step to creating FEAR FREESM veterinary visits, was learning basic behavior and the signs of fear, anxiety, and stress (FAS) in dogs, cats, and other companion animals.

4 Sedation allows practitioners to not only follow the veterinary oath to “prevent or relieve animal pain and suffering,” but to practice better medicine with more thorough and accurate physical exams (pets don’t hide pain or sensitivity), the TPR and BP are more normal, the blood chemistries are more accurate, and there is a lack of the immunosuppression and digestive upset that was so common with stressed pets. ♦

THINGS YOU NEED TO KNOW ABOUT...

USING SEDATION WITHOUT HESITATION IN A FEAR FREESM PRACTICE

Dog Presents for Examination



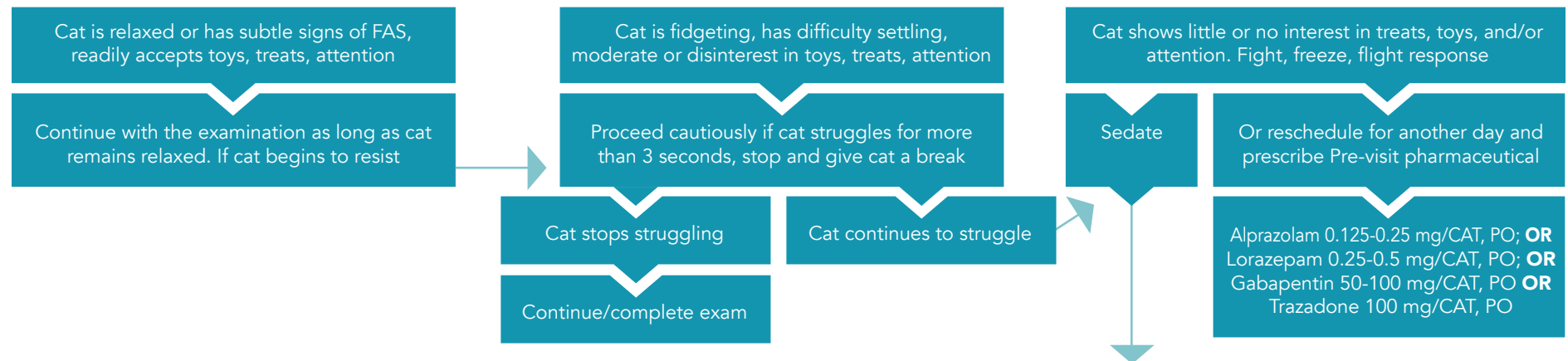
Canine Sedation Protocols Healthy Patients (use lower end of dosage range with geriatrics)

	Stress		Pain
LOW STRESS/ MILD PAIN	Dexmedetomidine 3-7 mcg/kg IM or IV, OR Acepromazine 0.01-0.03 mg/kg IM or IV with midazolam 0.2 mg/kg IM or IV	+	Buprenorphine 0.02-0.03 mg/kg IM or IV, OR Hydromorphone 0.05-0.2 mg/kg IM or IV, OR Morphine 0.3-2.0 mg/kg IM; 0.1-0.5 mg/kg IV
MODERATE STRESS & PAIN	Dexmedetomidine 5-10 mcg/kg IM or IV & Butorphanol 0.2-0.4 mg/kg IM (If patient is painful use buprenorphine or a pure mu opioid. Do not use Butorphanol.) +/- Midazolam 0.2 mg/kg IM or IV	+	Buprenorphine 0.02-0.03 mg/kg IM or IV, OR Hydromorphone 0.05-0.2 mg/kg IM or IV, OR Morphine 0.3-2.0 mg/kg IM; 0.1-0.5 mg/kg IV
FRACTIONAL CANINE	Dexmedetomidine 10-20 mcg/kg IM & Butorphanol 0.2-0.4 mg/kg IM (If patient is painful use buprenorphine or a pure mu opioid. Do not use Butorphanol.) + Ketamine 1-3 mg/kg IM, OR Tiletamine/Zolazepam 1-2 mg/kg IM	+	Buprenorphine 0.02-0.03 mg/kg IM or IV, OR Hydromorphone 0.05-0.2 mg/kg IM, OR Morphine 0.3-2.0 mg/kg IM; 0.1-0.5 mg/kg IV

THINGS YOU NEED TO KNOW ABOUT...

USING SEDATION WITHOUT HESITATION IN A FEAR FREESM PRACTICE

Cat Presents for Examination



Feline Sedation Protocols Healthy Patients (use lower end of dosage range with geriatrics)

	Stress		Pain
LOW STRESS/ MILD PAIN	Dexmedetomidine 5-15 mcg/kg IM or IV, OR Acepromazine 0.05-0.1 mg/kg IM or IV with midazolam 0.2 mg/kg IM or IV	+	Buprenorphine 0.02-0.03 mg/kg IM or IV OR Butorphanol 0.2-0.4 mg/kg IM or IV
MODERATE STRESS & PAIN	Dexmedetomidine 5-20 mcg/kg IM, & Butorphanol 0.2-0.4 mg/kg IM (If patient is painful use buprenorphine or a pure mu opioid. Do not use Butorphanol.) +/- Midazolam 0.2 mg/kg IM or IV	+	Buprenorphine 0.02-0.03 mg/kg IM or IV OR Hydromorphone 0.05-0.1 mg/kg IM or IV OR Morphine 0.05-0.2 mg/kg IM
FRACTIOUS FELINE	Dexmedetomidine 10-20 mcg/kg IM with Butorphanol 0.2-0.4 mg/kg IM, OR 0.02 mg/kg Buprenorphine IM (If patient is painful use pure mu opioid instead of butorphanol or buprenorphine) + Ketamine 2-5 mg/kg IM OR Tiletamine/Zolazepam 1-2 mg/kg IM	+	Buprenorphine 0.02-0.03 mg/kg IM OR Hydromorphone 0.05-0.1 mg/kg IM OR Morphine 0.05-0.2 mg/kg IM

