

Pharmacists Caring for Veterinary Patients – Part II



Who Am I?

- Pharmacist with over 20 years of experience in veterinary pharmacy
- Disclose that I developed and instruct online courses in veterinary pharmacy for students and pharmacists – University of Florida
- Teach pharmacology to veterinary students in the Caribbean using distance education methods (Grand Cayman Island)
- Regulatory affairs/regulatory compliance consultant to veterinary drug distributors
- Pharmacist who has filled many, many veterinary prescriptions over the years
- I am an old Fort Sumner girl.

Learning Objectives - Pharmacists

1. Compare and contrast common human and veterinary disease states with emphasis on therapeutic options.
2. Describe fundamentals of pharmacokinetics and pharmacology that will support a pharmacist's ability to recognize species specific disease state differences.
3. Recall drugs of choice to treat common endocrine diseases, musculoskeletal diseases and congestive heart failure. Additionally, recall drugs for the treatment of behavioral modification and chronic kidney disease in pets.
4. Recall the mechanism of action for drugs that are known to be toxic to canine and felines.
4. Communicate effectively with animal owners and veterinarians to: meet state-mandated counseling requirements, ensure patient safety, and solve drug administration problems.

Learning Objectives -Technicians

1. Recognize veterinary pharmacy as a specialized area within pharmacy practice.
2. Compare and contrast common human and veterinary disease states with emphasis on therapeutic options.
3. Recall drugs of choice to treat common endocrine diseases, musculoskeletal diseases, congestive heart failure and infectious diseases. Additionally, recall drugs for the treatment of behavioral modification and chronic kidney disease in pets.
4. List drugs that are known to be toxic to canine and felines.

I will share with you some veterinary pharmacy clinical pearls.

Species Specific P'kinetics

Fundamentals of pharmacokinetics and pharmacology in small animals.

A cat is not a small dog. A mouse is not a small elephant.

ADME – same principles as people but with species specific exceptions

Small animal/monogastrics experience first pass metabolism like people. We want drugs with high bioavailability. Few drugs survive the rumen.

Metabolism – *significant* differences in cats. They are deficient in glutathione, glucuronyl transferase making glucuronidation conjugation difficult and therefore can not metabolize drugs like people or other small animals.

GI transit time faster in monogastrics versus ruminants. Dogs>people. So, caution with some of the prolonged release, once a day cardiac drugs, theophylline SR.

Clinical Examples

We generally do not calculate the dose for a drug (2mg/kg) for a mouse and extrapolate that to an elephant because a drugs p'kinetic profile dose not extrapolate across species. Additionally, the pharmacologic responses of a drug can be very different between species.

Linear extrapolation of mg/kg dosing assumes that differences in weight and species p'kinetics are not clinically significant. Although simple to do, it can overdose large animals and underdose small animals.

Generally do not extrapolate doses outside of species such as a rodent vs. large mammal. Or ruminant to monogastric. Or reptile to a mammal. Use BMR as a guide.

Some animals have more/different receptors than others. Cattle have β_2 receptors than pets or people.

Some species are more affected by GABA inhibition than others.

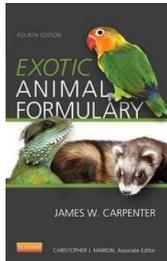
Clinical Examples

Prednisone is a prodrug. Cats and horses lack the enzyme necessary to convert prednisone to prednisolone. Therefore, administer prednisolone to those species.

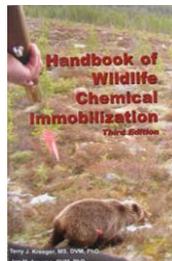
Ionophores used in cattle for coccidostat but will kill horses.

Opiates will cause predictable sedation in dogs but can cause CNS excitation in horses and cats.

Clinical Pearls - "Rope or Dope?"



Invest in Carpenter if doing a lot of exotic animal compounding.



Common reference for vets that do a lot of chemical immobilization with ultra-potent opiates such as etorphine or carfentanil.

Clinical Examples

Chocolate is toxic to dogs, specifically the methylxanthine theobromine.

Theobromine competitively inhibits cellular adenosine receptors, resulting in CNS stimulation, diuresis, and tachycardia. Also increases intracellular calcium levels. The net effect is increased strength and contractility of skeletal and cardiac muscle.

Clinical signs of chocolate toxicosis usually occur within 6–12 hours of ingestion. Initial signs include; polydipsia, vomiting, diarrhea, abdominal distention, and restlessness. Signs may progress to hyperactivity, polyuria, ataxia, rigidity, tremors, and seizures. Death is generally due to cardiac arrhythmias, hyperthermia or coma.



Why is Tylenol toxic to cats?

- ▶ As little as one, 500mg tablet can kill a cat.
- ▶ Cats are deficient in glucuronyl transferase, because of that ingested APAP cannot form a conjugate with glucuronide. So, APAP can make it through Phase I metabolism but not Phase II and there is a build up of toxic Phase I metabolites. Glutathione, in a Phase II metabolic pathway tries to step in an help but it quickly becomes overwhelmed and the pt. develops methemoglobinemia. Mucomyst administered IV provides an alternative substrate for conjugation with the reactive metabolites of APAP. It also helps treat the injury at the cellular level, oxidative stress.



Degenerative Joint Disease DJD

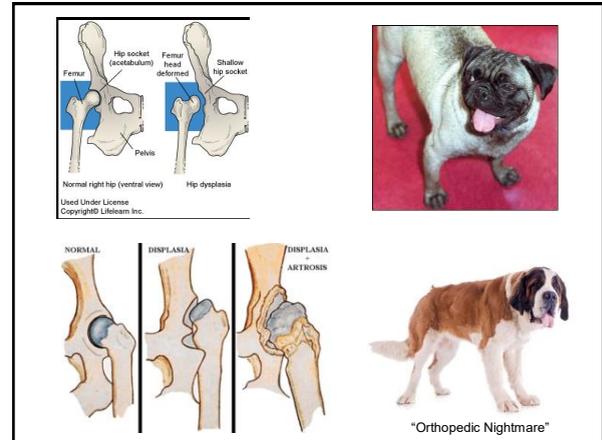


Compare/contrast human and veterinary disease states with emphasis on treatment.

Inflammatory musculoskeletal conditions such as hip dysplasia or other orthopedic issues in dogs. Typically progressive and chronic medical management with pain medications and/or NSAIDs is frequently required for the remainder of the animal's life.

Hip dysplasia is a crippling disease observed in almost every breed. Common clinical signs in patients with DJD are;

- Difficulty getting up from a lying position
- Difficulty in ascending or descending stairs
- Changed in appetite or behavior
- Stiff gait, lameness, reduced range of motion
- Atrophy of muscles surrounding the affected area, "rabbit hop"
- Joint swelling, joint instability, crepitus
- Dull, aching pain



Treatment Options

- Joint Supplement/condroprotective
- NSAID such as Rimadyl or Deramaxx
- Tramadol - analgesic effects better with an NSAID, ~10mg/kg
- Gabapentin tabs/caps only. **Liquid contains xylitol that is toxic to dogs!**
- There is no FDA approved for *chronic* use in cats. Will try using Metacam chronically.



Diabetes Mellitus in Dogs and Cats

Compare/contrast human and veterinary disease states with emphasis on treatment.

- Dogs and cats can develop insulin-dependent diabetes mellitus (DM) similar to humans. In both species, DM is a result of the loss or dysfunction of pancreatic beta cells. Eventually, the diabetic dog or cat will exhibit classic signs of diabetes such as; polyuria, polydipsia (PU/PD), polyphagia, and weight loss which sends them to the veterinarians office for a consult.
- Cats – early on they are most similar to a Type II person, but will eventually progress to being insulin dependent.
- Dogs – immune mediated, like a Type I person, will always be insulin dependent.

Compare/contrast human and veterinary disease states with emphasis on treatment.

- Additional complications may include cataracts in dogs.
- Diabetic neuropathy will cause cats to become progressively weaker in the rear legs and they assume a unique posture termed plantigrade stance.



Figure 3.

Cat with plantigrade stance due to diabetic neuropathy.



Compare/contrast human and veterinary disease states with emphasis on treatment.

- Insulin and diet modification form the basis of treatment in canine and feline DM. Treat for improvement in PU/PD.
- Be aware of the unit strength of insulin formulation a pet is using and guide owners to purchase the correct corresponding syringes. Human products (Lantus®, NPH®, Levemir®) are formulated in a concentration of 100 units/mL, veterinary insulin products (Vetsulin®, ProZinc®) are formulated in a concentration of 40 units/mL.
- Pharmacists are well positioned to counsel and educate pet owners on the need for pairing of the correct insulin product with the corresponding syringes.
- One web site that pharmacists can recommend for owner education and support is www.petdiabetes.com

Species	Drug Name	Common Dosing Ranges
Feline **Meow**	Lantus® (glargine U-100)	0.25-0.5 units/kg SQ every 12 hours.
	ProZinc® (protamine zinc insulin U-40)	0.1-0.3 units/pound (0.2-0.7 units/kg) SQ every 12 hours. Use U-40 syringes.
Canine **Woof**	Vetsulin® (porcine zinc lente, U-40)	0.5 units/kg SQ once or twice daily Use U-40 syringes
	NPH® (neutral protamine hagedom U-100)	0.5-1 unit/kg SQ once or twice daily
	Levemir® (detemir U-100)	0.1-0.2 units/kg SQ every 12 hours

Dosing reference taken from PHA 6935 Veterinary Pharmacy Course Content



Signs of hypoglycemia; lethargy, vomiting, anorexia, abnormal gait, weakness, strange behaviors or tremors.

If signs of hypoglycemia, rub 1 to 2 teaspoons of corn syrup onto the gum tissue. If the animal responds within 5 minutes, offer them food. If the animal does not respond within 5 minutes, seek veterinary care.



Chronic Renal Failure in Cats



Compare/contrast human and veterinary disease states with emphasis on treatment.

- Chronic renal failure (CRF) is one of the most common illnesses affecting geriatric cats. It is progressive, no cure.
- There are many potential causes of CRF; genetic factors, diabetes, polycystic disease, infections, neoplasia, hypercalcemia and idiopathic.
- The staging of CRF into one of four stages is reflective of the remaining level of kidney function.
 - Stage 1, the kidneys have experienced a renal insult, but azotemia and clinical signs have not developed. This stage usually goes undetected.
 - Stage 2 includes decreased glomerular function and the beginning of azotemia. Very early signs of polydipsia and polyuria may occur.
 - In stages 3 and 4, at least 75% of the nephron has been destroyed. Azotemia is commonly present and the cat will exhibit clinical signs of weight loss, poor appetite, vomiting and lethargy.

			
STAGE I	STAGE II	STAGE III	STAGE IV
Normal appearance	There may be an increase in drinking and urination	Common signs include: <ul style="list-style-type: none"> frequent drinking frequent urination reduced appetite weight loss dehydration vomiting a dull unkempt coat weakness 	Common signs include: <ul style="list-style-type: none"> possible mouth ulcers blindness severe vomiting diarrhoea refusal to eat dehydration weakness lethargy

Kidney disease is 7 x more common in cats than dogs.

Compare/contrast human and veterinary disease states with emphasis on treatment.

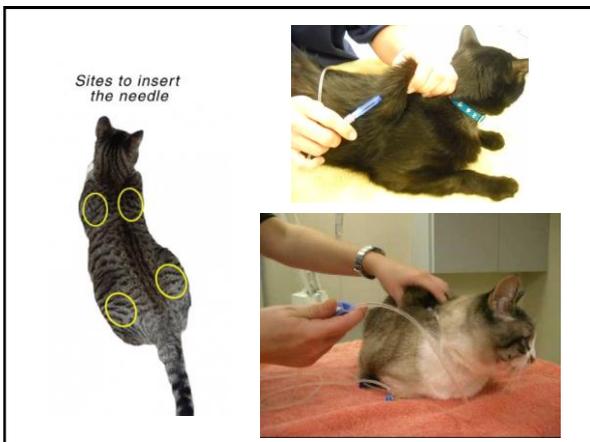
- Treatment is directed at the complications of decreased kidney function. Designed to correct deficits and excesses in fluid, electrolyte, acid-base and nutritional balance to minimize the loss of renal function.
- Cats suffering from long-term kidney failure will often undergo fluid therapy to prevent dehydration. Fluid therapy is the mainstay of treatment for cats with CRF, along with dietary management. Fluid administration corrects dehydration and increases urine production, which decreases azotemia. Acid-base imbalances, particularly metabolic acidosis, are common complications of CRF.
- Managing dehydration and electrolyte imbalances can extend the lifespan of CRF cats by 1-3 years.

Compare/contrast human and veterinary disease states with emphasis on treatment.

- It can be difficult for cats to drink as much water as needed to prevent dehydration. If water consumption is inadequate to compensate for polydipsia, dehydration will result.
- Clinical signs of dehydration are decreased appetite, lethargy and constipation. Patients that develop recurring episodes of dehydration are candidates for intermediate or long term therapy for SQ fluids administered at home by the owner.
- LRS and NS are the two most commonly used fluids. Relatively inexpensive and owners can be taught proper in-home administration techniques. Fluids selected for SQ administration should provide adequate free water and electrolytes for best management.
- A typical cat may receive 75-150 mL of fluids daily or as needed.

Compare/contrast human and veterinary disease states with emphasis on treatment.

- Fluids are typically administered along the cat's dorsal line on the neck or behind the shoulders.
- Commonly used needles for administration are 18 or 20 gauge in size. Pharmacists are well positioned to educate animal owners on the use of syringes, needles, IV extension sets and techniques to minimize contamination of bags of fluids.
- Unlike human medicine, it is common for a bag of fluids to be stored in the refrigerator and used until the contents are gone. Yes, you read that correctly..... 😊
- In addition to fluid therapy, most patients will be fed special diets that are formulated for CRF patients. These diets are often low in protein, phosphorus, calcium, and sodium. Often restricted, termed "prescription" diets obtained from the attending veterinarian.
- Reducing the amount of protein in the diet helps prevent azotemia and reduce clinical signs of the disease.



Clinical Pearl

Subcutaneous Fluid Administration for Needle-Nervous Clients by Liz Hughston.

Our dog threw up last night at 4 am. He kept me company while I cleaned it up.



Congestive Heart Failure



Compare/contrast human and veterinary disease states with emphasis on treatment.

Clinical signs of heart failure are caused by the accumulation of fluids, low cardiac output, changes in cardiac and skeletal muscle and congestion.

A dog with CHF is typically brought into the veterinarian for cough, dyspnea, exercise intolerance, abdominal enlargement or syncope. Cats are usually brought into the veterinarian for breathing or walking problems. The breathing problems are due to pleural effusion or pulmonary edema.

Owners usually complain of exercise intolerance and syncope. Clinical signs are weak arterial pulses, tachycardia, arrhythmias, and cool extremities as well as weight loss, exercise intolerance, dyspnea, and decreased muscle mass. Signs of fluid retention in left-sided heart failure include complaints of dyspnea, orthopnea, exercise intolerance, and cough.



Compare/contrast human and veterinary disease states with emphasis on treatment.

- The goal for managing CHF is to control the clinical signs related to the disease. Since this is a progressive disease, there is no cure.
- Therapy typically consists of three drugs; a diuretic, a positive inotropic agent and an ACE-inhibitor. The diuretic reduces preload and/or afterload, the positive inotropic agent improves cardiac function, and the ACE-inhibitor is a vasodilator.

Common signs of heart failure

CONGESTIVE	LOW OUTPUT
<ul style="list-style-type: none"> Coughing Dyspnea/orthopnea Anorexia/lethargia Edema/ascites Restlessness, especially at night 	<ul style="list-style-type: none"> Tire easily Reluctance to exercise Less playful Lethargic Depressed Collapse/syncope

Signs can be subtle
May be discounted as signs of aging

Compare/contrast human and veterinary disease states with emphasis on treatment.

- Loop diuretics are the most effective agent in decreasing blood volume and reducing signs of congestion. Furosemide (Salix® veterinary) can be orally dosed to manage CHF in both cats and dogs. It is common to see the human generic formulation used in small animal patients.
- Dog starting dosing is 2.2 mg/kg Q 12-24 hours, increase as needed.
- Cats are started initially on 6.25 mg/day.



Compare/contrast human and veterinary disease states with emphasis on treatment.

ACE-inhibitors- use for their vasodilating effects to decrease systemic vascular resistance, adverse cardiac remodeling, and hypertrophy effects. Enalapril (Enacard® veterinary) is a FDA approved ACE-inhibitor for dogs and cats.

Dosage for dogs is 0.5 mg/kg PO BID
cats is 0.5 mg/kg QD.

Retail and community pharmacists may see the human generic prescribed over the brand name veterinary product.



Compare/contrast human and veterinary disease states with emphasis on treatment.

- Pimobendan (Vetmedin®) is FDA approved for use in dogs with CHF. Vetmedin has largely displaced digoxin therapy and is considered the positive inotropic drug of choice for CHF. It is indicated for management of the signs of mild, moderate, or severe CHF in dogs due to dilated cardiomyopathy.
- Pimobendan is a phosphodiesterase-III inhibitor that increases intracellular calcium sensitivity in the cardiac contractility apparatus. This leads to increased cardiac contractility without an increase in myocardial oxygen consumption.
- Pimobendan is a non-sympathomimetic, non-glycoside inotropic drug, and it is considered an "inodilator" because it also exhibits vasodilator effects.
- Do not use in cats because cats with CHF usually have hypertrophic cardiomyopathy, which is a contraindication.

Compare/contrast human and veterinary disease states with emphasis on treatment.

Behavioral symptoms of separation anxiety most commonly manifest as a pet vocalizing, chewing destructively, urinating, or defecating when the owner is away. Some pets may even show aggression, refuse to eat, vomit, or salivate excessively. Dogs who bark when they are alone are in the midst of a vicious cycle.

If medication is the only approach used for treatment the results are often poor. Just like human behavior modification, i.e. smoking.

- The treatment options for behavioral modification and separation anxiety;
- Tricyclic antidepressants (TCAs)
- Selective serotonin re-uptake inhibitors (SSRIs)
- Monoamine oxidase inhibitors (MAOI's)
- Benzodiazepines (BDZ)
- Bupirone



DRUG	DOGS	CATS
Acetpromazine	0.5-0.2mg/kg PO	1.1-2.2mg/kg PO
Veterinary - Promace		
Amisguiline	Starting dose of 0.5 mg/kg PO Q 12h, then can be increased up to 3 mg/kg PO Q 12-24h. ^{1,3}	Starting dose of 0.5 mg/kg PO Q 12h and then increased up to 2 mg/kg PO Q 12-24h. ³ Or, 2.5-7.5 mgical PO Q12-24h. ⁴
Alprazolam	For anxiety disorders: 0.01-0.1mg/kg PO. Start with 1.2mg (total dose) for a medium sized dog. Do not to exceed 4mg/dog/day. ^{1,3}	For anxiety disorders 0.125-0.25mg/kg PO Q12. ^{1,4}
Bupirone	Low grade anxiolites and fears: 1mg/kg PO Q 8-24h. Mild anxiety: 2.5 - 10mg per dog PO Q 8-24h. Severe anxiety, thunderstorm phobia: 10-15mg/dog PO Q 8-12h. ^{1,3}	for low grade anxiety and fears: 0.5-1mg/kg PO Q 8-12h or 2.5-5mg per cat PO Q 8-12h x 6-8w. ^{1,4} Or, 1-2 mg PO Q 12h. Or, 2.5-5mg per cat PO BID. ^{1,4}
Clomipramine	1 mg/kg PO Q 12h X 2 weeks, then 2mg/kg PO Q 12h X 2w, then 3 mg/kg PO Q 12h X 4w, and then as a min dose. ^{1,14}	0.5 mg/kg PO Q 24h. ^{1,3} Or, 1-2.5 mgical PO Q 12-24 hours. ³
Veterinary - Clomicalm,	2-4 mg/kg/day PO. ¹	

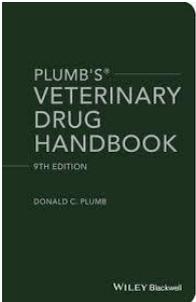
Dosing reference taken from PHA 6935 Veterinary Pharmacy Course Content

Diazepam	0.5-2.2 mg/kg PO one hr before trigger stimulus and repeated prn. ^{1,11}	0.2 mg/kg PO Q 12h, can be increased up to 0.4 mg/kg PO Q 12-24h. ^{1,11} For urine spraying: 1-2.5mg per cat PO Q8-12h. ¹¹
Fluoxetine	Starting dose of 0.5 mg/kg PO Q 24 h X 6-8 weeks. Dose can be increased up to 1 mg/kg PO Q 24h. ^{1,11,14}	0.5-1 mg/kg PO Q 24h X 6-8 weeks to start. ¹³ Or, 1-5 mg/cat PO Q 24h in the am. ¹
Paroxetine	0.5-1.1 mg/kg PO Q 24h for 6-8 weeks. ^{1,11}	0.5 mg/kg PO Q 24h for 6-8 weeks. ¹³
Selegiline Veterinary - Anipryl	For depression anxiety due to decreased cognitive function: 0.5-1 mg/kg PO Q 24h. ¹	Or, 1.25-2.5 mg/cat PO Q 24h. ¹ 0.25-1 mg/kg PO Q 12-24h using the lowest dose possible. ^{1,11}
Sertraline Human - Zoloft	2-4mg/kg PO once daily or divided BID, OR 1-4mg/kg PO Q24 for compulsive disorders. ¹¹ For dominance aggression 0.5-1mg/kg PO Q24. ¹¹	0.5mg/kg PO once daily OR 0.5-1mg/kg PO Q24 for compulsive disorder or urine marking. ¹¹

Dosing reference taken from PHA 6935 Veterinary Pharmacy Course Content

Clinical Pearls

- If you see "SID" on a veterinary prescription in the sig it means once-a-day.
- The Veterinary Drug Handbook, written by a pharmacist, and is considered one of the most useful references in veterinary pharmacy. Verify indications, dosages, contraindications and a wonderful tool for patient counseling.
- Print or online (for 1 year) \$85.



"The Virus"

Online Subscription to the VDH



Questions? Let me know if I can do anything to assist...

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