18th Annual

SMALL ANIMAL VETERINARY SYMPOSIUM

Sunday, March 19, 2017

9:00 a.m. – 6:30 p.m.

San Francisco Airport Marriott
1800 Old Bayshore Highway.
Burlingame, CA 94010
(650) 692-9100

SAGE

CENTERS FOR
VETERINARY SPECIALTY
AND EMERGENCY CARE

SAGE

Our Mission

To set the highest standard of compassionate, collaborative veterinary care that improves the lives of pets and people.

Our Values

Compassion
Service
Integrity
Collaboration
Sustainability
Innovation

Sage Philosophy

We believe animals are amazing.

We are here because we appreciate and love animals. We will give pets and their families the best possible care with kindness and respect.

We believe in continual learning.

Our profession is based on scientific knowledge. Our success depends upon creative problem solving, up-to-date training, and the finest skills. We are committed to advancing veterinary medicine and improving pet care throughout the Bay Area.

We believe in collaboration.

We work in partnership with referring veterinarians and one another, knowing it is fundamental to our integrated approach and to continuity of care. All of us are responsible for maintaining the high standards and positive attitude that make Sage a great place to work.

We believe we are part of a greater whole.

In pursuing our mission, we have both opportunities and an obligation to contribute to our communities, to minimize our environmental impact, and to model sustainability.

18th Annual SAGE Small Animal Symposium
Sunday, March 19, 2017

Thank you for attending the 2017 SAGE Symposium! SAGE Centers for Veterinary Specialty and Emergency Care is pleased to provide a full day of continuing education to Bay Area veterinarians, technicians, managers, and client service staff. We look forward each year to spending this enjoyable and informative day with you.

We hope that you enjoy the educational program offered and take the opportunity to foster ties within our regional veterinary community. Following the event, please take a moment to fill out our online evaluation and let us know your thoughts. Your suggestions are not only welcome, they are essential in ensuring that this event is the best it can be year after year!

Since Last Year's Symposium:

• SAGE moved from San Mateo into our new Redwood City facility in October 2016. Located at 934 Charter Street, the new hospital features a state-of-the-art critical care unit with quiet cat ward; five operating rooms, including an interventional procedure suite; dedicated wet & dry physical rehabilitation spaces; and a spacious conference room for community and educational events.

• We welcomed AnimalScan Advanced Veterinary Imaging to our Campbell and Redwood City facilities. MRI scans are now able to be conducted on-site using a high-field scanner.

• We've added a new specialty. This March, SAGE introduced Dermatology at our Concord and Dublin facilities, where Dr. Stacey Holz will treat and diagnose patients with varied skin conditions.

• We've welcomed 12 new doctors to our growing team, several of whom will be speaking at this year's event. We hope you get a chance to meet with those who are in attendance.

Dr. Matt Blanchong	Emergency/Critical Care	Concord
Dr. Margot Daly	Physical Rehabilitation	Campbell
Dr. Mark Dosch	Surgery	Concord, Dublin
Dr. Ryan Garcia	Internal Medicine	Campbell
Dr. Stacey Holz	Dermatology	Concord, Dublin
Dr. Terence Krentz	Emergency/Critical Care	Campbell
Dr. Kelly Lin	Emergency/Critical Care	Campbell
Dr. Jennifer Martin	Alternative Medicine	Redwood City
Dr. Colleen McCoy	Surgery	Redwood City
Dr. Ayeley Okine	Internal Medicine	Concord
Dr. Rebecca (Beki) Regan	Oncology	Campbell
Dr. Abbie B. Whitehead	Alternative Medicine	Dublin

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Track 1

Anticonvulsants & Long-term Seizure Monitoring

Starr Cameron, BVetMed, DACVIM (Neurology)

Seizures

- Causes
  - ***Primary***: Idiopathic Epilepsy Definition
    - Usually between 6 months and 5 to 6 years old
    - Completely normal in between the seizures
    - Normal neurologic exam (except if performed immediately during post-ictal period)
  - ***Secondary/Symptomatic***: neoplasia, infectious/inflammatory disease, trauma, ischemic/vascular disease, storage diseases
  - ***Reactive***: metabolic/electrolyte disturbances (hypoglycemia, hepatic encephalopathy, hypocalcemia), toxins (lead, ethylene glycol)
- Definitions
  - ***Status Epilepicus***: seizure activity lasting longer than 5 minutes
  - ***Cluster Seizures***: 2 or more generalized seizures within 24 hours
  - ***Generalized***: previously called "grand-mal", classic tonic/clonic seizure activity with loss of consciousness
  - ***Partial or Focal***: can include motor activity, such as gum chewing, fly biting, repetitive movement of one or more limbs – without loss of consciousness; can also include an acute behavior change, such as absent seizures when the pet appears to "spaced-out", or fear or aggression
- Differentials that may be confused for seizures but are not actually seizures
  - Common:
    - Vestibular Disease
    - Pain – especially neck pain
    - Syncope
    -
  - Uncommon:
    - Myasthenia gravis
    - Sleep Disorders
    - Behavior Abnormalities
    - Narcolepsy

Anti-Epileptic Drugs

- **When to start treatment?**
  - Any episode of status epilepticus or cluster seizures
  - Seizures that occur more frequent than once every 4 to 6 weeks
  - A single seizure that has a life-threatening complication
  - If a seizure is under the category of symptomatic or reactive then the underlying disease should also be addressed.
- ***Phenobarbital (PB)***
  - Dose (initial): 2-3 mg/kg (1 mg/lb) PO BID
  - Elimination half-life (T½e): dogs - 40-90 hrs (72 hrs), cats - 40-50 hrs (48 hrs)
  - Therapeutic monitoring: serum PB level, CBC/Cheimstry 2 - 3 weeks after starting. Goal is either seizure control & 20-30 ug/mL serum level. Recommend CBC/chemistry/PB level q6-12 months therapy or pending seizure control
  - Pros: predictable, inexpensive, readily available, intravenous formulation, numerous tablet sizes, effective/reliable
  - Cons: polyuria/polydipsia, polyphagia, sedation (moderate to severe, but usually transient), ataxia/weakness, hepatopathy (dose and time dependant), p450 enzyme induction, idiosyncratic bone marrow necrosis (rare), will see an elevated ALP
    - Will make dogs appear hypothyroid on bloodwork so only treat for hypothyroidism if indicated by clinical signs

- ***Zonisamide (Brand: Zonegran)***
    - Dose: at least 5 mg/kg PO BID(dogs), SID (cats)
        - 10mg/kg PO BID(dogs) and SID (cats) if also receiving Phenobarbital
    - T½e: dogs - 15 hours, cats - 33 hours
    - Therapeutic monitoring: CBC/chemistry within first 10-14 days of therapy to monitor for idiosyncratic reactions
    - Pros: BID dosing, SID dosing in cats, anecdotally more effective than levetiracetam and gabapentin, less sedating than PB/BR, fewer side effects, effective
    - Cons: sedation (dose dependant and usually mild and transient), keratoconjunctivitis sicca (very rare), idiosyncratic hepatic necrosis (1 reported case), metabolic acidosis (subclinical), anorexia/vomiting/diarrhea (more common in cats and dose dependant)
- ***Bromide (KBr)***
    - Dose (initial): 30-40 mg/kg q 24 hrs or divided and given BID
    - T½e: dogs - 25 days, cats: do NOT give due to high risk for airway disease
    - Therapeutic monitoring: serum BR level 3-4 months (steady state). Therapeutic goal 1-2 mg/mL serum [Br] if used with PB or 2-3 mg/mL serum [Br] if monotherapy.
    - Pros: no hepatic metabolism (useful for hepatic encephalopathy or animals with liver disease), effective especially for intermittent cluster seizures or occasional protracted seizures, synergistic with PB
    - Cons: gastritis, pancreatitis, polyuria/polydipsia, polyphagia, sedation (potentially moderate to severe), ataxia/weakness fairly common, takes a very long-time to become therapeutic, the diet must remain VERY consistent or levels can change quickly and dramatically
- ***Levetiracetam (Brand: Keppra)***
    - Dose: 20 – 30 mg/kg PO TID
    - T½e: dogs – 3 – 4 hours, cats ~3 hours
    - Pros: no hepatic metabolism (useful for hepatic encephalopathy or animals with liver disease), less sedating than PB/BR
    - Cons: sedation/ataxia (dose dependant and usually mild), must be given TID for seizures as half-life is so short
    - Other: Keppra XR (extended release) - 500 mg, 750 mg, 1000 mg tablets. Tablets cannot be split (film coated for extended release). T½ e 20 hr in dogs (improved bioavailability and time to steady state if given with food). Dosing 30 mg/kg BID. Some dogs do not process this medication at all.
- ***Gabapentin (Brand: Neurontin)***
    - Dose (antiepileptic): 15 – 30 mg/kg PO TID
    - T½e: dog – 3 – 4 hours, information on use in cats is anecdotal
    - Pros: effective for *partial seizures* and seizure-like conditions (feline hyperesthesia syndrome), inexpensive, less sedating than PB/BR
    - Cons: sedation/ataxia (dose dependant and usually mild), must be given TID for seizures as half-life is so short
- ***Pregabalin (Brand: Lyrica)***
    - Dose: 2 - 4 mg/kg BID to TID; usually start BID and with half the dose, as can be very sedating, especially in cats
    - T½e: dogs - ~7 hours, cats - no information
    - Pros: less sedating than PB/BR combination, has been the “magic drug” for some refractory epileptics

- Cons: sedation/ataxia can be profound, especially in cats, VERY expensive if NOT compounded by a veterinary compounding pharmacy

- ***Felbamate***
  - Dose: 15 mg/kg PO BID to TID, can be increased by increments of 15mg/kg every 2 weeks until seizures are controlled, doses not to exceed 300mg/kg/day
  - T½e: dogs - ~4 to 8 hours, cats - no information
  - Pros: less sedating than PB/BR combination, has controlled seizures in some refractory patients, tolerated very well in most patients, but the side effects can be quite varied
  - Cons: hepatic toxicity (especially if patient is on other medications that are metabolized by the liver), nervousness/anxiety (usually at higher doses), KCS, idiosyncratic blood dyscrasias, generalized tremors in small dogs (rare), cytochrome P-450 and may increase blood levels of Phenobarbital, expensive
- ***Topiramate***
  - Dose: 2 - 10 mg/kg BID to TID; usually start BID at 2 mg/kg and then double the dose every 2 weeks until at 10 mg/kg dose
  - T½e: dogs 2 – 4 hours, cats - no information
  - Pros: fewer side effects, minimal metabolism
  - Cons: sedation/ataxia can be profound, especially if start with the higher doses initially; moderate cost
- ***Diazepam (Brand: Valium) and Midazolam***
  - Oral diazepam is not a useful AED in dogs because of the short T½e and development of tolerance. Diazepam is NOT recommended orally in cats due to a risk of idiosyncratic l hepatic necrosis.
  - Dosages: IV - 0.5mg/kg, Rectal - 1mg/kg
  - Pros: very fast acting, usually get the seizures stopped quickly
  - Cons: goes away very fast, therefore another anti-epileptic drug SHOULD be given at the same time as the diazepam/midazolam
- **Clorazepate (also a benzodiazepine)**
  - Dose: 0.5 – 1 mg/kg TID
  - T½e: dogs – 3 to 6 hours, cats - no information
  - Pros: works quickly due to short half-life, useful for at-home use in patients that tend to have clusters
  - Cons: sedation/ataxia can be profound, levels tend to decrease with time and increases in the dose of medication is usually needed, can increase the blood levels of Phenobarbital and cause an increase in Phenobarbital side effects
- **Which Drug to Choose?**
  - 1st line
    - Phenobarbital
    - Zonisamide
    - Bromide – not in a status epilepticus or cluster situation due to long half-life
    - Keppra – if seizures are short, partial, or there is a long time (weeks to months) between the seizures, or in ANY patient with severe liver concerns
  - Pulse dosing – only in the appropriate circumstances
    - Keppra
    - Clorazepate

A Paradigm to the Orthopedic Exam

William E. Scherrer, DVM, DACVS

The orthopedic exam is a tough topic to discuss, because it is a segment of veterinary medicine which truly embodies the concept of “practice makes perfect”. During this lecture, I will talk about the thought processes and actions I employee with every patient I see for orthopedic evaluation. Please keep in mind that what works for me may not work for everyone, but I believe the basic ideas and principles translate across most clinical situations.

These are my techniques, opinions, and methods and are not set in stone…not even for me. They represent the means by which I have taught veterinary students, interns and surgical residents to approach the orthopedic workup, with hopes that they will perform a complete and thorough evaluation, and put themselves in position to discover the correct cause of the patient’s problem. If one knows the correct source of injury, one is better able to formulate a cohesive plan for treatment, and provide a more accurate prognostic picture for the patient’s owner.

Typically, the “exam” starts before the patient or owner enters the hospital. This is why our staff is so motivated to acquire records and imaging from the referring hospital prior to the patient’s visit.

I had a professor in college (I was a psychology major, so take this with a grain of salt) tell the class that “stereotypes are merely a shortcut that your brain uses to more efficiently assess situations”. If you think about human development, this makes perfect sense. We evolved in a dangerous world, where “fight or flight” decision making often meant the difference between survival and elimination. Anything our ancestors could use to make that decision making process faster or more efficient provided a survival advantage. Of course, in modern times, the thought of stereotyping is marred by negative connotations, but in its purest form, it serves a strong purpose for us still. The main danger associated with stereotyping in the context of medical analysis, is not letting go of your initial pre-analysis in the face of contradictory data.

With regard to the orthopedic exam, I mentioned that mine begins prior to patient arrival…that is to say, it starts with reviewing the pertinent records and imaging, and utilizing learned stereotypes.

The signalment begins the process. Age of the patient, breed predispositions, sexual status…these are all important aspects in beginning the analysis. A 5-year-old MC Labrador is not a 5-year-old MC German Shepherd is not a 5-year-old MC Greyhound.

The history presented for the pet can give significant clues as to the origin of lameness problems. The owner's assessment and history is often vital, and can differ markedly from the history found in records or the history as it is relayed from one staff member to another. The etiology of the injury, if known…or even the lack of a known etiology, can provide hints at the cause. Historic progression of lameness or static nature of the lameness can lead to an idea of underlying cause; or potentially, the notation of intermittent lameness with instant spontaneous resolution for a period of time, as is often reported with medial luxating patella in small dogs. Is the description more consistent with true lameness, or are there subtle descriptions of actual weakness, which would lead in a direction of neurologic deterioration as opposed to orthopedic etiology. Additionally, the presence of other medical disease may hint at sources for the owner's noted presentation: laryngeal paralysis is often concurrent with degenerative neurologic disease, hypothyroidism may predispose to generalized muscle weakness and dysfunction, Cushing's disease an lead to general muscle atrophy and weakness, etc. Travel history and tick exposure can also lead to uncovering vague sources of lameness.

Next, the referral physical exam findings may reveal significant information, and may be very different from currently visualized or reported findings. Often, the referral exam is very similar to findings at my hospital; however, when they vary significantly, the picture can become extremely interesting. If the report notes the contralateral limb involvement, we may be dealing with a bilateral disease, shifting limb lameness, multi-joint pathology, etc.

Lastly, the referral imaging can provide significant clues regarding the underlying disease process. Occasionally, there is evidence of chronicity that is surprising to owners, but may help paint a clearer picture of etiology and expected progression for the disease process. Degenerative joint disease, bone neoplasia, irregular growth, development and repair can all be evidenced on radiographs, among other things.

So, we have evaluated the signalment, history and records, and correlated those findings with available imaging. We have additionally cross-referenced the historic data with the patient's owner's assessment, recollection and current complaint…all of this prior to any physical contact with the patient. This can allow us to note if any stereotype we have developed fits with the patient's reality, and it is time to begin the actual orthopedic and general physical exam.

Above all else, for the orthopedic exam, the best advice I can give is to make the exam repeatable. It will seem monotonous, boring or even machine-like to some, but if you perform the exam the same way consistently, you will develop a clear ability to discern normal versus

abnormal, breed and species differences, and you are much less likely to miss/skip important findings.

My physical assessment actually begins while I am discussing the case with owners. I request that they allow the patient to wander around the exam room at their will. Not only will it often allow the owners to relax and more accurately convey their concerns, but it gives the patient the opportunity to move without having the feeling of being dominated or tested. If they feel less crowded, and as if a pack or predator is not judging their ability, sometimes they will show subtle changes they wouldn't otherwise allow to be evident if they felt threatened by a stranger standing directly over them.

Once the history is obtained and some potentially valuable insight is gained by casual observation, we move to the outside movement analysis. If possible, I like owners to walk their dog so the patient again feels as relaxed as possible, in the current situation. Initially, I encourage owners to allow their dogs to sniff anything/everything, pee, poo, go straight or circle, up and down stairs and hills, etc. It is very relaxed by design. After the casual movement for a couple minutes, we have more structured mobility assessment. Walking in a straight line, followed by trotting and possible running give basic information, and often is adequate for the purposes of our evaluation. However, there are times when slow movement up and down an incline such as stairs and hills is necessary to bring the lameness to light. Progressively tighter circling, first in one direction, then in another may demonstrate a subtle favoring, or more often, ataxia. All of the above findings are taken in whole.

After we move back into the protected environment of the exam room, I like to do a quick and relatively non-intrusive exam, combining orthopedic and general evaluation with a small massage. This is the beginning of my palpation examination. First, I feel for muscle symmetry. You can tell a lot about atrophy, balance, muscle tone and weight distribution from a brief running of your hands over the body surface of the patient. I then move down the thoracic limbs, feeling for joint effusions and/or soft tissue masses or swellings. I then auscult the heart and lungs, and move to spinal palpation. This leads me into gastrointestinal palpation, followed by hind end assessment for muscle disparity, effusions, and swellings. Finally, I lift the tail to note any discomfort, evaluate the rectum and check for conscious proprioception. The key points here are that, a) the entire exam to this point has been without stress (usually), and can be extremely informative, and b) has not taken long to perform.

In my experience, muscle atrophy is common with patients suffering orthopedic lameness for any substantial period of time. However, significant unilateral muscle atrophy

typically accompanies neurologic and/or neoplastic processes. Whereas, significant generalized muscle atrophy may be more likely with endocrinopathies or other systemic disease.

Joint effusions are more readily apparent in my opinion when the animal is standing, and compressing the joints. Single joint effusion may be expected with certain orthopedic conditions, and even bilateral joint effusion may be common. However, multijoint effusion may simply reflect unfortunate multijoint arthritic pathology, or may actually represent immune-mediated polyarthritis or other infectious/inflammatory diseases.

Spinal pain, especially in the absence of obvious orthopedic discomfort or disease, taken in combination with ataxia or other neurologic signs, will result in an immediate referral to our neurology service (those of you who work with me know that I am not keen on working up neurologic disorders). The exception would of course be, that the neurologic findings are long-standing, while the lameness complaint is newly recognized.

Based on the findings from the above workup, the next step would typically be the recumbent examination. Some patients do not mind this process, while others will fear for their lives and react negatively as their fight or flight response kicks in. I try to avoid sedation if at all possible, in order to obtain a realistic and representative reaction to a given stimulus. I like to begin the exam with the affected limb. This is a change from the beginning of my career, when I tried to manipulate the affected limb last, thinking that the patient may realize that the exam was not overly concerning, and might relax a bit by the time I started on that limb. However, over time I came to realize that I was more likely to miss any short window of tolerance I may have had to assess the lameness before the patient completely lost patience.

During the recumbent palpation, I work from the digits to the trunk in a systematic fashion. I flex and extend each digit, and palpate between each digit and between the pads. I palpate the region of the sesamoids at the metacarpal or metatarsal pads, and flex/extend each of the major joints, assessing range of motion, crepitus and comfort. Next, I palpate the associated long bones and soft tissues as I progress proximally from one joint to the next, until reaching the trunk. Finally, I palpate the axillary or inguinal region for masses or discomfort.

If time and tolerance of the patient permit, I will palpate all of the limbs in this fashion, if for no other reason than to establish a baseline of knowledge moving forward.

After recording all pertinent findings, I like to review the referral imaging with owners. I believe this helps solidify their understanding of the disease process, as well as giving them a sense of engagement and investment in their pet's welfare. I begin this evaluation by ensuring

that the date on the films correlates with the owner recollection, record notations and patient physical findings. I then like to verbally confirm laterality of the radiographs. This can either reaffirm the current complaint and findings, or it may remind owners of a previous problem that may not have been noted in the history, but is very beneficial information.

After ensuring that the radiographs are representative of the current issue, we (the owner and myself) will assess all seemingly unrelated areas first. This can not only allow reveal previously unidentified problems, but, more commonly, I will use it in order to establish a better owner understanding of normal anatomy and the process by which radiographs are evaluated. It helps to understand that x-ray exposure to the developer through air results in areas of black, that blockage of the x-rays (as with bone and metal) results in white, and that some soft tissues with high water density may be grey. Armed with that brief introduction, we look at the long bones for smooth, homogenous continuity. If there are areas of irregular bone density or development, owners can better understand the findings. Fractures and laxations tend to be pretty self-explanatory.

Next, we transition to the joints. Joint discussion can be more challenging to explain to owners, but I make every attempt to explain what it is that I am seeing (and forgive any lack of understanding on their part by explaining that it took thousands of radiographic evaluations for me to develop an acute sense of normal, so it should be easier for me to assess subtle changes than it would be for them, with their 5-minute introduction to radiographic evaluation).

Lastly, we may discuss soft tissue findings (or lack thereof). Most commonly, this is in the realm of questioning regarding visualization of the cranial cruciate ligament or meniscus on radiographs. Having explained briefly the relative lack of sensitivity of radiographs for evaluating soft tissue, it usually is more easily accepted that the ligaments and meniscus cannot be seen with radiographic evaluation. Often, the discussion of soft tissue evaluation for orthopedic examination centers around the development of effusion. However, occasionally there will be an abnormal accumulation of soft tissue which warrants a concern for neoplasia.

For the most part, this would conclude my typical orthopedic examination. The summarization of findings and tentative diagnosis with treatment options and prognosis would ensue. While this seems like an extended visit, with practice and repetition, this process may take a total of 20 minutes, and usually results in an owner who feels confident in the findings, is appropriately engaged in the process, and is invested and optimistic moving forward. The further discussion regarding treatment usually takes an

additional 20-30 minutes, depending on the diagnosis, resulting in a typical 45-50-minute visit for most orthopedic patients.

Fluid Therapy in the Critical Care Patient

Terence Krentz, DVM

Fluid administration is the cornerstone of treatment hypotension, hypovolemia and trauma. Its selection and use based on physiologic principles, but clinical practice largely determined by clinician preference. While there are many options, no ideal resuscitation fluid exists. Fluid therapy recommendations were largely based on the Starling's model of fluid dynamics, and have since been updated with the discovery and understanding of the endothelial glycocalyx layer (EGL).

- Classic compartment model
  - Intracellular (ICF) and extracellular (ECF: interstitial, intravascular) compartments
  - Capillaries & post-capillary venules act as semipermeable membranes absorbing fluid from interstitial space
  - Hydrostatic & oncotic pressure gradients across semipermeable membrane is the principle determinant of transvascular exchange
- Capillaries & venules act as semi-permeable membranes
  - Fluid transfer depends on net hydrostatic & osmotic forces
  - Tonicity refers to the ability of a solution to initiate water movement, and is dependent on the presence of impermeant solutes (Glu, Na+) in the solution.
- Osmotic pressure
  - Determined by the number of non-permeable particles in solution
- Hydrostatic pressure
  - Pressure exerted on a portion of a column of fluid as a result of the weight above it when at equilibrium
- The EGL is a web of membrane-bound glycoproteins on luminal side of endothelial cells
- Subglycocalyx space produces colloid oncotic pressure
  - Important determinant of transcapillary flow
- Nonfenestrated capillaries throughout interstitium have been identified
  - Absorption of fluid not through venous capillaries

  - Fluid returned to circulation primarily as lymph

- EGL
  - Semipermeable to anionic molecules (albumin, plasma proteins)
  - Size, structure determine ability to penetrate layer
  - Healthy EGL impermeable to molecules > 70 kDa
  - Thinner in microcirculation; thicker in larger vessels

- Fluid within EGL is non-circulating portion of intravascular volume
  - Protein concentration gradient between free-flowing plasma & endothelial intracellular clefts

The ideal fluid will produce a predictable and sustained increased in intravascular volume, with a chemical composition similar to the ECF. It should be metabolized and completely excreted without accumulation in tissues, nor produce any adverse metabolic or systemic effects. It also needs to be cost effective.

Types of fluids include crystalloids and colloids. Crystalloid solutions contain small molecules that easily pass through blood vessels: 0.9% sodium chloride, Lactated Ringers, Normosol. Colloid solutions are suspensions of molecules within a carrier solution. They exert an effect on plasma volume by acutely increasing colloid osmotic pressure (COP). They are relatively incapable of crossing a healthy semipermeable membrane owing to its molecular weight: synthetic colloids, albumin, blood products.

0.9% sodium chloride contains sodium and chloride in equal concentrations. This is isotonic compared to the ECF. Balanced electrolyte solutions are relative hypotonic, with a lower sodium that the ECF. These contain molecules (lactate, acetate) that can be converted to bicarbonate to minimize changes in pH. However, they are poor volume expanders but do have the ability to improve hemodynamics. Improvement in tissue perfusion is variable and transient. Proponents of crystalloids argue that colloids are expensive and impractical to use as resuscitation fluids while crystalloids are inexpensive and readily available. Crystalloids have been established (but not proven) to be effective first line resuscitation fluids. Crystalloid use is not without possible side-effects, including fluid overload, disruption of the EGL, electrolyte and acid-base abnormalities, rheologic disturbances, hypothermia, delayed recovery from anesthesia and impaired wound healing.

Proponents of colloids will argue they are more effective in expanding intravascular volume with retention in the intravascular space, maintaining COP. They are dose-reduced in relation to crystalloids, conventionally in a use ratio of 1:3 colloids to

crystalloids. They have a shorter duration of effect than albumin and are believed to plug membrane pores. But there is no proven benefit as well as a trend towards higher mortality with the risk of coagulopathy, acute kidney injury (AKI) and hypersensitivity. Generally they are more expensive than crystalloids with no effect on survival shown in multiple studies.

- Fluid administration
    - Cephalic or saphenous venous access
    - Largest gauge, shortest length IV catheter
    - Central venous access or intraosseous catheter
    - Subcutaneous fluids not recommended due to longer absorption times
- Moderate to aggressive fluid therapy regimens
    - Bolus 10-20 mL/kg to effect (1/4 shock dose)
    - Replacement of blood loss at a ratio 3:1 or a volume of 80-90 mL/kg dogs
        - Cats 45-60 mL/kg
    - Expected to increase/maintain arterial BP, cardiac output, tissue perfusion/oxygenation
    - Dehydration deficit (mL): body weight (kg) x % dehydration x 1000 (mL/L)
        - Replace over 24-48 hours
- Consequences of fluid therapy
    - < 15% of 1L bolus administered over 1 hour is retained within the vascular compartment 20 minutes after completion
    - Recipe-based fluid therapy regimens
        - Worsen pulmonary gas exchange & limit oxygen diffusion to tissues (promote capillary vascular endothelial swelling)
        - Likely to lead to interstitial fluid accumulation & detrimental dilutional effects

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Pearls of Polytrauma

Terence Krentz, DVM

Evaluation of the trauma patient begins with triage. A primary survey should be performed including the cardiovascular, respiratory, neurologic and urinary systems. Following intravenous access, collect emergency point of care blood work, perform a focused assessment with sonography (FAST) with potential sampling of cavitary effusions, and then perform a secondary survey of a more thorough exam of the patient for underlying complications.

The initial patient exam ideally should be performed in less than two minutes. The triage area should be equipped with supplemental oxygen, supplies for intravenous (IV) and intraosseous (IO) catheterization, fluids, electrocardiogram (ECG) and non-invasive blood pressure measurement (NIBP). A crash cart/kit should be readily accessible continuing endotracheal tubes, a laryngoscope, resuscitation drugs and an electrical defibrillator.

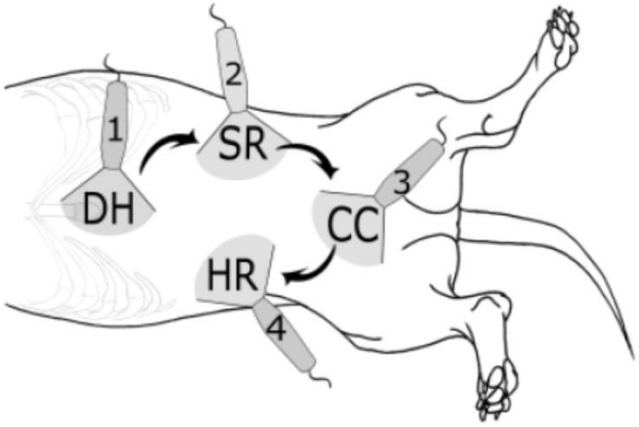
Objective measures of shock

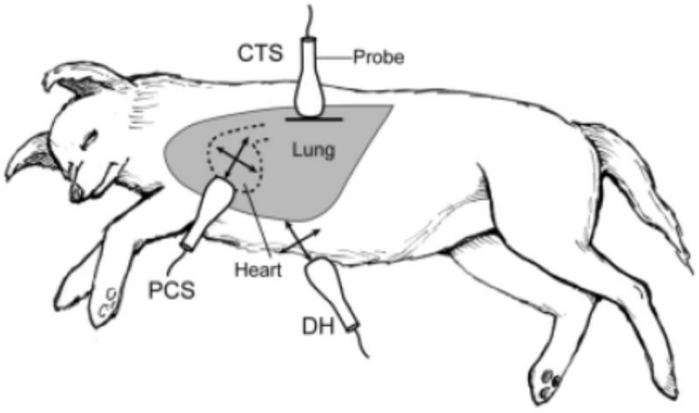
Parameter	**Value**
Mentation	Depressed
Capillary refill time (CRT)	>2 sec
Mucus membranes (MM)	Pale pink, white, injected
Heart rate (HR)	Cats: >220 or <160 beats/min Small dogs: >160 beats/min Large dogs: >100 beats/min
Respiratory rate (RR)	>40 breaths/min
Pulse quality (PQ)	Absent/weak femoral pulses
Systolic blood pressure (SBP)	<90 mm Hg
Lactate (Lac)	>2.5 mmol/L

Vascular access should be obtained through the cephalic or lateral saphenous vein. These sites are technically simple and well tolerated, but can be difficult in cases of shock. Catheters are inexpensive. Use the largest gauge and shortest length catheter available. If there are no concerns over coagulopathy or intracranial hypertension, a central venous catheter can be placed in the jugular vein using a short/long IV catheter. In the event vascular access can't be achieved, an IO catheter can be placed in the medial surface of the proximal tibia, the tibal tuberosity and the trochanteric fossa of the fumur.

An initial emergency database should at a minimum include a packed cell volume (PCV), total protein (TP), blood urea nitrogen (BUN) and glucose. More information is always better! Additional measures of perfusion include acid-base status (pH, bicarbonate, P_VCO_2), lactate as well as base excess (BE) and central venous oxygen saturation ($S_{CV}O_2$). Use of a FAST scan can provide valuable information even in studies conducted in less than five minutes, with

information such as effusion (pleural, pericardial, peritoneal), cardiac contractility and subjective estimation of volume status, as well as markers of thoracic trauma such as pneumothorax, diaphragmatic hernia or rib fractures.





The secondary survey includes a reassessment of the cardiovascular, respiratory, neurologic and urinary systems, as well as more thorough evaluation of the orthopedic system. You can also assess the efficacy of interventions such as fluid therapy with improvement in HR/PQ, as well as continued assessment for the presence/absence of effusion.

Shock is defined as an inadequate production of energy at the cellular level. This usually occurs secondary to decreased delivery of oxygen and nutrients to tissues. Shock can occur secondary to an absolute decreased in intravascular circulating volume (hypovolemic shock), a severe decreased in oxygen contents in the blood (anemia or hypoxemia), vasoconstriction or vasodilation (maldistributive shock) or failure of the cardiac pump (cardiogenic pump).

Fluid therapy is instituted with isotonic crystalloids based on estimated blood volume (60-90 mL/kg in dogs, 45-60 mL/kg in cats), given in one-quarter increments over 10-15 minutes with reassessment of vital parameters. Hypertonic solutions, synthetic colloids and blood

products have been used in the resuscitation process. Subcutaneous fluids are not appropriate due to longer times of absorption and time spent in administration.

Evolution of fluid therapy includes the use of limited volume and hypotensive resuscitation. Hypotensive resuscitation involves restoration of lower than normal systolic blood pressure (80-90 mm Hg) which helps facilitate control of hemorrhage and reduces the risk of bleeding while maintaining blood flow to vital organs (kidneys, gastrointestinal tract). Limited volume resuscitation involves a balanced fluid therapy approach using a combination of crystalloids, hypertonic crystalloids and synthetic colloids along similar principles. A conservative resuscitation strategy has shown improved survival, especially in cases of trauma but also for non-traumatic hemoabdomen.

Multimodal pain management can be employed with great success with a variety of drugs including opioids, NMDA antagonists, local anesthetics and α2-adrenergic agonists. NSAIDs are not recommend in the acute management of trauma due to concerns over coagulation (platelet function) and acute kidney injury (renal vascular vasoconstriction).

Drug	**Class**	**Dose**
Bupivacaine	Local anesthetic	1-2 mg/kg SC q6h
Demedetomidine	α2-adrenergic agonist	1 mcg/kg ; 0.5-3 mcg/kg/hr
Fentanyl	Opioid	1-2 mcg/kg ; 2-5 mcg/kg/hr
Hydromorphone	Opioid	0.05-0.1 mg/kg
Ketamine	NMDA antagonist	0.1-1 mg/kg; 2 mcg/kg/min
Lidocaine	Local anesthetic	1-2 mg/kg IV/SC; 2-3 mg/kg/hr
Morphine	Opioid	0.15-0.5 mg/kg IV slow
Oxymorphone	Opioid	0.03-0.1 mg/kg
Remifentanyl	Opioid	3 mcg/kg, 0.1-0.3 mcg/kg/min

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Should this fracture go to surgery?

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Fractures in our companion pets can be categorized many ways. Typically, most fractures are described based their anatomical location i.e., bone involved, simple vs comminuted, fracture type (transverse, oblique, spiral), location within the bone (diaphyseal vs metaphyseal), amounts of displacement (minimal, moderate, complete) as well as single vs multiple bones involvement. Accurate description of the fracture type and location is critical in determining the optimal treatment method as well as whether the fracture will respond well to non-surgical/ conservative management.

Other factors that are also important to consider when trying to determine if a facture can be successfully managed conservatively are 1) age, 2) Body Condition Score (BCS), 3) intended activities, 4) metabolic status and 5) single vs polytrauma. Fortunately, in our companion pets these factors are often known and can be applied systematically to a fracture treatment algorithm to help determine which fractures will optimally respond well to conservative fracture management. Conservative fracture management usually involves some form of splinting or casting.

Proper casting of a distal extremity requires adequately immobilizing the joint above and below the fracture. Therefore, casting whether complete or bi-valved is limited to the distal extremities involving fractures distal to the elbow and stifle involving the digits, metacarpal/ tarsal bones and radius/ulna and tibia. Fractures proximal to the elbow and stifle do not respond well to traditional casting methods. Bi-valve casting rather than a full cast is most often used as it allows future replacement of the underlying bandage while reusing the previously made anatomic cast.

Fracture treatment with a splint usually involves a pre-made splint such as a “Meta-Mason” splint or lateral pre-fabricated (Jorg-Vet) splint ideally suited for the hind limbs. In my opinion, palmar or plantar splints are best utilized for very distal fractures of the digits or metacarpal bones. Diaphyseal fractures of the radius/ulna or tibia are rarely adequately immobilized by just lateral or palmar/ plantar splinting.

Fracture proximal to the elbow or stifle can occasionally respond to specialized and difficult to apply “Spica-splint” or Schroeder-Thomas splints. The Spica-splint can effectively immobilize minimally displaced fractures of the humerus and scapular however they do require general anesthesia or heavy sedation to apply and can be very challenging and time consuming to change throughout a 6-8 week fracture healing period.

Conservatively managed fractures:

Ideal

1. Minimally displaced diaphyseal fractures of the radius/ulna and tibia
2. Metacarpal/ metacarpal fractures

3. Digit fractures

Satisfactory:

1. Distal diaphyseal fracture of the radius/ulna and tibia
2. Minimally displaced pelvic fractures
3. Mildly displaced sacroiliac luxations
4. Some spinal fractures
5. Caudal maxillary or mandibular fractures

Poor:

1. Non-reduced long bone fractures
2. Proximal radius/ulna or tibia fractures
3. Fractures above the elbow and stifle
4. Displaced pelvic
5. Displaced spinal fractures.
6. Rostral maxillary or mandibular fractures.

Case examples reviewed.

Dermatology Challenges: Pruritic Pitfalls and Beast Bacteria

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Pruritic Pitfalls

We all may know a pruritic patient that comes to see us and leaves us scratching our heads as well. The keys to avoiding pruritic pitfalls reside in a systematic approach coupled with some patience and endurance. While many patients that present with pruritus are indeed atopic individuals, there are many other concurrent infectious diseases that may go overlooked and often contribute to the inflammation and pruritus of the patient. Many atopic animals may also have defects in skin and barrier function that can result in increase adherence by bacteria and promote growth of Malassezia. Identifying these will benefit the patient and improve the patient's outcome.

The most common concurrent disorders with atopic patients that the author sees in dermatology practice are:

- Flea Allergic Dermatitis
- Food Allergy/Cutaneous Food Adverse Reaction
- Demodicosis
- Sarcoptes/Scabies Hypersensitivity
- *Malassezia* dermatitis
- Bacterial Pyoderma

Steps to avoid the pruritic pitfalls

Some of the clues to help the patient still reside in the history and the key to a good history is making sure you and your staff know the right questions to ask. For example: If asking a pet owner about flea control for their dog, do not simply ask "Do you use flea control?" and end with a yes or no answer. Instead ask more detailed and more insightful questions such as "What flea control product do you use ? When did you last use this for your pet? How often do you usually use this? Do the other pets in the household receive flea control? Does your pet swim?"

Some of the clues to help the pruritic patient are of course apparent during the examination. Look at the lesions and patterns of the lesions or pruritus (i.e. what areas of the body are pruritic). For example if a pruritic dog is mainly chewing their tail and pelvic limbs, do not overlook this pattern of flea allergic dermatitis in the dog. Secondary lesions on an animal comprised of pustules and crust or scale are often due to secondary bacterial infections. Secondary lesions on an animal comprised of brown waxy debris are often due to *Malassezia*. Further inspection using the microscope is warranted for any of these to confirm and outline a

plan. Also note if the lesions are on haired or non haired skin (ex: dermatophytes can affect haired skin whereas immune-mediated disorders can affect the nasal planum which is not haired) or Mucocutaneous junctions. Take note of if the lesions are symmetrical or asymmetrical (symmetrical lesions often occur with inflammation and asymmetry with infection and neoplasia).

Concurrent disorder contributing to pruritus	Key to identification and management
Flea Allergic Dermatitis	Look for the pattern of pruritus (in dogs) and look more into the flea control for the pet and the household as well as the lifestyle of the pet (i.e. swimmer or outdoors more)
Food Allergy / Cutaneous Food Adverse Reaction	A good 8 week (in dogs) and 12 weeks (in cats) novel protein food trial remains the gold standard for diagnosing. Remember the other flavored medications, toys, pill pockets, treats, etc.
Demodicosis	Skin scrapings and trichograms and utilize some of the new flea and tick control products we have that can eliminate mites.
Sarcoptes / Scabies Hypersensitivity	Skin scrapings may occasionally reveal this more elusive mite. Look out for the pattern of extreme pruritus involving the pinna, lateral elbows, ventrum, etc.
Malassezia dermatitis	Cytology is key in not missing this yeast!
Bacterial pyoderma	Cytology and often bacterial cultures are key in identifying and establishing a plan to treat these.

Diagnostics

Virtually all pruritic patients should have a dermatology minimum data base with a good history, dermatological exam, as well as cytology and skin scrapings. The use of cytology in practice is still lower than it should be as this simple diagnostic tool is often under utilized. The Microscope is the most important piece of diagnostic equipment we use in dermatology and it's use will help you raise your level of medicine to a higher standard.

Management Options for Pruritus

We start with a thorough exam including cytology (microscopic examination of surface material of the skin) and/or skin scrapings to determine concurrent infections. Any concurrent bacterial or *Malassezia* infections are treated.

Utilize excellent flea control to prevent flea allergy as many atopic animals can have a predisposition to flea allergy.

High potency fatty acid supplementation can decrease inflammation and may help some pets (especially those with dry skin).

Avoid any allergens when possible (including food allergens or indoor/outdoor allergens). A food trial is recommended for dogs with non-seasonal pruritus as food allergens can be flare factors for dogs with atopic dermatitis.

Bathing can be very helpful for infections, itch relief, and removing pollen or other allergens.

For short-term or symptomatic relief of itch:

- Steroid containing sprays or medications may be needed to break the itch/scratch cycle. Oral Prednisone or Prednisolone is usually administered at 0.5mg/kg SID - BID and tapered. Temaril-P may be given according to manufacturer label.
- Antihistamines are symptomatic and are very safe but do not help very many pets with acute allergies. These can be used if helpful (usually most helpful when used consistently daily) long-term.
- Oclacitinib is a new non-steroidal medication that may be used short term as it usually provides relief within days of starting. *see below for more information

For long-term management (allergies cannot be cured!) - non-steroidal therapies include:

- Allergen Specific Immunotherapy (ASIT) involves allergy testing to identify the environmental allergens that may be flare factors. This information is used (along with a good history, etc.) to develop a recipe for oral (SLIT/sublingual immunotherapy) or injectable (SCIT/subcutaneous immunotherapy) allergen specific immunotherapy. The response to this therapy is appreciated slowly over time and usually ~50-60% effective with the maximum benefit apparent in 6-12 months of starting. Side effects are rare with ASIT in dogs and cats. This is a very safe therapy and some patients can certainly respond more quickly (in the initial months) allowing them to use less concurrent medications.
- Cyclosporine (Atopica): is a non-steroidal oral medication used to modulate the immune response at ~5mg/kg SID in dogs and ~7mg/kg SID for cats. This helps the majority of dogs and cats that use this therapy within 1-2 months. If a patient responds to Cyclosporine therapy within the first 30-60 days of use, it is usually continued long-term. Often the frequency can be reduced to some degree over time. Side effects can include vomiting and diarrhea and giving this medication with food (or freezing capsules) often helps to prevent this. Usually annual CBC/Chemistry panel/Urinalysis are recommended with long-term use.
- Oclacitinib (Apoquel): is a new non-steroidal fairly fast acting oral medication (FDA approved for dogs only). Treatment doses are 0.4-0.6mg/kg once daily long-term (up to twice daily for short period of up to 14 days). Response is usually seen within days of initiating this therapy. It is a JAK inhibitor and is specific for JAK 1 and JAK 3 rather than JAK 2. The inhibition of JAK enzyme pathways, inhibits cytokines including inflammatory cytokines such as IL-31 (pruritogenic). Side effects can include vomiting or diarrhea and this medication is contraindicated in patients with infections or current or historical demodicosis. Currently many of us in dermatology are monitoring CBC/Chemistry panels regularly (every 6 months) with it’s chronic use.

- Monoclonal Antibody targeting IL-31 (Canine Atopic Dermatitis Immunotherapeutic/ Cytopoint): is a new non-steroidal injectable medication (dogs only). This canine monoclonal antibody targets and neutralizes IL-31 (a inflammatory and pruritogenic cytokine). Treatment doses are a minimum dose of 2 mg/kg body weight. The full volume from each vial (comes in 10mg, 20mg, 30mg, and 40mg dose vials) is to be drawn into one syringe. The dose is administered subcutaneously as a single injection in hospital up to every 28-30 days (every 4-8 weeks as needed). Response if often seen within 24 hours. This can be given to dogs of any age. Side effects can include lethargy during the first 24 hours.

Summary of therapy options for Atopic Dermatitis

Therapy	Dose	Route	Efficacy range	Time until maximum benefit
Bathing	varies	topical	low to moderate	minutes but may not last
Antihistamines	varies	PO	low	can be weeks
Fatty Acids	18-20 mg/lb. SID of EPA	PO	low	can be 2 months
Steroids	0.5mg/kg SID (prednisone)	PO	moderate to high	days
Cyclosporine	5(dog)-7(cat) mg/kg SID	PO	moderate to high	typically 1-2 months
ASIT (SCIT or SLIT)	build up and maintenance	SC or PO	moderate to high	up to 6-12 months
Oclacitinib	0.4-0.6mg/kg SID*	PO ***dogs**	moderate to high	days
mAb targeting canine IL-31 (Cytopoint)	~2 mg/kg once q 4-8 weeks	SC ***dogs**	moderate to high	hours to days

Remember: we cannot cure allergies but we can manage them to help our patients lead a more comfortable and happier life.

Beast Bacteria

Those of you that are football fans may be familiar with the term “Beast Mode” during a successful play by a former Seattle Seahawks running back. Unfortunately, bacteria (particularly Staphylococcus) are increasingly taking on their own ability to operate in a “beast mode” of mutation and adaptation and successfully survive and resist antibiotics.

Bacterial pyoderma in dogs is usually caused by Staphylococcus pseudintermedius and is not usually considered contagious. More recently, however, antibiotic resistant and potentially contagious bacterial skin infections are being diagnosed with greater frequency in animals. Bacteria will not usually invade normal skin. Rather, skin damaged or inflamed as a result of allergic skin disease or another underlying disorder is a good environment for bacteria to invade, overgrow, and result in an infection. The inflammation of the skin changes the microclimate of the skin (increases humidity and temperature) which favors bacterial growth. A pet who swims frequently may also be predisposed to bacterial skin infections. Animals with allergic skin disease (particularly underlying atopic dermatitis), parasitic skin disease, immunosuppression, Hypothyroidism, Cushing's disease, cancer, Pemphigus, etc. can be at risk for bacterial pyoderma. Bacteria may have increased adherence ability in pets with underlying atopic dermatitis.

Clinical Signs
Common clinical signs can consist of pruritus, pustules, bullae, ulcers, fistula, epidermal collarettes, erythema, partial alopecia, scale, crust, fistulae (furunculosis/deep), and odor.

Diagnosis
The diagnosis is based upon both examination and microscopic examination of an impression slide cytology demonstrating bacteria and neutrophils (direct slide cytology is usually better to find bacteria than tape). Bacterial cultures (culture and sensitivity) are needed to determine exact species and effective antibiotics, especially in more severe or refractory infections.

Resistant Bacterial Infections
More and more we are seeing forms of bacteria that are resistant to many antibiotics including methicillin resistant forms and multi-drug resistant E.coli. Multi-drug resistance incidence has significantly increased. Treatment with low concentrations of a bactericidal agent can generate multi-drug resistance via increase in mutation rate. In "reactive resistance" bactericidal antibiotics function as mutagens.

The MRS (methicillin resistant strains) are resistant to all B-lactams and may be resistant to Fluoroquinolones, Sulfas, Clindamycin, etc. Do not use Cephalosporins or Clavamox regardless of susceptibility.

Methicillin Resistant Staph. Pseudintermedius (MRSP): This species is commonly cultured from patients and can cause a variety of ear/skin infections in pets. While it can be spread from animals to people, this is very rare and there is much less concern about MRSP compared to MRSA in terms of risk to humans.

Methicillin Resistant Staph. aureus (MRSA): This species is usually more concerning as MRSA is a cause of disease in people and an increasing problem in pets (cats, dogs, and horses). It can be transmitted between animals and people (in both directions).

Methicillin Resistant Staph. schleiferi (MRSS): This species is closely related to S. pseudintermedius. It is most commonly found in skin and ear infections. Transmission to people from pets is very unlikely.

MRSA is the main concern with regard to Staph. infections, and warrants particular attention when it causes infection in a pet. However, any bacterial infection in a pet should compel owners and veterinarians to use excellent hand hygiene principles. For other Staph. species (MRSP), the risks of transmission to people are much lower, but it is still essential to implement measures to further reduce the spread. In cases such as MRSA, it is even more important to take precautions including washing hands frequently, avoiding contact with the

infected part of the animal's body (plus the nose, where MRSA can be), keeping the infected site(s) bandaged (if possible), keeping infected pets off the bed, and restricting contact with high risk people (young children, elderly, people who are immunocompromised). For the other Staph. species, the risks to people are much lower, but it is still reasonable to implement these measures to reduce risk. Please see Worms and Germs handouts at wormsandgermsblog.com. *KEY POINT: WASHING HANDS/GOOD HAND HYGIENE IS PARAMOUNT*

Treatment of MRS and other resistant bacteria require appropriate drug, dose, and duration based upon culture and avoid use of antibiotics when possible and use topical antimicrobials that do not promote resistance. Key attributes of topical ingredients are in the table below.

Topical Ingredient	Available in/ Forms	Key attributes
Acetic Acid	Cleaners, Shampoo, Spray, Wipe	acidic, antibacterial, anti-fungal
Benzoyl Peroxide	Shampoo, gel	antibacterial and follicular flushing as well as keratoplastic and keratolytic, drying,
Ceramides	Spot on, Shampoos	lipids important for barrier function
Chlorhexidine	Shampoo, Spray, Mousse	antibacterial and anti-fungal at higher concentrations
DMSO	solvent	enhances absorption of other substances
Topical Fatty acids	Spray, Shampoo	keratolytic, can be moisturizing
Ketoconazole	Spray, Wipe, Shampoo	anti-fungal
Miconazole	Solution, Shampoo	anti-fungal and antibacterial (including MRS)
Topical Oatmeal (colloidal)	Spray, Shampoo	humectant, increase water content of stratum corneum = moisturize, antipruritic
Phytosphingosine	Spot on, Shampoo, Spray, Wipe, Mousse	lipids important for barrier function
Pramoxine	Spray, Shampoo	anti-pruritic
Selenium Sulfide	Shampoo	keratolytic, keratoplastic, degreasing
Sulfur	Shampoo, Dip	antibacterial and keratolytic, keratoplastic
Vetericyn VF	Spray, Hydrogel	antibacterial and anti-fungal, promotes healing/re-epithealization

Track 2

It Ain't Easy Being Wheezy: Feline Asthma and Differentiating From Other Causes of Respiratory Distress

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Asthma is a type of bronchitis characterized by airway limitation and reversible bronchoconstriction. It represents a type I hypersensitivity involving IgE mediated mast cell degranulation leading to increased vascular permeability, smooth muscle contraction, vasodilation, and inflammation. The end result of this inflammatory cascade is tissue damage. A combination of airway epithelial dysfunction and destruction, excessive mucus production, bronchial inflammation and edema, and bronchial smooth muscle hypertrophy and spasm occur, and contribute to the pathogenesis of asthma not only in cats but in other species with asthma.

Asthma most often affects young to middle age cats, however, cats of any age and sex can be affected. The literature shows that Siamese cats maybe overrepresented, and the overall prevalence is estimated to be 1-5%. Clinical signs vary and can include dyspnea, wheezing, cyanosis, and coughing. Some owners mistake coughing fits or an exaggerated expiratory push as vomiting, or in some cases vomiting can be the result of forceful coughing, so asthma should remain on the differential list for vomiting cats.

The diagnostic approach for asthma is similar to the approach for many other diseases. Obtaining a minimum database including physical examination, routine bloodwork, and urinalysis is important to rule out coexisting conditions and to determine if any additional diagnostics or treatments will be contraindicated. Physical exam findings may include expiratory wheezes, crackles (common with congestive heart failure and chronic lung disease), decreased chest compliance, rhonchi, an inducible cough, or it may be unremarkable. While the chemistry panel in an otherwise healthy animal is often unremarkable, the CBC can sometimes reveal a peripheral eosinophilia (17-46%). The degree of eosinophilia if present, does not correlate in any way with the degree of airway eosinophilic infiltration. The demonstration of any underlying metabolic conditions may alter the next course of diagnostics or treatment. Thoracic radiographs are extremely important as a screening tool. Although they may not definitively confirm the diagnosis, they can be helpful to increase suspicion or to rule out other disease processes (ie. congestive heart failure / heart disease, neoplasia, etc.). Common thoracic radiographic findings in patients with asthma include a bronchial or bronchointerstitial pattern, lung lobe collapse, and hyperinflation of the lung. Up to 23% of cats with asthma can have unremarkable radiographs. Thoracic CT can also be considered and, in some cases, can be performed under sedation. Bronchoscopy can be performed to directly evaluate the airways and to determine where best to sample via bronchoalveolar lavage for cytology and culture. Abnormalities seen on bronchoscopy can overlap with those found with pneumonia, bronchitis, neoplasia, and parasitism, so these changes are often nonspecific. Pre-treatment with bronchodilators before bronchoscopy or even before a tracheal wash is strongly recommended to minimize the risk of bronchospasm which can be life-threatening. The following options can be considered for preventing bronchoconstriction:

Terbutaline – 0.01mg/kg SQ up to every 2-4 hours or 0.625mg/cat PO every 12-24 hours

Endotracheal albuterol – 1-2 puffs of albuterol directly into the endotracheal tube

Airway cytology often reveals an eosinophilia (>17%), however eosinophilia is not specific for asthma and can be found in patients with bronchitis, parasitism, pneumonia, neoplasia, and in normal cats. Infectious disease is an important differential and should be excluded, if possible, during the diagnostic work-up with aerobic and anaerobic cultures, PCR testing specific to respiratory disease, mycoplasma cultures or PCR, heartworm testing, fecal floats, Baermann test, and fungal testing. Not all of these tests will be necessary in every patient, but the more that can be ruled out, the more confident the diagnosis of asthma. Response to therapy can be an important diagnostic tool, especially in critical or oxygen dependent patients, in patients where there are significant risks with pursuing an extensive work-up (ie. concurrent heart disease, renal disease, etc.), or for those owners who have financial constraints.

There are a handful of potential biomarkers to aid in the diagnosis of asthma and to help to rule out other causes of respiratory distress, however, none are uniformly definitive and many overlap with other disease processes. Detection of oxidative damage via the measurement of hydrogen peroxide in the exhaled breath condensate has been shown to be positively correlated with airway eosinophilia, however this is not commercially available. Endothelin-1, which has been implicated in the pathogenesis of inflammatory airways diseases, has been experimentally shown to increase in concentration in patients with asthma. This has not be studied in patients with naturally acquired disease and there are no bedside tests available. Barometric whole body plethysmography is a very effective tool to diagnose asthma and monitor treatment, but it requires specialized equipment and is not widely available. Serum immunoglobulin measurements has shown promise as a biomarker for asthmatic cats, however, demonstration of atopy does not show a causal relationship with asthma. NT-proBNP can help to distinguish between congestive heart failure and respiratory disease as a cause of dyspnea in cats using a cut off 265pmol/L which has a 90.2% sensitivity and 87.9% specificity. A 2009 study by Fox et al. showed that NT-proBNP levels were higher in cats with CHF regardless of the etiology of their underlying heart disease, however, there was overlap between groups.

The treatment options for asthmatic patients include corticosteroids, bronchodilators, cyclosporine, immunotherapy, and some other novel therapies. Corticosteroids are the mainstay of therapy and is often dosed at 1-2kg/kg q 12h or 5mg/cat q 12h for prednisone/prednisolone, 10-20mg IM q 4-8 weeks for depomedrol, 110-220mcg q 12h for inhaled fluticasone, and 400mcg q 12h for inhaled budesonide. Although betamethasone inhalers are used for some asthmatic humans, no dosing information is available for cats or dogs. Prednisone/prednisolone is preferred over depomedrol as the dosage can be titrated and adjusted. Corticosteroid therapy, although it often resolves clinical signs, does not always resolve the underlying inflammation present. Persistent inflammation may lead to ongoing airway remodeling and hyperreactivity, relapse, and hospitalization. Ideally repeat BALs to obtain samples for cytology would be performed before and during treatment to guide treatment and monitor efficacy, however this is rarely done. In lieu of objective measures, treatment adjustments based on clinical signs

must suffice. Monitoring for radiographic improvement can be considered, but radiographs are often not sensitive enough detect improvement in lower airway inflammation and chronic irreversible changes may persist (ie. lung lobe collapse, bronchial fibrosis, bronchiectasis, etc.) despite improvement in the clinical signs. We often base our therapeutic recommendations off of clinical signs and only repeat radiographs if there is clinical deterioration.

Bronchodilators are often employed to compliment the effects of corticosteroids. B2-adrenergic agonists such as terbutaline and albuterol, and methyxanthines (phosphodiesterase inhibitors) such as theophylline and aminophylline are often used. Both drug classes work to increase cyclic amp which decreases the interaction between actin and myosin leading to bronchodilation. Dosing is as follows:

- Terbutaline
  - 0.01mg/kg SQ q 2-4 hours
    - Onset 15 minutes, peak 30-60 minutes, duration up to 4 hours
  - 0.1-0.2mg/kg PO q8-12 hours
  - 0.312–0.625 mg/cat PO q8-12h
    - Dose up to 1.25 mg in larger cats if needed
    - Peak 2-3 hours

- Albuterol
  - 90mcg q 3-4 hours in a crisis
    - Onset 5 minutes; Duration 3-6 hours
- Salmeterol (long acting)
  - 50mcg q12h
- Theophylline
  - Standard 6-8mg/kg PO q12h
  - Extended Release 25mg/kg PO q24h
- Aminophylline
  - 4–8 mg/kg SQ, IM, IV q8–12h
  - 5-6.6 mg/kg PO q12h

The side effects of selective B2 agonists include tachycardia, CNS stimulation, tremors, hypokalemia, and hypophosphatemia. It is not recommended to give albuterol chronically as it is a racemic mixture containing have both bronchodilatory effects and bronchoconstrictive / pro-inflammatory effects. Levalbuterol, which is R-albuterol, a strictly bronchodilatory drug, can be considered for chronic use, but there are no published reports. Salmeterol, a long acting albuterol, has not been shown to be effective experimentally. The side effects of methylxanthines including tachyarrhythamias, gastric acid secretion, gastrointestinal signs, CNS stimulation, insomnia, PU/PD, and polyphagia. Caution should be used when given with enrofloxacin (inhibits metabolism of theophylline), ketamine (increased incidence of seizures), and B-adrenergic agonists (antagonistic effects). Theophylline and aminophylline tablets have been discontinued at this time.

Cyclosporine is often used as an immunomodulatory agent as it inhibits inflammatory responses and mast cell degranulation. Dosing is 5-10mg/kg PO q 12h. Side effects include GI signs, hypertrichosis, gingival hyperplasia, secondary infections, and malignancies. Data regarding efficacy is mixed.

Immunotherapy is another consideration, however, caution should be used with intradermal testing due to the concern for inducing an asthmatic crisis. Serum testing may be less reliable than intradermal testing, but it is not influenced by steroid therapy and will not result in an asthmatic crisis. Responses to immunotherapy are variable.

Many other therapies including omega 3 fatty acids, tyrosine kinase inhibitors, inhaled lidocaine, cyproheptadine, certirizine, leukotriene-receptor antagonists, bronchial thermoplasty, and monoclonal antibody therapy have been studied on the human and veterinary sides with variable results.

The prognosis for asthmatic cats is variable and depend upon the response to therapy. Many cats an do well with prompt and aggressive treatment, however, some continue to have progressive disease and others do not respond.

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The Coughing Dog:

Andrew Waxman, DVM, DACVIM (Cardiology) and Diane Roberts, DVM, DACVIM (Internal Med)

We will go through several cases and discuss differentiating types of coughs and discuss management of these specific disorders.

Case 1: Heart failure

Dogs in congestive heart failure may suffer from a variety of underlying heart diseases, but most common would be valvular disease (myxomatous mitral disease) or myocardial disease (dilated cardiomyopathy). Until signs are obvious many patients with heart disease can be completely asymptomatic. The onset of signs can be over a few days or sudden. Congestive heart failure is most often characterized by coughing and dyspnea. The coughing in most dogs in congestive heart failure can range from soft/deep coughing to aggressive hacking/gagging. The hacking quality coughing is commonly seen in dogs with co-existing tracheal and/or bronchial disease.

On examination dogs in heart failure will usually have a heart murmur (grade varying depending on form of heart disease), increased heart rate, and pulmonary crackles. Crackles associated with pulmonary edema tend to have a fine quality versus the coarser crackles associated with chronic lung disease.

Diagnosis of congestive heart failure can be presumptive based on history and examination; however, thoracic radiographs are necessary to confirm the presence of cardiomegaly and lung changes typical of edema. While a Doppler/echocardiogram can be helpful in determining the underlying form of heart disease, in the urgent scenario thoracic radiographs are most important. Typical radiographic changes would include cardiomegaly and interstitial to alveolar changes in the caudal lobes and perihilar regions. Once patients are more stable a cardiac referral is advised to determine the extent of underlying heart disease.

Treatment of acute or fulminant congestive heart failure should include oxygen supplementation and furosemide. Starting doses of furosemide are typically 2-4 mg/kg IV or IM and repeated as needed every 1-2 hours until ease of respiratory effort is seen. If facilities allow, enhanced diuresis can be obtained with a continuous infusion of furosemide at 0.25 to 1.5 mg/kg/hr. Injectable furosemide is light sensitive to the IV tubing should be protected by a UV barrier. In severe/refractory cases sodium nitroprusside may be necessary to reduce afterload and increase venous capacitance. The medication pimobendan can be helpful in the acute setting if oral medication administration is possible for its contractile support and vasodilation properties.

Prepare owners that congestive heart failure is the result of typically severe heart disease. Improvement is seen in the vast majority of patients, however, survival is expected to be somewhere between 9 and 12 months from onset of respiratory signs.

Treatment

I. Urgent therapy
    1. Furosemide 2-4 mg/kg IV/IM q2-6h

2. Oxygen support
3. Pimobendan 0.25 mg/kg PO BID
4. Afterload reduction if severe (Nitrates, hydralazine, amlodipine)

II. Chronic therapy
    1. Triple therapy
        a. Furosemide 2 mg/kg PO BID
        b. Pimobendan 0.25 mg/kg PO BID
        c. ACE-inhibitor, Enalapril 0.5 mg/kgh PO BID

III. Followup
    1. Recheck thoracic X-rays
    2. Monitor kidney values and electrolytes

Case 2: Chronic bronchitis

Dogs with chronic bronchitis typically have a deep harsh cough that is often paroxysmal. The cough can be followed by gagging or retching which means the dog is likely bringing up mucous or sputum and then swallowing it. Typically, these patients feel good clinically but over time they may develop exercise intolerance. They normally maintain a good appetite and are bright and alert. If there is fever, depression or lethargy, there is likely another disease process at work. It is important to ask questions about the environment the dog lives in and establish if there is any exposure to second-hand smoke or perfumes, scents, molds or new construction/paint. Chronic bronchitis is more common in smaller breeds (poodles, Pekingese, yorkies, Chihuahuas) but can be seen in any dog and has been extensively documented in the cocker spaniel.

On exam, cough can often be elicited on tracheal palpation. This does not help you differentiate from tracheal collapse but does differentiate from reverse sneezing which many owners describe as a cough. Lung sounds in a chronic bronchitis case can vary from harsh crackles to being completely clear. If you hold off one nostril of the dog for 10 seconds and then release it, the dog will inhale deeply. This will often allow you to hear crackles that were previously occult. You may also note an expiratory wheeze. Some dogs may also have a respiratory arrhythmia noted which is likely due to high vagal tone. Rarely, dogs with chronic bronchitis can have syncopal events due to this high vagal tone or it can be secondary to pulmonary hypertension from their lung disease Due to the breeds being represented, it is not uncommon for these dogs to have a murmur. The crackles will typically be much louder than those heard with pulmonary edema and also remember these dogs are still active and eating well while heart failure dogs are not.

Chronic bronchitis can have many inciting causes and is characterized by excessive mucous secretion in the airways and also by thickening of the bronchial tree (hyperplasia of the smooth muscle and epithelium) which can then cause increased airway resistance and collapse. Environment and obesity are also strong contributing factors.

Diagnostic testing should include at a minimum thoracic radiographs. The classic sign is prominent or thickened bronchial walls (“donuts or tram lines”). Occasionally these dogs may also have signs of hyperinflation. Chest radiographs are essential to rule-out heart disease, lung masses, or pleural disease as well. The mainstay of diagnosis is bronchoscopy to allow evaluation for airway collapse and also to obtain samples for cytology and culture. During bronchoscopy, mucosal surfaces are noted to be

irregular and often thickened and hyperemic. Frequently excessive mucous is noted. On cytology, excessive neutrophils or eosinophils may be noted. In humans, lung function testing is more commonly used but that is difficult to perform in dogs. CT is growing in popularity to evaluate lung disease as it shows much greater detail.

The mainstay of treatment for chronic bronchitis is steroids. I start new cases with prednisone 1mg/kg PO BID x 7 days then 0.5mg/kg BID for 7 more days. Usually at this time, the dog will have dramatically improved. The drug can then be weaned down to the lowest dose needed (often 0.1-0.25mg/kg every other or every 3rd day). Usually I try to discontinue the steroids after 3 months or so. If side-effects are severe or if the prednisone cannot be weaned down, then inhaled steroids should be considered. Flovent (fluticasone at 125-250mcg BID) is rapidly absorbed and bioavailability is high. AeroDawg makes an inhaler for use with dogs. I typically do not use antibiotics in newly diagnosed chronic bronchitis. If you have a patient that has been well managed that acutely decompensates, then secondary infection may play a role. Empirical antibiotic choices would include doxycycline (5mg/kg BID), azithromycin 5mg/kg daily (poor activity against gram negatives), enrofloxacin 10mg/kg daily (careful with theophylline-reduce the theophylline dose by 30%) or clavamox at 30mg/kg TID. The use of bronchodilators is controversial as dogs do not have the same level of bronchoconstriction as cats and humans. There is some evidence though that it can help with mucociliary clearance. Theophylline extended release is recommended at 10mg/kg BID. Terbutaline is thought to be less effective and more likely to cause restlessness and anxiety in dogs. It is critical that clients also address obesity and the environment. The American Lung Association has a website that gives recommendations on improving air quality (www.lung.org). . It is helpful if your clients pay attention to any environmental or seasonal triggers.

It is important to note that cough suppressants are not indicated without managing the underlying inflammation associated with bronchitis. The use of anti-tussives without other meds will allow progression of the lung disease. Also if the cough is productive, it is useful to let some coughing occur. However, if the cough is dry or causing distress to the dog, hydrocodone is my first choice (0.22mg/kg PO q 6-12hrs). Anecdotally, there have been recommendations to use maropitant (cerenia) to treat coughing. One paper has shown that it does seem to have some anti-tussive properties but no anti-inflammatory properties so it should definitely not be a single agent therapy.

The owners should be prepared that this will likely be a lifelong issue for their pet. You will likely have periods where the bronchitis is well controlled but it will often resurface.

Case 3: Tracheal Collapse

Dogs with tracheal collapse typically have a loud often honking or high pitched cough that is very easy to elicit on tracheal palpation. The cough often occurs when dogs are excited or active. These dogs also tend to feel good and maintain good attitudes and appetite. Certain breeds are way overrepresented such as the Yorkie followed by the Pomeranian, Maltese, pug, toy poodle.

Diagnosis of tracheal collapse can be partially made on plain films but the degree of collapse cannot be fully evaluated. It is very important that both inspiratory and expiratory films be taken to fully evaluate the trachea. Fluoroscopy is very useful to see the dynamic nature of the collapse but can miss lower airway collapse. The mainstay of diagnosis is still bronchoscopy. When performing bronchoscopy, the larynx (for function and also possible collapse) and soft palate should also be evaluated. The tracheal

collapse should be graded on a scale of 1-4 and it is very important that the mainstem bronchus and lower airways also be evaluated for collapse. Often, we will obtain samples for culture during this procedure as well.

Treatment for tracheal collapse is always started with medical management. Obesity is a major contributing factor that must be addressed. In contrast to chronic bronchitis dog, anti-tussives are the mainstay of therapy for collapsing trachea. I still rely most heavily on hydrocodone at 0.22mg/kg q 6-12hrs but do occasionally have patients who respond better to butorphanol at 0.1mg/kg PO q 6-8hrs. If anti-tussives alone are not effective, a short course of steroids can be used to combat the secondary inflammation that has developed. A more recent therapy that is gaining attention is the use of stanazol to improve tracheal wall strength. Possible mechanisms include enhanced protein or collagen synthesis, increase of chondroitin sulfate content, increase in lean body mass or decreased inflammation. Dogs with tracheal collapse (not bronchitis) were treated with 0.3mg/kg divided BID for 2 months then tapered for 15 days. The grade of collapse was noted to be improved when tracheoscopy was repeated at 75days. This is still very preliminary data. Medical management consisting of sedation, steroids and cough suppressant is often effective even for dogs that come in with acute respiratory distress-especially if it is their first major episode.

For very severe cases of tracheal collapse that are not improving significantly with medical management, a tracheal stent can be considered. Stents are very effective for patients that have wheezing, dyspnea or difficulty breathing. They are only moderately effective for patients that have severe cough. You should prepare your clients that their pet will likely still need medications even after a stent is placed and that there are sometimes complications with stents (fracture, granulation tissue or lower airway collapse). I typically do not recommend a stent if there is evidence of lower airway collapse as this often worsens after stent placement. However, for patients that are wheezing or have dyspnea, the response to a stent is often dramatic and immediate after placement.

Cytology for Veterinary Oncology

Sonjia Shelly, DVM, DACVP, Veterinary Diagnostics and Preclinical Research Services
Naoko Sogame, DVM, Ph.D., DACVIM (Oncology), SAGE Centers

Introduction:

Cytology is a valuable tool for veterinarians. While cytology may not provide the same degree of information compared to histopathology, it is often a first diagnostic step for working up oncologic cases.

Advantages of cytology include:

- Fast and easy without the need of special equipment
- Minimally invasive
- Cost effective
- May offer a definitive diagnosis or narrow the list of differentials

Information obtained by cytology allows a veterinarian to formulate a more tailored diagnostic/treatment plan for each patient. For example, a healthy dog with histiocytoma may not need extensive staging tests prior to removal of the mass. By contrast, a dog with cytological evidence of a poorly differentiated mast cell tumor should be fully staged (e.g. abdominal ultrasound, bloodwork, +/- thoracic radiographs, +/- fine needle aspiration of sentinel lymph nodes/liver/spleen) prior to the mass removal.

Cytology is also useful for evaluation of metastatic lymph nodes. Lymph node involvement has been shown to be a negative prognostic indicator in a number of cancers. Palpation of the lymph node alone was found to be very insensitive in accurately detecting the nodal metastasis. In one study evaluating dogs with oral melanoma, 40% of dogs with normal sized lymph nodes had microscopic evidence of metastatic disease. This finding highlights the importance of thorough clinical staging when dealing with oncologic cases.

Cytology has its limitations. Cytology cannot assess tissue architecture, margins, and vascular/lymphatic invasions, which are important parameters for predicting cancer behavior. Cytology results are highly dependent on sample quality. This depends on a veterinarian's technique as well as the nature of the lesion.

Sample Preparation:

1. Good sample: cellular yet thin preparation of intact cells

- Prepare the slide(s) with material in or near the middle of the slide.
- Use the "blood smear" technique or squash preparation so that the cellular preparation is uniform but not too thin.
- Be certain to allow slides to completely dry (air-dry or blow with dryer) before inserting into the slide (PAP) container.

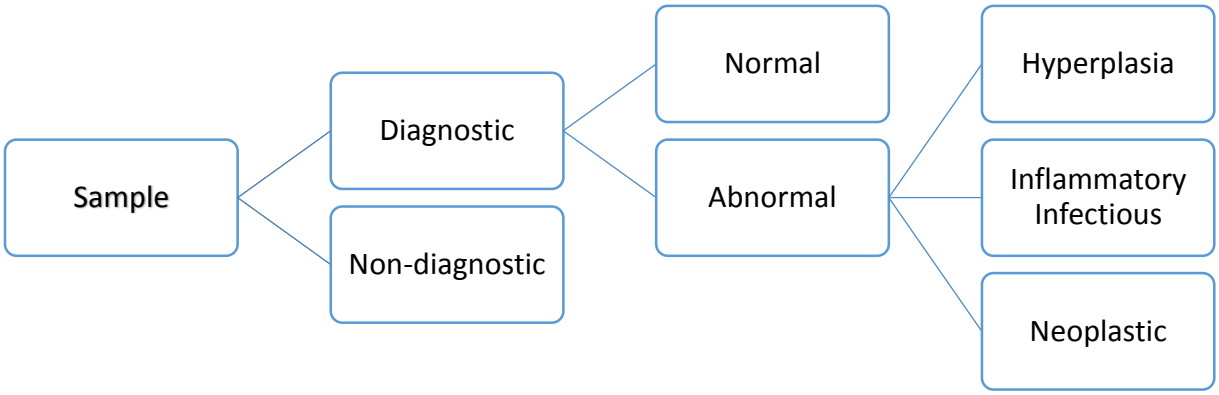
- Keep slides at room temperature prior to pick up by couriers.
- Do not put cytology slides in the same bag as a biopsy in a formalin jar.
- If you choose to stain a slide to ensure cellularity, please also submit unstained slides of the same site.
- If you choose to make slides from a fluid sample, please indicate if the fluid has been spun down by you before you made the slide(s).
- If you stain a slide to check quality, please remember to include other unstained slides.

2. Reasons for "non-diagnostic" samples
- Insufficient samples
  - non-exfoliating tumor (sarcomas)
- Ruptured cells
  - Most common with large cell lymphoma
  - Associated with too much force when smearing the sample. Consider using a cover glass instead of a slide
- Blood contamination
  - Either due to highly vascular tumor (thyroid, hemangiosarcoma) or excessive aspiration
  - Consider using a smaller needle and perform quicker aspiration
- Thick preparation
  - Common when samples are highly cellular
  - Once the cells are expelled from the needle, smear it right away

3. In house evaluation before sending off to the lab
- Does your sample meet the criteria of a "good sample"?
- Always leave some slides unstained. Special stains may be indicated in some cases.

Cytologic Interpretation:

1. Determination of the pathologic process



2. Tissue classification
- Round cell

    - Typically exfoliate well
    - Appear as individual cells
    - Distinct cytoplasmic borders
- Epithelial
    - Typically exfoliate well
    - Often clustering of cells (may form acini, tubules)
    - Distinct cytoplasmic borders
- Mesenchymal
    - Exfoliate poorly
    - Size variable – can be spindle shaped or stellate
    - Often appear as individual cells
    - Wispy cytoplasmic borders (trails of cytoplasm) seen

3. Criteria of malignancy

- Recognition of malignant morphologic features. These criteria can be divided into mild, moderate, and marked.
    - General appearance
        - A uniform population of pleomorphic cells
    - Nuclear features
        - Most important criteria for identification of malignancy
        - Anisokaryosis, multiple nucleoli, abnormal nuclear shape, coarse chromatin pattern, abnormal mitoses, abnormal nuclear margin
    - Cytoplasmic features
        - Anisocytosis, basophilia, high N/C ratio, variable N/C ratio, atypical vacuolization
- The higher the number of criteria observed → higher chance of malignancy
    - Cell populations with > ~3-4 (at least moderate) features are concerning for malignancy
    - The criteria are not identical for all types of malignancy and locations
        - The presence of cells in an abnormal location, for example epithelial cells in the lymph nodes, is a strong indicator of malignancy

Case Examples:

A series of oncology cases will be reviewed during this session.

Chronic Weight Loss in Cats – Inflammatory Bowel Disease vs. Low Grade Lymphoma

Presenters: Catherine Rivara DVM, DACVIM (Internal Medicine), Michael Kiselow DVM, DACVIM (Oncology)

Objective: To discuss the differential diagnoses for chronic weight loss in feline patients - primarily inflammatory bowel disease and lymphoma – and to review diagnostic testing + treatment strategies for each.

Introduction

Inflammatory bowel disease (IBD) and small cell lymphoma are common causes of chronic gastrointestinal (GI) tract disease in cats. The history and clinical signs of the affected cats are non-specific and commonly overlap. IBD and small cell lymphoma can be difficult to distinguish from other causes of both primary and extra gastro intestinal disease initially. Thus a thorough diagnostic workup is necessary. A definitive diagnosis requires intestinal biopsy to obtain histopathology. This lecture outlines the clinical picture of these cats, the diagnostic challenges, treatment and prognosis.

History

As with any patient, it is essential to obtain a thorough history of that patient, environment, and household. These will include (although not limited to)

- Signalment
- It has been reported that IBD predominantly affects middle-aged animals and that there may be certain breed predispositions, including Siamese and other Asian breeds, but any breed may be affected.
    - Breed predispositions reported- in Siamese, other Asian breeds
    - No breed predispositions reported with GI lymphoma in cats
- Environmental (indoor/outdoor)
- Concurrent systemic illness
- Current & past diets
- Retroviral status
- Exposure risk to toxins
- Travel history
- Episodes of dietary indiscretion
- Any other housemates exhibiting signs
- When the clinical signs started and progression
- Frequency of signs, severity
- Vomiting vs. regurgitation
- Diarrhea- character, small bowel vs. large vs. mixed

Clinical signs-

  - Vomiting and small bowel diarrhea most common
  - Weight loss
  - Decreased appetite, ravenous appetite
  - Large bowel disease- large bowel diarrhea with blood, mucus, tenesmus
- Clinical course
  - Most commonly cyclical- characterized by spontaneous exacerbations and remission
  - Triggers for disease- rarely identified
    - Dietary indiscretion, change in diet
    - Transient exposure to pathogens
    - Transient exposure to drugs (NSAIDs, steroids, antibiotics)

**Important to note- clinical signs of ID are not disease specific! Share numerous overlapping features with other disease

Physical exam:

- Evidence of chronic malnutrition
  - Weight loss, poor hair coat, muscle wasting
- Abdominal palpation
  - Evidence of pain, discomfort, nausea
  - Intestinal thickening, lymphadenopathy, mass effect
- Oral exam- evaluate under the tongue
- Neck /cervical palpation- thyroid slip
- Evaluate for icterus
- Evidence of concurrent dermatitis, skin lesions, may raise suspicion for food allergy

Diagnostic plan

In formation of a diagnostic plan it is important to remember that the clinical signs of inflammatory bowel disease and gastro intestinal lymphoma are not disease specific. These diseases have numerous overlapping features with other disease.

Summary of causes of chronic vomiting in cats-Hauk et all JAAHA 2016

Primary GI disease

Primary GI disease	Extra GI disease
IBD	Pancreatitis
IBD	Hyperthyroidism
Food allergy/food intolerance	Uremia
Gastro intestinal neoplasia	Hepatobiliary disease
Motility disorders	Heart worm
Foreign body, dietary indiscretion	Neurologic disease
Gastric ulceration	

Initial diagnostic tests are most likely to screen for extra gastro intestinal disease. These should include;

- CBC
- Biochemical profile
- TT4 (middle aged to older cats)
- UA
- Fecal
- Abdominal radiographs
- Ultrasound-When considering abdominal ultrasonography, it is important to remember that inflammatory bowel disease and lymphoma of the small intestine share similar features. You cannot differentiate inflammatory bowel disease and lymphoma based on ultrasound alone.
    - Zwingenberger et al JAAHA
        - US thickening of muscularis propria of SI was significantly associated with small cell LSA (98%)
            - However only 30/62 (48%) of cats with LSA had muscularis thickening. This means that the presence of muscularis thickening is very specific for LSA, but is an insensitive test (i.e., there can be many 'false negatives,' wherein the disease is present, but ultrasound fails to identify it).
        - Lymphadenopathy associated with both LSA and IBD
        - However significant overlap with US findings and thus histopath is necessary for differentiation of IBD and LSA
- Cytology
    - Ultrasound-guided FNA of thickened intestinal wall and enlarged lymph nodes can usually be performed with little/no morbidity to patients
    - However this is a poor test for trying to diagnose low-grade (small cell) lymphoma because the neoplastic cells are well-differentiated lymphocytes, which are very similar in appearance to normal resident nodal lymphocytes
- GI panel
    - Vitamin B12
        - Cobalamin (vitamin B_{12}) is a required cofactor for normal nucleic acid synthesis and hematopoiesis.
        - Vitamin B_{12} is absorbed by specific receptors located in the ileum
        - Hypocobalaminemia not specific to IBD vs. LSA
        - Simpson et al JVIM, n = 22
            - IBD n = 9
            - LSA n = 6
            - Hepatobiliary disease n = 3
            - Hepatobiliary or intestinal disease n = 3
            - Undiagnosed n = 3
        - Kiselow et al JAVMA
            - Hypocobalaminemia documented in 78% of cats with LSA
    - Folate- may be helpful for determine location of gastro intestinal disease
    - TLI[- EPI is rare in cats and most commonly secondary to chronic pancreatitis

Diagnostic plan is designed around exclusion of infectious/parasitic agents, non-GI disorders, EPI and intestinal structural abnormalities (surgical disease). Once these disease processes are rule out the remainder most commonly include:

- Food responsive enteropathy- can be ruled out /in with antigen restricted diet – must feed for at least 7 days
- Lymphoma
- Inflammatory bowel disease

Definitive diagnosis

To differentiate between inflammatory bowel disease and small cell lymphoma in the cat biopsy is essential. As noted both diseases have similar clinical signs, physical exam findings, and ultrasound findings. Thus biopsy should be discussed.

Biopsy findings in inflammatory bowel disease must also then be evaluated in light of the clinical case

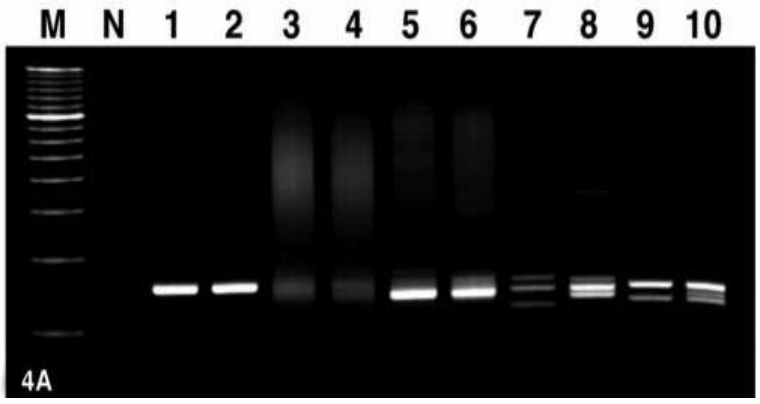
- Lymphoplasmacytic enteritis (LPE)- most frequently reported form of feline IBD
  - Presence of LPE alone does not however mean only IBD
  - Also associated/present in intestinal parasites, dietary sensitivity, hyperthyroidism- Jergens JFMS 2012
  - Changes in mucosal architecture (villus morphology, fibrosis) are related to presence and severity of GI disease

Surgical vs Endoscopic biopsies

- Quality of the endoscopic biopsy of great importance
- Ileal bx in cats – seems to be a more consistently affected organ when LSA present
- Evans et, al JAVMA
  - 4 cats with gastric LSA on surgical biopsy; 3 confirmed via endoscopy
  - 9 cats with duodenal LSA on surgical biopsy; 1 confirmed via endoscopy*
    - * = Statistically different
- Histopathology
  - Kiupel et al Vet Pathol, n = 63 with intestinal disease (IBD = 12, LSA = 51)
    - Full thickness intestinal biopsies performed in order to evaluate all tissue layers
      - Mucosa: n = 63 (100%) infiltration
      - Submucosa: n = 39; 37 LSA*, 2 IBD
      - Muscularis: n = 28; 27 LSA*, 1 IBD
      - Serosa: n = 22, all LSA*
      - * = Statistically consistent with lymphoma
        - Specificity for LSA increases with depth of infiltration
          - Submucosa 75%
          - Muscularis 86%
          - Serosa 100%
    - Also statistically supportive of lymphoma are:
      - Diffuse infiltration of all tissue layers by lymphocytes
      - Monomorphic appearance of lymphocytes

        - Factors consistent with100% specificity for lymphoma
            - Intravascular infiltration by lymphocytes
            - Serosal infiltration (as above)
            - Intraepithelial surface nests of lymphocytes
    - This information supports the practice of collecting full-thickness intestinal biopsies in effort to confidently distinguish between LSA and IBD.
    - Immunohistochemistry
        - CD3: pan-T cell marker
        - CD79a, CD20: B-cell markers
        - 89-94% of low grade LSA is T-cell phenotype
            - 100% of low grade lymphomas with epitheliotropism are T-cell type

- **PARR**
    - PCR for Antigen Receptor Rearrangement
    - This assay is based on the concept of clonality, such that a population of neoplastic cells is genetically similar/identical.
    - Using known genetic sequences that are conserved in B-cells and T-cells, complementary PCR primers are created that can identify/bind the DNA from a suspected lymphoma lesion.
        - For investigation of feline lymphoma, primers have been created to recognize sequences in the T-cell receptor (TCR) gene for T-cells and the CDR3 region of the IGH V gene for B-cells.
        - Following PCR processing, samples are evaluated via gel electrophoresis. The following results can subsequently be observed:
            - Single band: Indicates a clonal rearrangement of a single allele, consistent with a diagnosis of neoplasia
            - Double band: Indicates clonal rearrangement of both alleles of the gene.
            - 3-5 bands: Indicates an oligoclonal rearrangement, which can be due to either more than one clonal population of cells within a neoplastic lesion vs. a inflammatory/reactive process.
            - Smear: Indicates a polyclonal rearrangement from a heterogeneous population of lymphocytes, which is due to non-neoplastic, inflammatory/reactive lesions.



(From Werner, et al. Vet Pathol. 2005; 42(4): 596-607):

Polyacrylamide gel showing PCR products from 5 cats (samples run in duplicate)
Lanes 1+2: monoclonal bands = Lymphoma
Lanes 3 + 4: polyclonal smear = Reactive
Lanes 5 + 6: monoclonal bands within a polyclonal smear = Lymphoma following repeat processing
Lanes 7 + 8: nonreproducible bands = pseudoclonality
Lanes 9 + 10: two reproducible bands = monoclonal population with biallelic rearrangement or 2 monoclonal populations

- In feline studies, PARR analysis has revealed the following sensitivity for detecting lymphoma:
  - T-cell: ~91% (Moore, et al. Vet Pathol. 2012; 49 (4): 658-68)
  - B-cell: ~59% (Werner, et al. Vet Pathol. 2005; 42(4): 596-607)
    - Poor sensitivity due to:
      - PCR primers may not cover full range of segments within the IGH V gene locus
      - Assay cannot detect major chromosomal abnormalities that alter gene sequence
      - Somatic hypermutation (following antigenic stimulation) causes random single nucleotide changes throughout the IGH V gene
- Based on this information, PARR is a reliable test when screening for T-cell lymphoma, but is of low diagnostic value for B-cell lymphoma
  - However since the majority of low grade intestinal lymphomas are of T-cell type, PARR is a reasonable diagnostic option if histopathology is inconclusive.
  - Sensitivity of PARR for T-cell lymphoma also allows for the option of performing endoscopy instead of surgery for biopsy collection when owners wish to pursue less-invasive diagnostic testing.

Treatment

Inflammatory bowel disease

- Nutritional therapy
  - Antigen restricted or hydrolyzed diet
    - Reduce exaggerated host responses, attenuate intestinal inflammation
    - Dietary therapy alone in 1 study was reported to be successful n 50% of cats with IBD
      - Also that cats respond within 2-3 days suggesting shorter dietary trials can be utilized -Jergens JFMS 2012
  - Fiber supplementation
    - Psyllium 1/4tsp at each meal
    - Fiber enriched diets (low residue), contain beet pulp
  - Omega-3 polyunsaturated fatty acids (PUFAs)- may modulate inflammatory responses by reducing the production of pro-inflammatory metabolites (leukotriene B4)-Trepanier JFMS 2009

        - Dosing is empirical in cats- extrapolated from dosages of enteric coated PUFAs used in treatment of human IBD (52)
            - Iecosapentaenoic acid 17-25mg/kg/day
            - Docosahexaenoic acid 8-18mg/kg/day
    - Cobalamin supplementation
        - 250mcg SQ once weekly x 4-6 weeks, then q 1 month thereafter
        - Texas A&M website table
            - http://vetmed.tamu.edu/gilab/research/cobalamin-information
        - Positive response to B12 treatment will include improved appetite, weight gain, reduction in vomiting, diarrhea in affected cats
- Glucocorticoids
    - Prednisolone
        - 1-2mg/kg PO q 24hr
        - Cliemt communication surrounding steroid therapy is essential.
            - Recommendations about medication interacations (avoiding NSADs, aspirin, etc.)
            - Increased risk of diabetes mellitus
            - Association with heart disease
            - Do not stop abruptly
    - Budesonide
        - Budesonide undergoes extensive first pass hepatic metabolism in humans (>90%) and thus can be associated with less systemic side effects than prednisolone
        - Studies in cats limited
        - Anecdotal uses however are successful in some cats.
            - Dose 1mg PO once daily for most cats
            - Must compound
- Metronidazole
    - Mechanisms proposed
        - Anti protozoal
        - Anti bacterial
        - Possible immunomodulatory Anrdt et al 1994
    - Bitter taste can lead to very poor compliance in cats and thus can use metronidazole benzoate – Trepanier JFMS 2009
    - Caution for chronic use as has been associated with development of disease in other species
        - Neoplasia in rats A-Kareem et al J Surg Res 1984
        - Subset of Crohns disease in humans - Krause et al Am J Gastroenterol 1985
- Prebiotics
    - Minimal studies in veterinary medicine
    - Non-digestible carbohydrates that stimulate growth of protective enteric bacteria when fed
    - Examples
        - Fructo-oligosaccharides Galacto-oligosaccharides Inulin Lactulose
        - Psyllium Bran Beet pulp, pumpkin Resistant starch
    - Protective effects
        - Simtulate growth of protective bacteria

        - Enhance productinof short-chain fatty acids
        - Improve intestinal barrier function
        - Decrease pro inflammatory cytokines
- Probiotics
    - Live microorganisms which, given in adequate amounts, confer health benefits to the host
    - Examples
        - E coli Nissle 1917 VSL #3 Lactobacillus species Bifidobacterium species Saccharomyces boulardii Prostora Max (Iams)* FortiFlora (Purina)* Proviable-DC (Nutramax)*
        -
    - Protective roles
        - Alter the intestinal flora to suppress pathogenic bacteria
        - Improve intestinal barrier function
        - Stimulate production of anti microbial peptides
        - Decrease pro inflammatory cytokines

What can you do when biopsies are not an option ?

- May depend on patient severity
- Dietary trial with an elimination (novel intact protein or hydrolyzed) diet for 2 weeks
- Consider therapeutic trial with metronidazole
- consider B12 supplementation in cats with cachexia , watery diarrhea
- if large bowel signs present consider fiber supplementation
- When to use prednisolone
    - Cats that fail to respond to sequential therapy
    - Cats that have a rapid decline
    - Risks- can mask disease including neoplasia, aggrevate infections
    - Client communication is essential and should be documented
    - Taper slowly- over weeks and many cats may require low dose for months or longer

Treatment of feline small cell lymphoma of the gastro intestinal tract

- Treatment
    - Surgery
        - Rarely indicated due to the diffuse/multifocal nature of lymphoma.
        - Can be performed if there is an intestinal obstruction and/or perforation.
    - Radiation therapy
        - Also rarely indicated due to intra-abdominal location + diffuse nature of lymphoma.
    - Chemotherapy
        - Systemic treatment - most appropriate option
        - Chlorambucil (Leukeran®)

- Alkylating agent
- Activity does not depend on phase of the cell cycle
- Mechanism of action (MOA)
    - Covalently binds alkyl group to the N7 position of guanine (DNA base)
    - This results in cross-linking between DNA strands, which leads to strand breaks and apoptosis
- Dosing – multiple protocols have been reported:
    - 6-8mg/m^2 (usually 2mg) PO q 2-3d (Kiselow, et al)
    - 15mg/m^2 PO q 24hr x 4d, once every 3 weeks (Lingard, et al)
    - 20mg/m^2 PO once every 2 weeks (Stein, et al)

▪ Prednisone/prednisolone are commonly used in combination with chlorambucil
- Dosing:
    - 1-2mg/kg PO q 24hr

▪ Response rate
- 76-96% - combination of partial + complete remission

▪ Toxicity
- Neutropenia, thrombocytopenia, anemia
- Gastrointestinal disturbance
- Myoclonus (Benitah, et al)
    - Patient was scheduled to receive 15mg/m^2 q 24hr x 4d, then no treatment x 17d, then repeat
    - Patient was accidentally treated 12 hours apart instead of 24hrs
    - Clinical signs resolved within 7 days

- Prognosis
    - The range of median duration of remission for cats achieving complete remission has been reported at 567 – 897 days
    - Reported median survival times
        - 447 – 704d
    - Statistical prognostic factors
        - Remission – cats achieving complete remission survive longer than cats achieving partial remission (Lingard, et al).
- Rescue protocols – limited information
    - Cyclophosphamide (Stein, et al)
        - N = 7 cats that failed treatment with chlorambucil
        - All 7 had complete resolution of clinical signs
    - Lomustine (Dutelle, et al)
        - N = 16 cats that failed previous chemotherapy
        - Median progression free interval = 169d
- Ancillary therapy
    - Antiemetics
        - Cerenia (maropitant): 2mg/kg PO q 24hr
        - Metoclopramide: 0.2-0.4mg/kg PO q 8hr
    - Anti-diarrheals
        - Metronidazole: 10mg/kg PO q 12hr
        - Tylosin: 1/8 teaspoon (~325mg) PO q 12hr

- Cobalamin (vitamin B12)
  - 250mcg SQ once weekly x 4-6 weeks, then q 1 month thereafter

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The "F" Word in Cats
Feline Vaccine Associated Sarcoma

Bryan Marker, DVM, DACVM (Oncology) and Sharon Ullman, MS, DVM, DACVS

Goal: To gain an understanding of this disease including pathogenesis, diagnosis, treatment options and prognosis for feline patients with vaccine associated sarcoma.

1. Introduction
    a. History of the disease
        i. First published report in early '90s
            1. Hendrick and Goldschmidt
            2. 1987 Pennsylvania state law requiring rabies vaccination for cats
                a. 61% increase in feline fibrosarcomas
                    i. Sites of common vaccinations
                    ii. Considerable portion with inflammatory response similar to post vaccinal inflammatory reactions
                        1. Comparative aspects
                    iii. Crystalline foreign material composed of aluminum and oxygen
                        1. Aluminum hydroxide gel adjuvant used in manufacture of killed rabies vaccine
    b. Incidence and epidemiology
        i. 1 in 10,000 to 1 in 1,000
        ii. Anywhere between 4 weeks – 10 years
        iii. Temporal changes
    c. Pathogenesis
        i. Role of inflammation
            1. Adjuvant
                a. Stimulatory agent to improve immune response to killed infectious agents
                b. Vaccines implicated
            2. Granuloma formation
            3. Inflammation and malignant transformation
        ii. Non-vaccine associated injection site sarcomas
            1. Implications
                a. Corticosteroid long-acting formulations, microchip implants, meloxicam, penicillin, suture material
        iii. Tumor types
            1. Fibrosarcoma, others
        iv. Biologic behavior
2. Recommendations for vaccinations
    a. Record site of vaccination and type of vaccine used

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i. One site per vaccine injected
ii. Preferred vaccination/injection sites
1. *Distal* limb
2. Subcutaneous vs. intramuscular

b. Rabies, FeLV
i. Core vaccination recommendations
ii. Zoonotic potential considerations
iii. Local regulatory considerations
iv. Adjuvanted vs. recombinant vaccines
v. Tailor vaccine recommendations, risk assessment

c. Vaccination frequency
i. Duration of immunity vs. USDA licensing

d. Vaccine temperature

e. Reporting

3. Vaccine-associated Feline Sarcoma Task Force
a. Collaborative effort over 3 years beginning in '96
b. Mass evident at 3 or more months post vaccination
c. > 2 cm in diameter
d. Continued increase in size 4 weeks
e. Caveats
i. Trust your gut

4. Diagnostic work-up
a. Minimum data base and work-up
b. Advanced imaging: CT or MRI for local staging
i. 3D-imaging modalities provide essential information for proper surgical planning and/or RT
ii. Volume of tumor based on contrast-enhanced CT is ~ twice the volume measured using calipers
iii. Accurate pre-treatment knowledge of extent of the disease is essential: invasive, regional anatomy may translate to complex surgical approach, high rate of recurrence which markedly increases

c. Advanced imaging findings:
i. Irregular shape
ii. Digitiform projections
iii. Mixed (peripheral and intratumoral) contrast enhancement
iv. Blurring of fat planes
v. Signs of liquifactive intratumoral necrosis

d. Ultrasound
i. Irregular tumor margins
ii. Necrosis
iii. Mixed echogenicity
iv. Skip metastases highly correlated with tumor recurrence
v. Thickening of adjacent adipose tissue associated with higher incidence of muscular involvement

e. Proper biopsy techniques
i. Over the mass

ii. In an area that will be excised during surgery
iii. Not in the center or a necrotic region
iv. True cut or incisional

5. Surgical planning and management pre- and post-op
    a. Aggressive radical excision to avoid tumor recurrence
        i. Vaccination should be performed as often as necessary, but infrequently as possible
        ii. Injections should be given at sites at which surgery would likely lead to a complete cure
        iii. Interscapular region should generally be avoided
        iv. Post-vaccination monitoring should b performed
    b. Proper surgical planning and technique essential
        i. Surgical resection with a minimum of 2-3 cm margins lateral and deep
        ii. One fascial layer deep
            1. 5 cm margins & 2 fascial planes had 11% major complication rate
            2. Complete resection 97% and recurrence in only 14%
        iii. NEVER perform marginal resection or excisional biopsy
        iv. This will still only achieve complete resection in < 50%
        v. Median time to first recurrence
            1. Marginal resection 79 days
            2. Wide resection/radical surgery 325-419 days
            3. Non-referral 66 days
            4. Referral 274 days
        vi. Include all biopsy tracts including bone or fascia
            1. Interscapular will include dorsal spinous processes/dorsal aspect of the scapula
            2. Thoracic or body wall resection for truncal tumors
            3. Limb amputation/ hemipelvectomy
            4. Muscle flaps (latissimus dorsi, serratus ventralis for scapular function)
6. Treatment options- radiotherapy
    a. Definitive
        i. Neoadjuvant vs. adjuvant radiation therapy
            1. Preoperative RT advantages
                a. Smaller treatment field
                b. Superior cell killing?
            2. Disadvantages
                a. Wound healing complications
                b. Delays definitive intervention
            3. Post-operative RT
                a. Larger treatment field
                b. Risk for recurrence during post-operative healing
            4. 40-45% local recurrence rate with neoadjuvant RT and surgery

a. Median time to recurrence 398 to 584 days
b. Was there an objective response rate?
c. Longer disease free interval with complete vs. incomplete surgical margins, however recurrence rate *not improved* with complete resection

b. Treating gross disease
    i. Palliative
        1. Modest, short-term responses noted
            a. Relatively radio-resistant tumors

7. Electrochemotherapy
    a. Brief background
        i. Mechanism, how it works
            1. Chemotherapy injection, such as bleomycin or platinum compound
            2. Electric pulse applied
            3. Results in 'pore' formation, making cell membrane more permeable
            4. Cell membrane = potential barrier to delivery of chemotherapy to target (DNA)
        ii. The procedure
        iii. Therapeutic indications
        iv. What's the advantage?
        v. Potential complications
    b. Spugnini et al.
        i. ECT + cisplatin, yes cisplatin!
            1. Median time to recurrence 666 days vs. 180 days for control group
        ii. Second study
            1. Time to recurrence 19 months vs. 4 months
            2. Objective responses observed among recurrent tumors
8. Additional treatment options – IL-2
    a. Feline Interleukin-2 Immunomodulator, Live Canarypox Vector by Merial
        i. Conditionally approved by USDA 2015
            1. Adjuvant treatment for feline fibrosarcoma
        ii. How it works
            1. Attenuated canarypox virus vector carrying gene for feline IL-2
            2. IL-2 potent immune stimulator
            3. Increased activity of cytotoxic T-cells and NK cells
            4. IL-2 is approved to treat melanoma and renal cell carcinoma
                a. Systemic administration toxicity
            5. Jas et al. 2015 Trials Vaccinol
                a. Series of injections to the surgical site
                b. Significant prolongation in time to relapse
                    i. >730 days vs. 287 days
                c. All cats treated with surgery and brachytherapy

            d. Primary side effect
                i. Skin reaction
        iii. Concurrent with palliative RT vs. palliative RT alone
9. Additional treatment options
    a. Chemotherapy
        i. Metastatic rate 0-26% based on various reports
            1. Median time to metastasis 265-309 days
            2. Preferential metastatic sites
        ii. Carboplatin, doxorubicin, mitoxantrone, cyclophosphamide, ifosfamide, CCNU
            1. Adjuvant therapy
                a. Impact on survival
                b. Impact on local tumor recurrence
            2. Palliative management
                a. Objective response rates 25-50%
                b. Median response duration 84-125 days
10. Prognosis
    a. Poor prognostic indicators
        i. Marginal surgery
        ii. Incomplete margins
        iii. Monotherapy
        iv. Tumors > 2 cm in diameter
        v. Local recurrence
    b. More favorable prognostic factors
        i. Aggressive surgical resection
        ii. Wide, complete margins
        iii. Multi-modality therapy
        iv. Tumors 2-5 cm and > 5 cm in diameter
        v. Tumor type
        vi. Presence or absence of metastasis
        vii. Tumor grade?
11. New horizons
    a. Ongoing clinical trials

How I prevent acute pain from becoming chronic

managing surgical and traumatic pain

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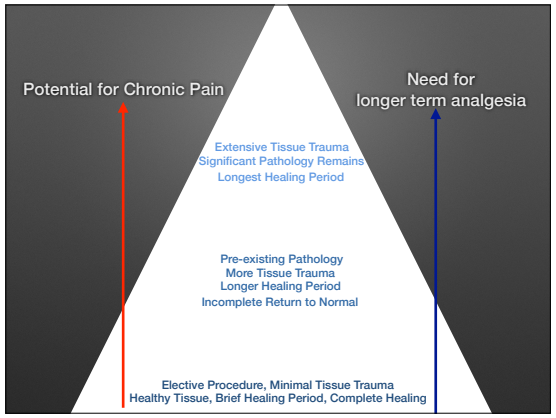
Why does this issue even matter?

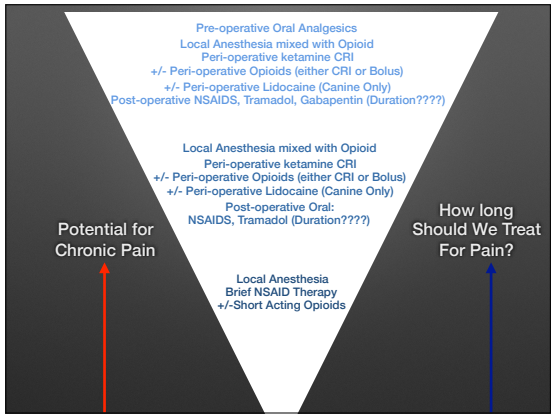
How are acute and chronic pain different ?

How does acute pain become chronic pain?

Factors that predispose to chronic pain



How can I prevent acute pain from becoming chronic ?



How can I screen for chronic pain ?

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Long-Term Pain in Cats How Much Do We Know about This Important Welfare Issue?

Persistent postsurgical pain: risk factors and prevention Prof Henrik Kehlet, MD Prof Henrik Kehlet Prof Henrik Kehlet, Prof Troels S Jensen, MD, Prof Clifford J Woolf, MD The Lancet Volume 367, No. 9522, p1618–1625, 13 May 2006

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ANESTHESIA
Cautionary Tales

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Greyhound Dentistry

Mature Dog Spay

What these patients have in common

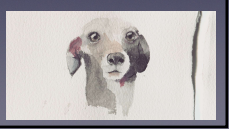
- Rescued
- Healthy based on physical examination
- Healthy based on blood screen
- Healthy based on known history
- Elective Procedures

What the adverse events had in common

- Unpredictable
- Potentially fatal outcomes
- Positive outcome as a result of monitoring strategy
- Positive outcome as a result of preparedness

"Filby" the Greyhound dentistry 2013

- Adult (DOB 2010) retired racing Greyhound
- Severe periodontal disease
- Pre-anesthesia screening
  - CBC, chem (no electrolytes)
  - Screening questions
  - PE

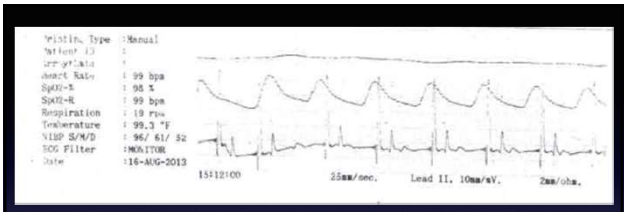


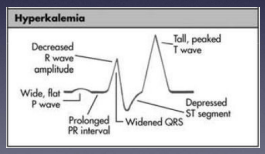
Filby's Anesthesia protocol

- Butorphanol/midazolam IM premedication (10:05)
- Ketamine/propofol ("Ketofol") induction IV (10:40)
- Isoflurane maintenance
- Bupivacaine local blocks

Filby's Anesthesia Timeline

- Premedication I.M. - 10:05
- Induction IV - 10:40
- Maintenance 10:45 to 13:45
- Adverse event - 13:45
  - heart rate suddenly down to 44 from 70 BPM
  - heart rate irregular
  - no P waves visible on lead II ECG





Bradycardia under Anesthesia Rule-outs

- Vagal stimulation ?
- Drug induced ?
  - ✳alpha 2 agonist
  - ✳opioid
  - ✳Inhalant
- Electrolyte abnormalities

Interventions

- Antisedan IV - no change
- Naloxone IV - no change
- Calcium chloride IV (slowly) - P waves returned

Cause of Bradycardia

- HYPERKALEMIA
  - Sudden
  - Loss of P waves

Outcome?

- Serum K^+ = 9.2 mE/dL at 2:45 PM
- Serum K^+ = 4.1 mEq/dL by 5:02 PM
- Serum K^+ remained normal
- Patient made full uneventful recovery

What happened?

- Where can that much potassium come from so quickly?

QUESTIONS?

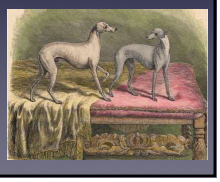
Martha's Spay
November 2015

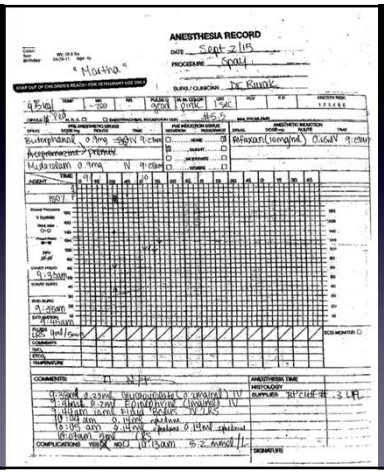
artha's Anesthesia Risk Assessmen

- Rescued from streets of Mexico City and relocated to Vancouver - up for adoption
- Pre-anesthesia screening
  - PCV, Total Solids, Urinalysis
  - Screening questions (history)
  - PE (WNL)

Anticipated Problems

The "H" 's




ANESTHESIA RECORD

DATE Sept 21/15

PROCEDURE Spay

SURG / CLINICIAN Dr Runk

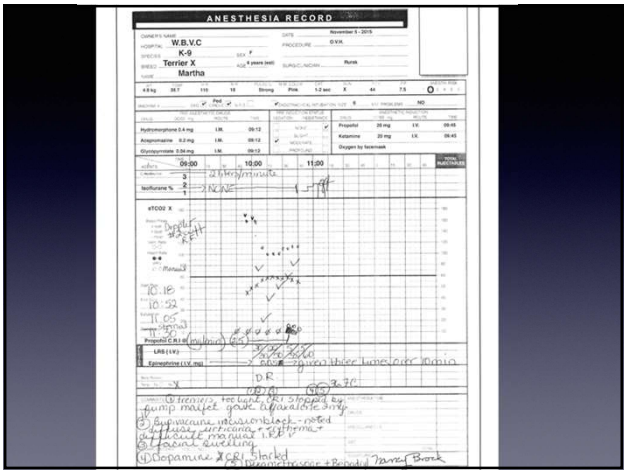
"Martha"

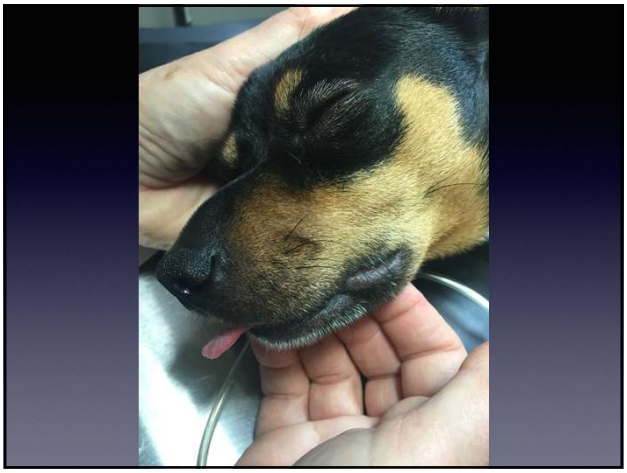
Martha Anesthesia Protocol

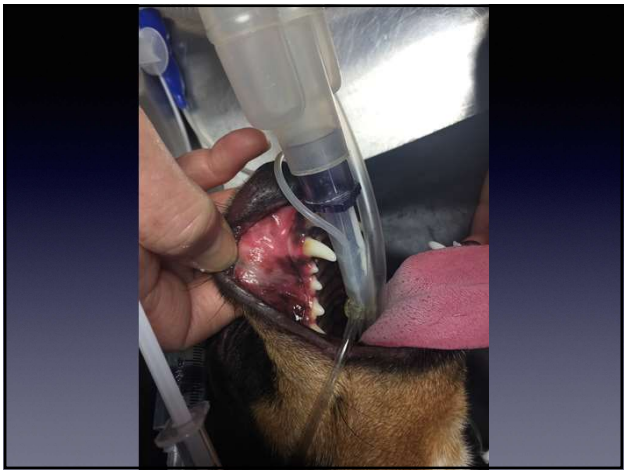
- Hydromorphone/Acepromazine IM premedication
- Ketamine/propofol ("Ketofol") induction IV
- Propofol C.R.I. maintenance started at induction
- Incision infiltration with bupivacaine 0.5%

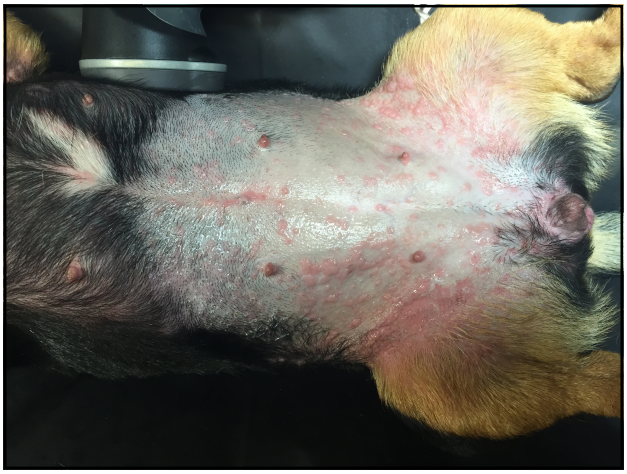
Martha's Anesthesia Timeline

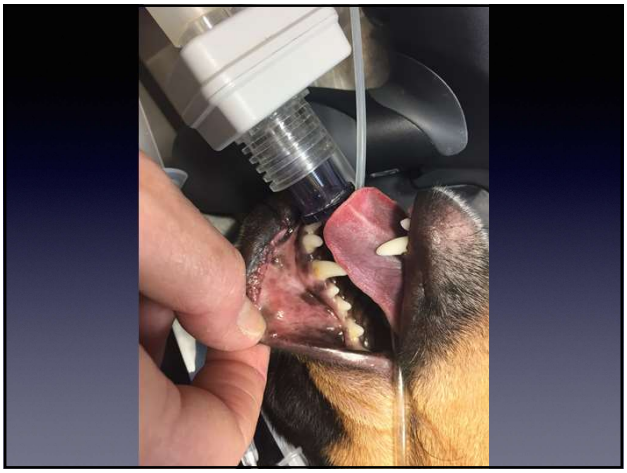
- Premedication I.M. - 09:12
- Induction IV - 09:45
- Maintenance 09:45 to 10:59
- Adverse event - 10:05
  - Heart rate suddenly160 →100 BPM
  - Systolic BP 160 → 90 → 20 mm Hg
  - Rash, facial swelling, difficulty ventilating


ANESTHESIA RECORD
W.B.V.C
K-9
Terrier X
Martha
09:00
10:00
11:00









nd Sudden Hypotension under Ane
Rule-outs

Interventions

- Epinephrine boluses - repeated
- Fluid bolus
- Benadryl and dexamethasone - eventually

Outcome?

- Systolic BP returned to acceptable range
- Surgery completed
- Rash and swelling gradually resolved over hours
- Patient made full uneventful recovery
- Metacam?

What the adverse events had in common

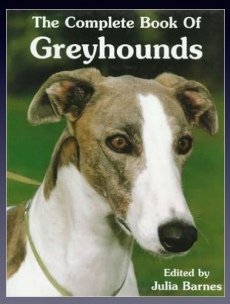
- Unpredictable
- Potentially fatal outcomes
- Positive outcome as a result of monitoring strategy
- Positive outcome as a result of preparedness

Lessons Learned About Anesthesia Risk Assessment

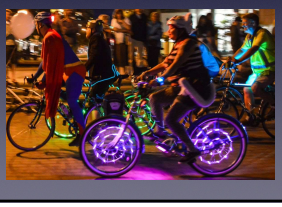
Lessons Learned About Monitoring

What if I don't have an ECG machine?

What if I don't measure blood pressure?



Thank You



Track 3

Just Breathe: Brachycephalic Airway Management

Leigh E. Glerum, DVM, DACVS
Sage Centers for Veterinary Specialty and Emergency Care

Brachycephalic dogs pose unique challenges for veterinarians. We are often asked to counsel our clients regarding observations about their dog's respiratory issues. We are also required to anesthetize these fairly delicate patients. It is wise for us all to have a working knowledge of brachycephalic respiratory anatomy combined with forethought regarding anesthetic protocols and procedures.

The primary sites of airway obstruction in brachycephalic dogs are within the upper airway. Nares are generally stenotic. Nasal turbinates are compressed and/or aberrant. Pharyngeal tonsils are often enlarged and everted. The soft palate is usually elongated and/or thickened. Chronic negative upper airway pressure can lead to eversion of the laryngeal saccules or more severe degrees of laryngeal collapse. Additional abnormalities can occur further distal in the airway, including microtrachea and bronchial collapse.

Gastrointestinal issues can complicate life for brachycephalic breeds. Regurgitation, vomiting, and gastroesophageal reflux contribute to overall patient distress and can ultimately lead to lower airway compromise by aspiration pneumonia.

Due to the propensity for brachycephalic dogs to regurgitate or vomit, it is prudent to consider management of their gastrointestinal tracts in the peri-anesthetic period. Fasting recommendations are currently a topic of research and discussion. There seems to be agreement that feeding a full meal soon before anesthesia is not prudent, but there is some evidence that feeding a reduced volume a few hours prior to anesthesia will diminish the incidence of gastroesophageal reflux. The administration of gastroprotectants, anti-emetics, and prokinetics should be considered—certainly in the immediate peri-anesthetic period and perhaps in the weeks prior to a procedure. Anticholinergics should be employed as needed, but they can decrease lower esophageal sphincter tone, increase gastroesophageal reflux, and/or increase gastric pH. Lower doses of acepromazine (0.005-0.1mg/kg) can decrease nausea. Opioids should be chosen carefully to avoid unwanted side effects such as panting, nausea, and reflux/vomiting. Less panting and less negative g.i. effects are generally seen with butorphanol and buprenorphine. Both drugs are fairly efficacious for mild to moderate pain control, but they must be administered at the appropriate frequency to prevent break-through pain (butorphanol 0.2mg/kg q1 hr or as CRI, buprenorphine 0.01mg/kg q6-8 hr). Mu agonists generally provide superior analgesia—less vomiting is seen with fentanyl and methadone (fentanyl 0.005mg/kg bolus/premed or CRI, methadone 0.5mg/kg premed, 0.1-0.2mg/kg q4-6 hr).

Management of patient stress is paramount. Agitation generally causes excessive panting and hyperthermia, exacerbating the negative effects of being brachycephalic in the first place. Pre-existing or surgically induced inflammation can be increased by airway turbulence. Administer sedatives early and repeat as necessary throughout the hospital stay. Corticosteroids or NSAIDs should be considered preemptively.

Oxygen delivery to the lower airways is a key to success. Patients should be pre-oxygenated prior to anesthetic induction. Anesthetic induction and endotracheal intubation should be rapid. Endotracheal tubes should be left in position as long as possible at recovery. Always be

prepared to re-intubate (keep an induction agent, laryngoscope, and endotracheal tube on/near the patient cage). A few patients will ultimately require a temporary tracheostomy. Suspending the maxilla in the initial recovery phase will maximize the size of the upper airway passage. Nasal oxygen is of questionable efficacy in brachycephalic patients due to their nasal turbinate conformation. Oxygen insufflated via nasotracheal tube bypasses the nasal cavity, but it does pose the risk of inducing a cough or gag reflex.

The need for rhinoplasty can be determined on routine physical exam. Enlargement of the nasal apertures can be achieved by wedge resection. The efficacy of nares modification theoretically can be overshadowed by abnormal intranasal conformation—air passes more readily through the enlarged nares, but flow is then disrupted by crowded turbinates. Most decisions regarding brachycephalic airway modification are made following pharyngoscopy and laryngoscopy under a light plane of anesthesia. The pharyngeal tonsils are often everted from their crypts, but they are not always significantly enlarged. Bilateral tonsillectomy can effectively enlarge the pharynx in dogs with particularly cramped upper airways. The caudal margin of a normal soft palate should be even with the tip of the epiglottis and the caudal margins of the tonsillar crypts. Staphylectomy may be performed by a variety of modalities, including sharp dissection, laser, and electrosurgical devices (e.g.-Ligasure). The goal of this procedure is to establish normal palatal margins while minimizing swelling and hemorrhage. The laryngeal saccules are essentially potential spaces in the airway located just rostral to the vocal folds. When the saccules evert due to negative pressure, the airway is further compromised. Saccules are usually resected sharply. Laser assisted resection of aberrant/irregular nasal turbinates is an ongoing subject of research, and such a procedure may further improve the ultimate outcome for our brachycephalic airway surgery patients.

Surgical modification of the upper airway is the right choice for many brachycephalic dogs with moderate to significant clinical affectation. Most of these dogs will exhibit a significant and durable improvement in upper airway status, but some clinical signs can recur postoperatively. Surgery/anesthesia is not without risk, as there is an approximately 4% mortality rate reported. Careful perianesthetic management and surgical technique should help mitigate such risk.

Integrative Medicine: How Best to Balance the West and the East

Jennifer Martin, DVM, CVA

Micki McCabe, DVM, DACVIM, CVA

Abbie B. Whitehead, MPH, DVM

Integrative medicine is an evolving discipline that tries to meld the benefits of Western medicine with those of other modalities, such as Traditional Chinese Medicine, or in our case, Traditional Chinese Veterinary Medicine (TCVM), for the greatest benefit of the patient. Integrative medicine combines modalities that support health and balance of both mind and body. This premise has naturally drawn scrutiny from the scientific community, and there is a strong movement toward improving the level of evidenced based practice in the alternative medicine arena.

Acceptance (and pressure for its growth) of integrative medicine is coming more rapidly from the pet owning public rather than the Western veterinary world itself. This tremendous interest by pet owners brings with it an equally tremendous responsibility to be open and honest about what integrative medicine has to offer. In the human medical world, integrative medicine is one of the fastest growing areas of medicine in the US. Harvard and Stanford Medical Schools, the Mayo Clinic, Center for Disease Control, and World Health Organization are a few of the well-known organizations with active Integrative Medicine Departments. All of these groups are seeking a better understanding of how to integrate "alternative" care into our western world, whether that includes Traditional Chinese Medicine, Ayurvedic Medicine, massage, or other modalities.

One of the controversies regarding the utilization of non-western therapy is whether there is a way to test and prove the benefit and usefulness of the treatment in question. Western medicine historically and theoretically relies on double blind studies, case studies, in vitro experiments, etc. to try to show the usefulness and relative safety of newer treatments. Having said that, much of what is considered acceptable practice in veterinary medicine in particular is, in fact, quite anecdotal or based on one or two case studies that have been published in a refereed journal at best. Eastern medicine, on the other hand, has centuries of history that has passed the test of time with consistency and results despite the somewhat poetic descriptions from the early ages. TCVM looks holistically at each patient: not just, for instance, what specific bacteria is growing in the urine, but what is the temperament of the patient, its digestion patterns, its environment, and other factors that make the individual respond in a certain way to its environment and to chosen treatment. More and more studies are being performed to try to validate and explain why many eastern therapies work. Traditional Chinese Medicine cannot always be tested in the same way as Western medicine, however, as oftentimes, patients with the same western diagnosis often times have vastly different TCM diagnoses, leading to different treatments, which is sometimes where Eastern medical therapy is successful when Western treatment fell short.

As in human medicine, the veterinary profession is seeing an ever-increasing acceptance of potential toxicity that might occur as we reach for stronger and stronger medical therapy. This level of acceptance is not always shared by the pet-owning public. If an owner is not given options, pet owners may not make informed choices for their pets' care. For instance, a client whose pet has cancer chooses not to pursue chemotherapy, yet may not be informed that options beyond euthanasia could support a pet's quality of life for a significant period of time. Many times, the best "proof," at least on an individual level, is a patient who has tried and exhausted Western therapy, only to find an alternative approach was the only relief the got from their underlying problem.

A 2007 survey done by the National Institutes of Health found over a third of adults and 12% of children in the United States used alternative therapies, including acupuncture and herbal supplements. As of 2011,

this number is approaching 40%. Interest is growing, and the pet owning population is following this lead. More than 50 North American medical schools are actively teaching integrative medicine to their students.

Over the years the Western community has seen many herbal or nutritional therapies come into mainstream use following first, an interest in the herbal, then by one or two case studies, and then in vitro and vivo studies that have proven efficacy of those therapies to the medical community. Some of the best-known examples are milk thistle/silymarin and Sam-E. The truth is that many of us are already practicing Integrative Medicine at some level! At the 2012 Veterinary Cancer Society meeting, studies were presented showing the benefits of the Chinese herbal combination, Yunnan Baiyao, on canine hemangiosarcoma cell lines. Another study was presented discussing in vitro potentiation of canine prostate cancer cells to mitoxantrone therapy using a green tea extract called Epigallocatechin Gallate.

In my hands, Integrative Medicine is born from a background in Internal Medicine for over two decades, followed by a sense over the past several years that there must be more that I could offer than advanced diagnostics, procedures, and Western medications for my patients. This is not to say that I have shunned more involved procedures or newer medications, I have simply added new modalities to my diagnostic and therapeutic toolbox. My practice involves integrating western medicine with acupuncture and Chinese herbal therapy.

Speaking of acupuncture therapy, from the National Institutes of Health website, it is noted, "Acupuncture is generally considered safe when performed by an experienced practitioner using sterile needles. Relatively few complications from acupuncture have been reported. Serious adverse events related to acupuncture are rare, but include infections and punctured organs. Additionally, there are fewer adverse effects associated with acupuncture than with many standard drug treatments (such as anti-inflammatory medication and steroid injections) used to manage painful musculoskeletal conditions like fibromyalgia, myofascial pain, osteoarthritis, and tennis elbow." Animal acupuncture itself has been in use since at least 2000 BC. Briefly, defined points are stimulated using very tiny needles; fluid (injection), pressure, or laser. These points are located over nerves, nerve endings, blood vessels, or muscular motor regions. They have been identified as areas of decreased electrical resistance. Acupuncture has been shown to cause release of endorphins, enkephalins, dopamine, somatostatin, neurotensin, substance P, and serotonin. Laser can also be used along larger areas (sore muscles, incision lines for swelling, dermatitis) to normalize cell function, provide pain relief, reduce inflammation and promote healing. A TCVM practitioner's goal is to support the body's own ability to heal itself by helping reestablish health and balance.

We are planning a roundtable discussion so bring your cases! Alternatively, we intend to present cases that have either failed Western therapy and improved with acupuncture and herbal support, or that have benefited from a combined, or integrative approach to their care.

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Function, Fitness, Fun: Why Rehab Works
Margot Daly, DVM, CCRP
SAGE Campbell

Physical rehabilitation is the intersection of multimodal pain management, manual therapies, and targeted therapeutic exercise. The key for successful rehabilitation is a steady and gradual return to activity. Going from zero to sixty immediately after a TPLO is no good, but neither is having a dog walk around non-weight bearing for a month after surgery!

Multimodal pain management is essential, as a patient who is too painful to perform the prescribed exercises will not improve! This method of approaching pain includes our common oral and injectable medications (NSAIDs, tramadol, gabapentin, Adequan) as well as Pulsed Electromagnetic Field Therapy (Assisi Loop), LASER therapy, dry needle or electro-acupuncture, TENS, shockwave, and adjunct pharmaceuticals such as amantadine or TCVM herbal formulas.

Our clients can play a huge role in rehabilitation, and we should encourage them to be as proactive as possible with their pets' recovery. The more we can educate and assist them in understanding the purpose of rehabilitation, the concept of a controlled and steady return to function, and some simple techniques for successful therapy, the better the results will be. If rehab is fun and positive for both the owner and patient, compliance is much higher!

The first stage of rehabilitation is to regain function. These are the types of exercises and tools that we want to encourage owners to try at home during the first few weeks postoperatively. Helping owners become comfortable and effective with these exercises can be challenging, so here are a few tips:

Passive Range of Motion/Joint Compressions:

- Best if dog is relaxed and all the way in lateral - this can be a challenge!
- I encourage owners to gently traction and compress their own wrists/fingers to get a feel for how firm their touch should be. All motions should be smooth and steady.
- Support the whole limb, with one hand under the stifle/elbow and one hand on the metatarsals/metacarpals or under the hock/carpus.
- For hind limb joint compressions can place one palm distal to the hock and one palm proximal to the stifle and squeeze both hands together to achieve a compression in both joints with one movement.
- Gently rub or scratch the flank to encourage relaxation of severe hip and stifle flexion
- If the patient is very guarded, gently flexing and extending the limb in a neutral or comfortable position a few times can help relax them into allowing a greater range of motion
- Point out all joints in the limb and make sure that all of them have motion, so they are not just bicycling the hock with no stifle and hip motion.
- Clients can squeeze the lateral digits at the nail bed as the leg comes back into full hip/stifle extension to initiate the withdrawal reflex - can also use electric toothbrush at back of paw pad

- This can be paired with **assisted standing** and **patterning** in neuro patients - some orthopedic patients may do better in a standing position as well, depending on temperament
- Tail traction is also very helpful in patients with lumbosacral discomfort - most dogs with pelvic limb lameness will have some degree of compensatory back pain

Assisted Standing / Patterning:

- Physioroll or peanut, paper towel roll, rolled towels or even a padded exercise bench can be used to stabilize patient
- Bathmat, doormat, square of fake grass carpet, or DynaDisk under back paws for texture for patterning
- Make sure owners are pushing foot DOWN into the textured surface for maximum stimulation during patterning
- Front paws slightly higher than back paws if possible
- This is a great position to do some standing weight shifts/joint compressions in for comfort and activation of mechanoreceptors
- Peanut butter therapy or a helper if they are wiggly!

PAWZ booties or proprioceptive wraps:

- Protect feet, apply proprioceptive stimulus, provide mild irritating stimulus to the unaffected limb(s), encouraging the patient to shift weight onto the affected limb
- Should not be worn for more than one hour, patients should not be left unattended
- Use for walks (even if only walking outside to eliminate) and during any standing ther-ex

NMES units:

- Can be purchased by owners at a reasonable cost and used at home to prevent atrophy in a non-ambulatory patient, or to begin rebuilding muscle in an atrophied leg that is not ready for active exercises.
- We use the Current Solutions EMS 7500 Unit
- Clients also need to purchase electrodes and contact gel
- Rehab department can set up and train owners on use of the unit

The second stage of rehabilitation is to regain fitness with active therapeutic exercises including:

- Paws up/down - for eccentric strengthening, increased weight bearing, spinal extension
- Sit to stands - “doggy squats” for hamstrings and quads, functional exercise
- Transitions - targets the forelimbs and is an important functional exercise
- Pushups - triceps and biceps, most effective in a paws down position
- High stepping - proprioception, range of motion in elbows and stifles - slow and steady!
- Cushion walking - proprioception, core strength, encourages even weight bearing
- Hill walking - straight up and zigzag down for pelvic limbs, zigzag up and walk straight down for thoracic limbs
- Sit pretty - core strength
- High fives - shoulder and elbow range of motion, be sure to train both paws!

Keep things fun by picking 3-5 exercises per session and varying the sessions. My general rule of thumb is their ex daily five days per week or BID three days per week, in addition to

leash or harness walks. Find what motivates your patient and use it. RuffWear harnesses or Help Em Up harnesses can be helpful for ensuring safety and stability as the exercises become more challenging.

Orthopedic Rehabilitation:

- Always ensure patient pain is well managed. If mobility and limb use is worse after a rehab session instead of improved, re-evaluate your pain management and consider scaling back the level of impact on the affected limb. If function is improved after rehab sessions, you can be more assertive with your functional use exercises, as this often means that the lameness is a learned behavior or myofascial dysfunction.
- Monitoring and rebuilding muscle mass is essential. If specific muscle groups are affected, or are not recovering at the same rate as other groups, look deeper for discomfort and consider fine tuning your therapeutic exercises to more directly target the affected groups. It never hurts to improve core strength in addition to rehabilitating the injured limb!
- Gait retraining using cavalettis at both walk and trot can be helpful in improving coordination and minimizing gait abnormalities that may contribute to chronic low grade lameness or flare ups of myofascial discomfort - minor chronic iliopsoas discomfort, for example, can be secondary to an abnormal or uneven gait in the pelvic limbs.

Neurorehabilitation:

- Proactive, early involvement is key. This does not mean allowing your patient who just had a hemilaminectomy drag themselves all over the house, but it does mean short frequent sessions (up to four times daily!) of assisted standing, sensory stimulation, and patterning. Even patients without deep pain can sometimes regain some level of independent mobility with early intervention and patience.
- After the initial month postoperatively, carts can provide a useful tool for improving quality of life during rehabilitation and mobility assistance for patients who are either only partially mobile or do not regain enough function to move on their own. A well fitted cart maintains a neutral spinal position and can allow for some sensory stimulation of the hind limbs, both of which can minimize discomfort and improve the chances of recovery.

Geriatric rehabilitation / rehabilitation for chronic disease:

- Be mindful of concurrent neurologic and orthopedic conditions, or cardiac/respiratory conditions that limit the amount of active therapeutic exercise they can safely perform. For these patients, comfort and maintenance of daily function is paramount.
- Higher water levels in the underwater treadmill provide hydrostatic pressure to painful joints while reducing up to 70% of the patient’s body weight.
- Core strengthening in the form of cookie stretches, puppy sit ups and side crunches, cushion walking, and dynamic balance or “surfing” on a Fitbone, PhysioRoll, or Paw Pods is always helpful.
- Degenerative conditions should be reassessed frequently. Good communication with owners is key - they need to understand that we cannot reverse these diseases, but that our goal is to slow progression and maintain quality of life.

Mediastinal masses

Beki Regan DVM DACVIM (Onc)

Overview

- Clinical signs
- Imaging
- Differentials/diagnostics
- Treatments/prognoses

Clinical signs

- Dyspnea
  - Mass effect
  - Effusion
    - Chylothrorax
    - Neoplastic effusion
    - Tamponade

Clinical signs - hypercalcemia

- PU/PD
- GI upset
- Muscle soreness/lethargy

Differential diagnoses

- Lymphoma
- Thymoma
- Carcinoma (thyroid)
- Heart base (chemodectoma)
- Less likely…
  - Mast cell tumor
  - Hemangiosarcoma
  - Mesothelioma
  - Non-neoplastic causes

Imaging

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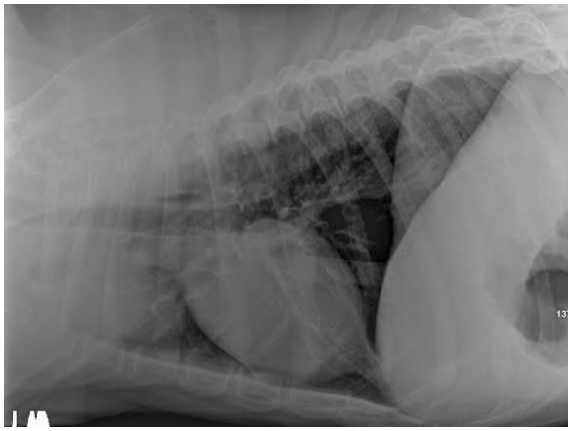
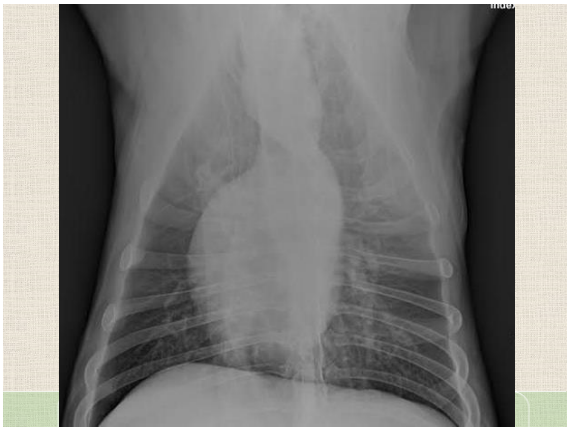
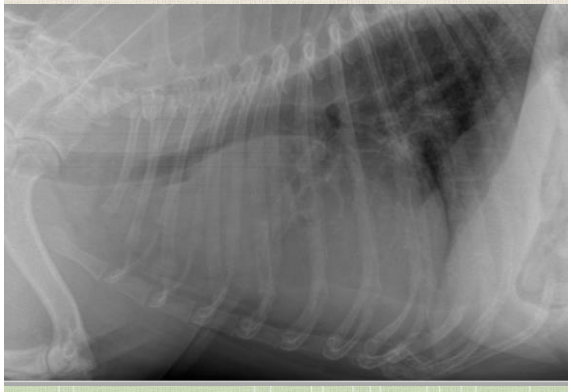






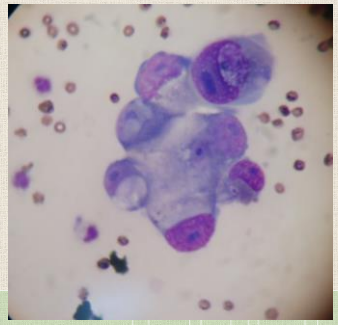
Obtaining diagnosis

- Cytology of neoplastic effusion

Cowgill 2003

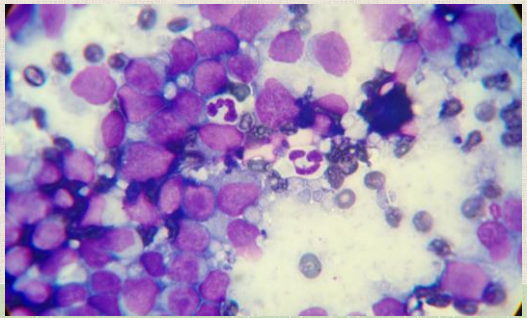
Obtaining diagnosis

- Cytology of neoplastic effusion



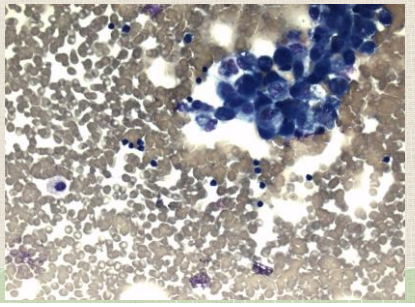
Obtaining diagnosis

- Cytology of mass (ultrasound guidance)



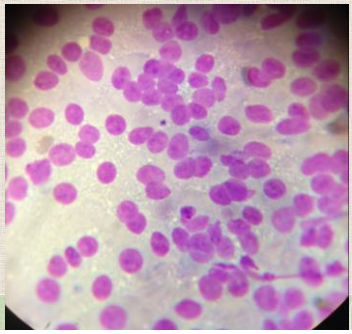
Obtaining diagnosis

- Cytology of mass (ultrasound guidance)



Obtaining diagnosis

- Cytology of mass (ultrasound guidance)



Look at sample before it is sent out

- Non-diagnostic samples result in more cost/annoyance to owner

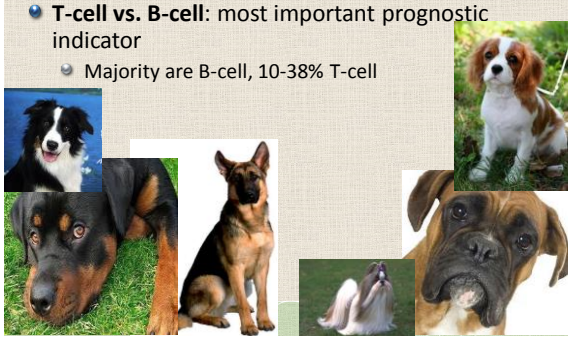
Canine Lymphoma

Mediastinal lymphoma - canine

- Often **T cell** phenotype (20% of T cell lymphomas)
- Associated with hypercalcemia
- May or may not have peripheral lymphadenopathy
- Diagnosis – cytology/biopsy

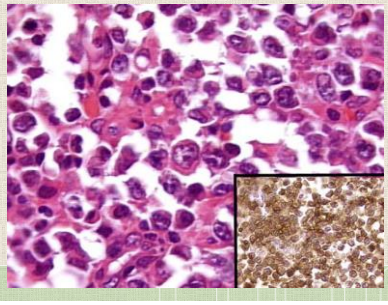
Immunophenotyping

- **T-cell vs. B-cell**: most important prognostic indicator
  - Majority are B-cell, 10-38% T-cell



Methods of immunophenotyping

- Gold standard: IHC (CD3 vs CD79)



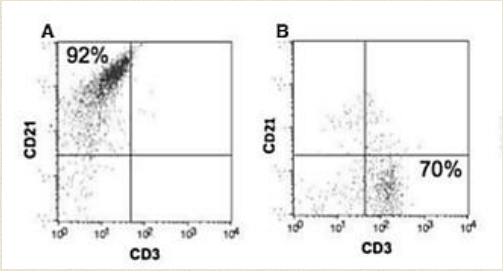
(Sueiro 2004)

Methods of immunophenotyping

- Flow cytometry

(Umassmed.edu)

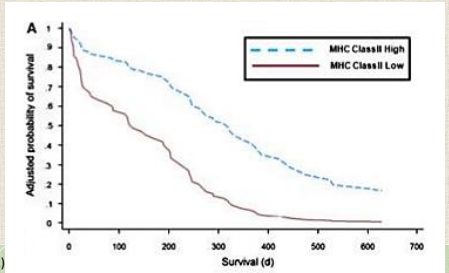
Flow cytometry



(Thalheim 2013)

Flow cytometry

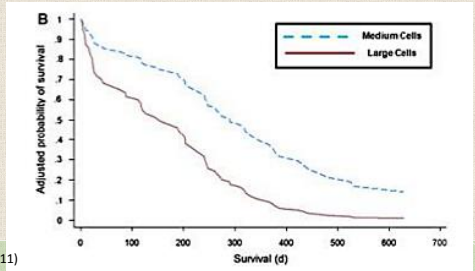
- It's not just about immunophenotype…
  - MHC class II levels



(Rao 2011)

Flow cytometry

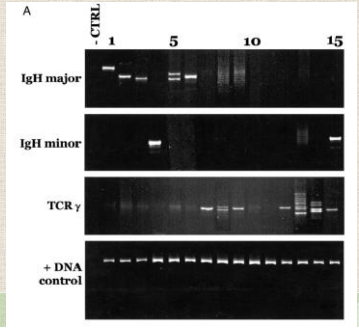
- It's not just about immunophenotype…
  - Cell size



(Rao 2011)

Methods of immunophenotyping

- PARR (PCR for antigen receptor rearrangement)



(Burnett 2003)

Methods of immunophenotyping

- 94% of flow samples agree with IHC
- 70% of PARR samples agree with IHC
- PARR has a lower sensitivity than flow – up to 25% false negatives
  - Specificity is the same (you can believe a positive)

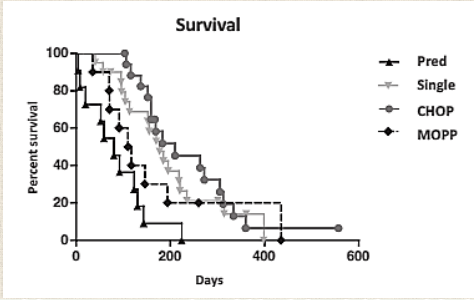
Treatment

- Standard of care: CHOP chemotherapy
- Should treatment differ based on immunophenotype?
  - 30% of oncologists treat them differently
  - T-cell LSAs have more chromosomal aberrations
  - Would they respond better to an alkylating agent-heavy protocol (little cross-resistance)?
  - T cell dogs have a lower response to Adriamycin than B cell

Chemo for T-cell lymphoma

L-MOPP	L-CHOP
ORR = 98%	ORR = 96%
78% CR	88% CR
Median OST = 270 days	Median OST = 234 days

Survival for T cell dogs



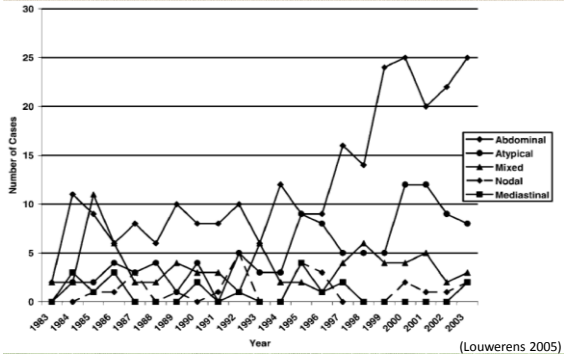
(Avery 2014)

Feline Lymphoma

Feline mediastinal lymphoma

- Most common thymic pathology in the cat
- Associated with FeLV
  - Young age cats
  - T cell phenotype
- Siamese cats overrepresented

Lymphoma post-FeLV



(Louwerens 2005)

Mediastinal lymphoma post FeLV

- Bimodal age distribution
  - Peak at 1 and 8 years
- Siamese younger than other cats at diagnosis
  - All FeLV negative
- 10% FeLV positive
- 24% had involvement of other organs

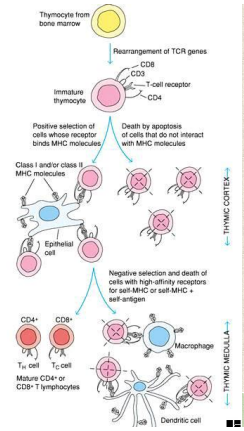
Treatment

CHOP	COP
ORR = 96%	ORR = 93%
62% CR	68% CR
OST = 484 days*	OST = 211 days*

*Not significantly different

Thymoma

Thymus



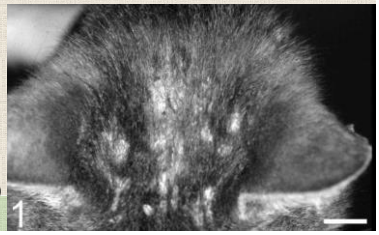
Thymoma

- Tumor of the thymic epithelium
- Retrievers and GSDs overrepresented

Paraneoplastic dermatitis

- Exfoliative dermatitis with CD3+ lymphocytes
- Can resolve post op

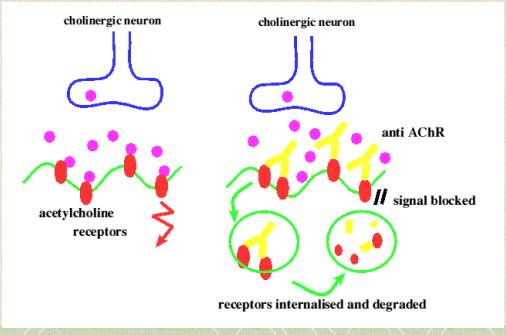
(Rottenberg 2004)

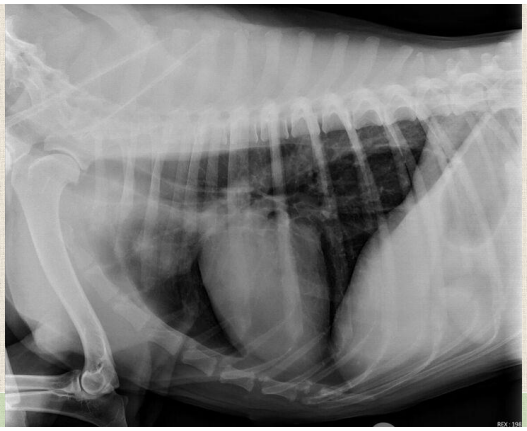


Paraneoplastic hypercalcemia

- 9-34% of canine thymomas
- Associated with PTHrp

Paraneoplastic Myasthenia Gravis





Myasthenia Gravis

- May or may not resolve after surgical removal
  - People – 21% of MG cases have thymoma, 45% of thymomas have MG
  - Cats – 50% of MG cases have thymoma , 5% thymomas have MG
  - Dogs – 3% of MG cases have thymoma, 10% - 40% of thymomas have MG

Others…

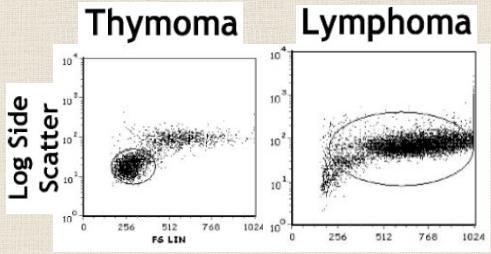
- Erythema multiforme
- Paraneoplastic lymphocytosis
- IMHA/ITP
- KCS
- Myositis
- Up to 1/3 of dogs with thymoma have a second malignancy

Pathology

- Epithelial cells with variable % of lymphocyte infiltrate
- Cystic spaces can be seen
- Mast cells (up to 85% of cases), eosinophils
- Most FNAs contained both mixed lymphocytes and epithelial cells

Flow cytometry for diagnosis

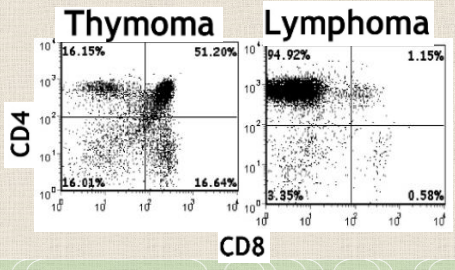
- Cell size smaller than lymphoma



(Lana 2006)

Flow cytometry

- Thymomas are double + (CD 4/CD8)



(Lana 2006)

Surgical excision

- Survival for cats
  - MST = 1825 days
- Survival for dogs
  - MST =635-790 days
- 8% perioperative mortality
- Recurrence possible (17%)

Surgical excision

- Prognostic factors
  - % lymphocyte composition (more is better)
  - Invasiveness
  - +/- megaesophagous
  - Presence of a second tumor

Radiation therapy for non-resectable disease

- ORR (rads) = 75%
- MST (dogs) = 248 d
- MST (cats) = 720 d

Thymomas in rabbits

- Present with exopthalmus, dyspnea, coughing
- 70% perioperative mortality rate in a case series of surgery
- MST with conservative management (prednisone) = 5 months

Radiation case series (Andres 2012)

- 15 RT alone, two post-op RT, 2 pre-op RT
- 6 definitive, 13 palliative
- MST = 313 days
- MST excluding 3 who died under anesthesia = 727
  - 16% died during tx ☹
- Body weight prognostic (under 1.57 kg vs over)

Thymoma case (Allan 2013)

- 10 yo MN Siberian Tiger
- 6 months of progressive weakness/muscle wasting

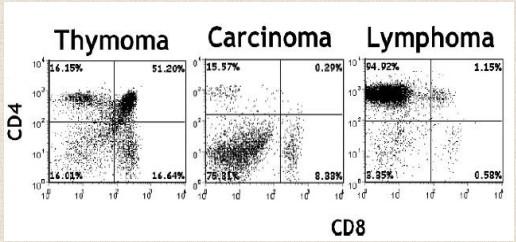
Carcinomas

Mediastinal carcinomas

- Less common
- Ectopic thyroid
  - Follicular
  - Medullary (neuroendocrine)
- Non-thyroid neuroendocrine carcinomas
- Anaplastic carcinomas

Diagnosis

- Flow cytometry



(Lana 2006)

Diagnosis

- IHC – all cytokeratin +
  - Thyroid transcription factor-1
  - Thyroglobulin
  - Calcitonin
  - Chromogranin
  - Synaptophysin

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Diagnosis

- IHC – all cytokeratin +
  - Thyroid transcription factor-1
  - Thyroglobulin
  - Calcitonin
  - Chromogranin
  - Synaptophysin

Treatment

- Non-standard (rare)
  - Surgery
  - Radiation
  - Chemotherapy
  - MST small case series = 243 d

Heart Base Tumors - Chemodectomas

AKA aortic body tumors

- Arise from chemoreceptor cells of aortic body
- Hemangiosarcomas are 70% and chemodectomas are 8% of cardiac tumors
- Breed predisposition (chronic hypoxia?)

Diagnosis

- Echocardiography
  - 74% sensitive and 98% specific for heart base tumors
- FNA is sometimes possible

Treatment

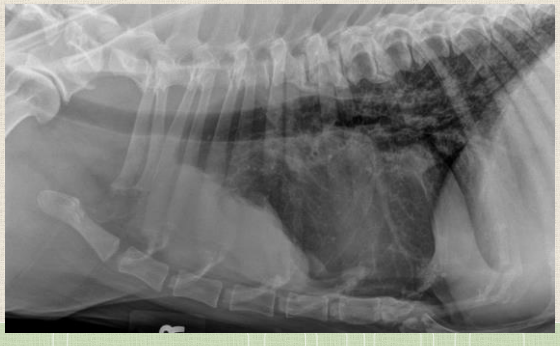
- Pericardial window
  - MST = 730 vs 42 days
- Radiation therapy
  - Case report of fractionated RT with survival of >4 years
  - Palliative radiation to entire heart
- Chemo?

Cases

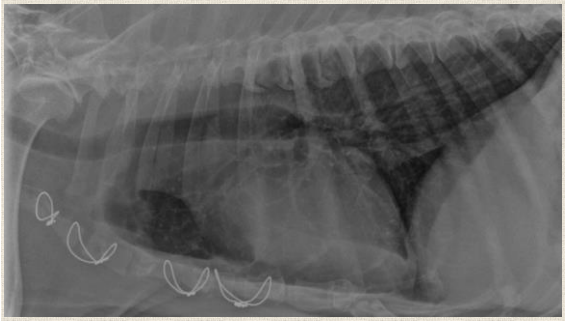
Case: Thula

- 9 yo FS Rottie
- Presented to surgeon for evaluation of elbow disease
- PE: Normal aside from arthritis

Thula's chest x-ray



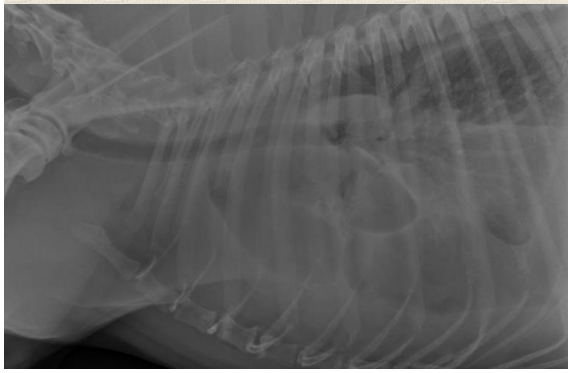
Thula post-op



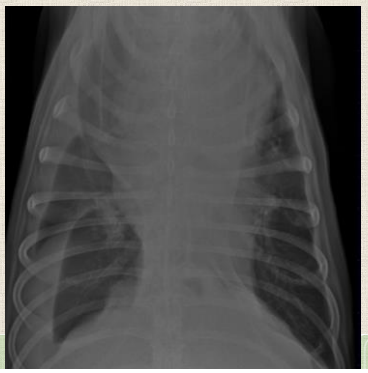
Case: Gretchen

- 10 yo FS Lab
- Presented on ER for lethargy, increased RR and RE
- PE: Fluid wave in abdomen, muffled heart and lung sounds

Gretchen's chest x-rays



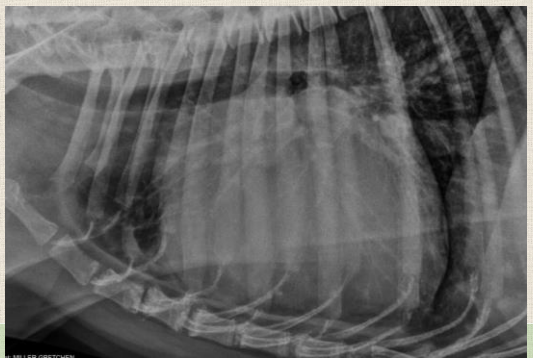
Gretchen's chest x-rays



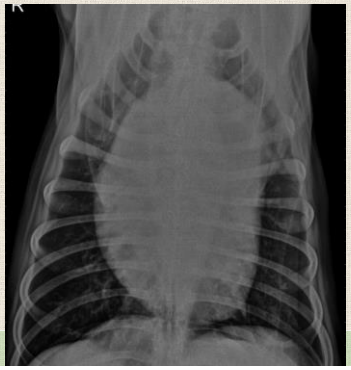
Treatment

- Thoracoscopic pericardial window
- Procedure went well
- Owner declined radiation/chemotherapy
- 13 months later, collapse episodes

13 months post window



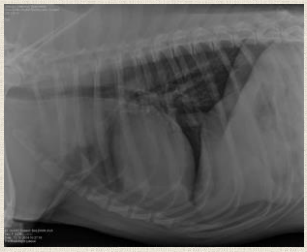
13 months post window

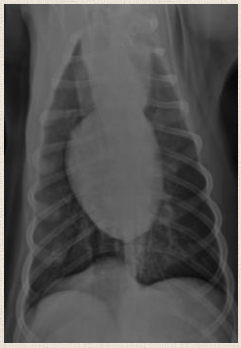


Case: Ava

- 5 yo FS Chocolate Labrador
- Presented for PUPD
- PE: Dehydrated, all else wnl
- BW: Total calcium = 15.5

Ava's chest x-rays





Pulmonary Hypertension

SAGE

An approachable team of specialists providing advanced, collaborative, and compassionate care.

Sara Johns, DVM
DACVIM (Cardiology)
3/19/2017

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Sammie

15yr old FS Jack Russell Terrier, 9kg

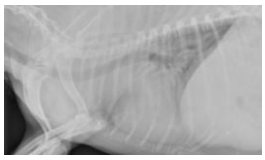
March 2014: presented to regular veterinarian for dyspnea/tachypnea
- Loud heart murmur noted
- Cardiomegaly on thoracic radiographs
  - Furosemide, enalapril, pimobendan
  - Little clinical improvement

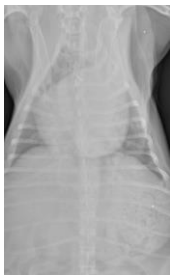
April 2014: furosemide increased

May 2014: furosemide increased, referred

Sammie

Current medications:
- Furosemide 25mg (3mg/kg) PO q8hrs
- Enalapril 2.5mg PO q12hrs
- Pimobendan 5mg PO q12hrs
- Spironolactone 25mg PO q12hrs





Sammie

Physical exam
- HR 110
  (dogs in left heart failure are tachycardic)
- Grade V/VI right sided systolic murmur
  (dogs in left heart failure have a left sided murmur)
- Loud crackles
  (dogs in left heart failure have soft crackles or no adventitious sounds)
- Moderately increased expiratory effort
  (dogs in left heart failure have increased inspiratory effort)

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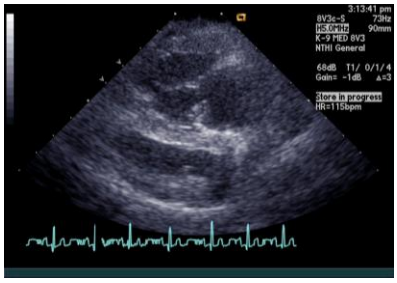
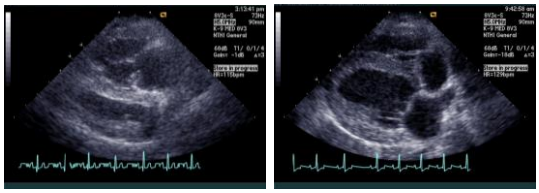
Sammie



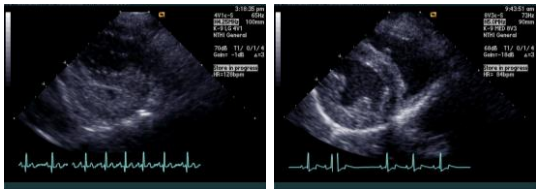
Sammie

Sammie **Normal**

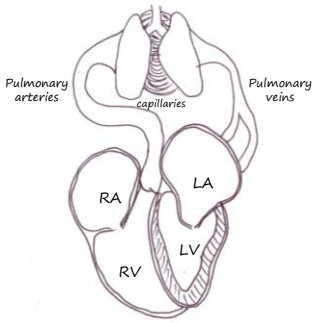


Sammie

Sammie **Normal**



Visual aid



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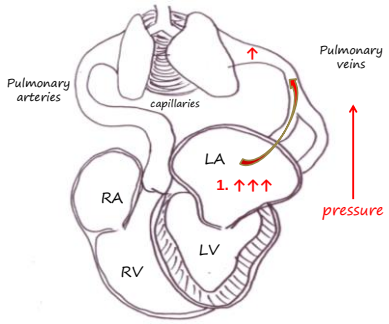
Visual aid



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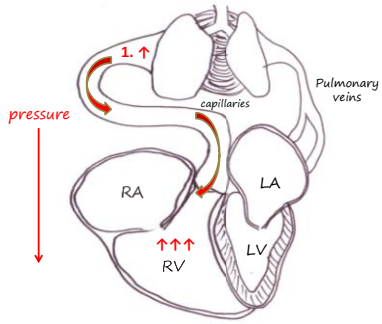


Sammie

Severe pulmonary hypertension and cor pulmonale

Mild ascites (right sided heart failure)

Treatment:

- Sildenafil 3mg/kg PO q8hrs
- Theophylline XR 10mg/kg PO q12hrs
- Clopidogrel 2mg/kg PO q24hrs
- Furosemide: taper to 1mg/kg PO q12hrs
- Enalapril 0.5mg/kg PO q12hrs
- Pimobendan 0.25mg/kg PO q12hrs
- Spironolactone 2mg/kg PO q12hrs

Definition

Pulmonary artery systolic pressure >30mmHg

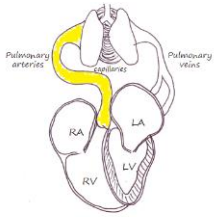
Influenced by:

- Pulmonary blood flow
- Pulmonary vascular resistance
- Pulmonary venous pressure

5 Classifications

Pulmonary arterial hypertension (precapillary)

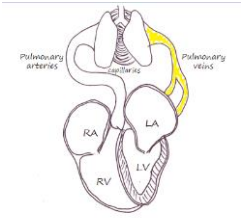
- Heartworm disease
- Systemic to pulmonary shunts
  - Atrial septal defect
  - Ventricular septal defect
  - Patent ductus arteriosus
- Necrotizing vasculitis/arteritis
- Idiopathic



5 Classifications

Pulmonary venous hypertension (postcapillary)

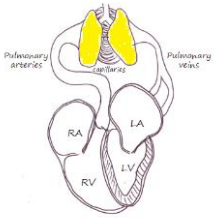
- Left sided heart disease
- "downstream resistance"
- Reactive hypoxic pulmonary arterial vasoconstriction with pulmonary edema



5 Classifications

Pulmonary hypertension associated with lung disease and/or hypoxemia

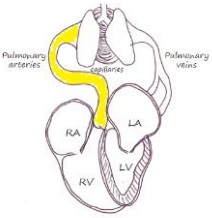
- COPD
- Interstitial lung disease
- Alveolar hypoventilation
- High altitude



5 Classifications

Pulmonary hypertension caused by chronic thrombotic or embolic disease

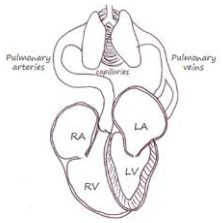
- Thromboembolic obstruction
  - Protein losing disorders
  - Hyperadrenocorticism
  - IMHA, DIC
  - Cardiac disease (cats)
- Nonthrombotic embolism
  - Heartworms/other parasites
  - Neoplasia
  - Foreign bodies



5 Classifications

Miscellaneous

- Compression of pulmonary vessels
- Lymphadenopathy
- Granulomatous disease



Pathophysiology

??

Vasoconstriction in response to hypoxia

Release of endogenous vasoactive mediators

Vascular remodeling: medial hypertrophy, intimal fibrosis

- → decreased luminal dimension and compliance
- → decreased total cross-sectional area of pulmonary vascular bed

Thrombosis

Pathophysiology

Endothelin-1

- potent vasoconstrictor and leads to vascular remodeling
- people with PHT have impaired clearance of ET-1

Prostacyclin: vasodilator, platelet inhibitor

Thromboxane A_2: vasoconstrictor, platelet agonist

- people with PHT have an imbalance of metabolites, favoring production of TXA_2

Clinical picture

Small breeds, middle aged to geriatric, females overrepresented

Exercise intolerance

Syncope
Cough
Dyspnea
Lethargy
Abdominal distension

Physical exam

Heart murmur, especially right sided
- Right sided murmur ≥ 4/6 was 43% sensitive and 93% specific for PHT

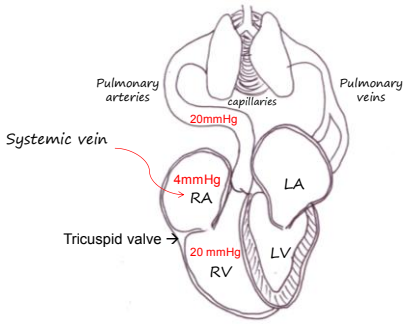
Split S2

Pulmonary crackles

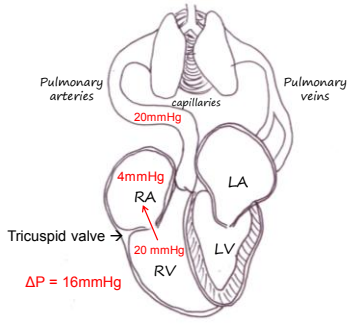
Cyanosis

Ascites
- Ascites + loud right sided murmur was 100% specific for PHT

Diagnosis – Right heart catheterization



Diagnosis – Echocardiography

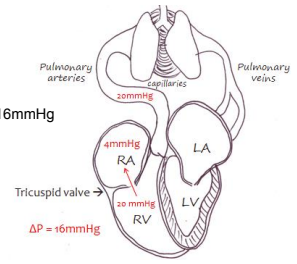


Diagnosis – Echocardiography

Normal pressures:
- RA ~4mmHg
- RV ~20mmHg

ΔP = 16mmHg

Modified Bernoulli
- $\Delta P = 4V^2$
- $16mmHg = 4V^2$
- $V^2 = 16/4 = 4$
- $V = 2$ m/s → Normal tricuspid regurgitant velocity



Diagnosis – Echocardiography

Mild: TR gradient 31mmHg – 50mmHg
- TR velocity 2.8 – 3.6 m/s

Moderate: TR gradient 51mmHg – 80mmHg
- TR velocity 3.6 – 4.5 m/s

Severe: TR gradient >80mmHg
- TR velocity > 4.5 m/s

Sammie's TR velocity:
5.22 m/s = gradient of 109mmHg

Diagnosis – Echocardiography

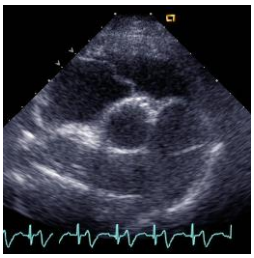
Right ventricular concentric hypertrophy and/or dilation

Septal flattening

Pulmonary artery dilation

Pulmonic insufficiency velocity

Heartworms, thrombi visualized



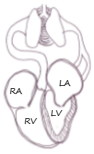
Diagnosis

Echocardiography – Drawbacks
- No TR
- Poor alignment with TR jet
- Poor image quality due to pulmonary disease/dyspnea
- RV myocardial failure
- Increased RA pressure
- Tachycardia

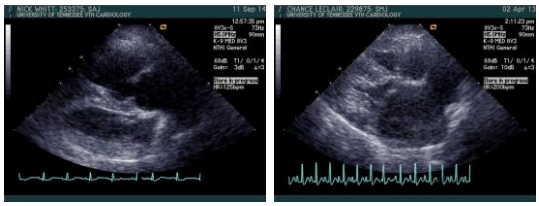
Diagnosis – Biomarkers

NT-proBNP
- Released by ventricles in response to overload
- Normal < 445 pmol/L
- Significantly increased in dogs with PHT and severity of increase is linearly correlated with severity of PHT (274 – 7713 pmol/L)
- Significantly increased in dogs with heart disease and severity of increase is linearly correlated with severity of disease (680 – 1725 pmol/L)

Left vs. Right



Right **Left**



Treatment

Ideal: treat the underlying cause

- Heartworm disease
- Blastomycosis
- Left heart failure

Pulmonary vasodilating drugs

Treatment: Endothelin pathway

Endothelin receptor antagonists

- ET-1 is a potent vasoconstrictor and leads to vascular remodeling
- People with PHT have impaired clearance of ET-1

Promising results in people

$3000/mo

Treatment: Prostanoid pathway

Prostacyclin analogs

- Prostacyclin: vasodilator and platelet inhibitor
- Thromboxane A_2: vasoconstrictor and platelet agonist
- People with PHT have an imbalance of metabolites, favoring production of TXA_2

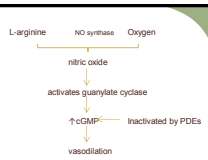
Administered as IV injections, CRIs, or inhaled formulation dosed 6-12 times daily

Treatment: Nitric oxide pathway

NO inhibits platelet activation and vascular smooth muscle proliferation and is a vasodilator

L-arginine + NO synthase + Oxygen → nitric oxide → activates guanylate cyclase → ↑cGMP ← Inactivated by phosphodiesterases → vasodilation

Treatment: Nitric Oxide



Inhaled NO

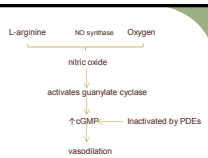
Rapid, complete reversal of acute and chronic forms of pulmonary hypertension

NO_2 and MetHb formation with prolonged exposure

Effect is lost within 30 seconds of discontinuation of NO

Case reports in a dog with caval syndrome and a dog with PDA

Treatment: PDE5 inhibition



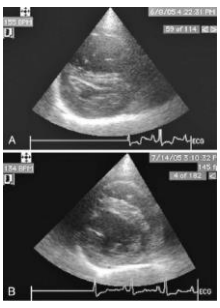
Sildenafil (Viagra®)

- Primary MOA is direct pulmonary artery vasodilation by blocking cGMP breakdown
- Multiple human studies demonstrate decreased pulmonary artery pressure, resolution of V/Q mismatch, and improved arterial oxygenation
- Significant improvements in exercise tolerance

Treatment: PDE5 inhibition

Sildenafil (Viagra®)

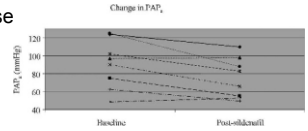
- 2007: Evaluated in 22 dogs
- 2 – 5.6 mg/kg/day
- Structural improvement on echo, though TR velocity unchanged
- Improved exercise tolerance, ease of breathing, decrease in cough, less ascites and partial or full resolution of syncope
- Survival times 8 - >735 days, median could not be calculated



Treatment: PDE5 inhibition

Sildenafil (Viagra®)

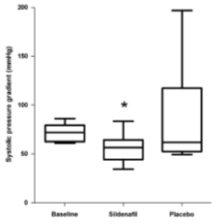
- 2006: retrospective, 13 dogs, all severe PHT
- 1.9mg/kg q8-24 hours
- 3 dogs died on day 1, otherwise median survival 175 days
- Improvement in ascites, cough, frequency of syncope
- Significant decrease



Treatment: PDE5 inhibition

Sildenafil (Viagra®)

- 2010: Prospective, randomized, controlled crossover study; 13 dogs, moderate – severe PHT
- 1mg/kg PO q8hrs
- Increased activity and QOL with sildenafil
- 5 dogs withdrawn from the study while on placebo due to worsening clinical signs



Treatment: PDE5 inhibition

Tadalafil (Cialis®)

- Human studies demonstrate decreased PAP with no improvement in arterial oxygenation
- Clinical improvement is similar to sildenafil
  - Improved QOL and exercise capacity
- Once daily dosing could improve compliance
- Experimentally effective in dogs

Treatment: PDE5 inhibition

Tadalafil (Cialis®)

- Single case report in a dog
- Several months of dyspnea and syncope, permanently oxygen dependent
- Dramatic improvement within 24 hours of instituting therapy, discharged within 48 hours with good exercise tolerance
- 1 mg/kg q48hrs
- Systemic hypotension was noted (possible overdosing)

	Day 0	Day 1 of tadalafil treatment	Day 7 of tadalafil treatment
PASP (mmHg)	122	108	96
SASP (mmHg)	100	80	75

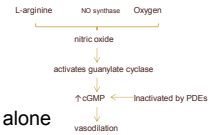
Treatment: PDE3 inhibition

Pimobendan (Vetmedin®)

- Randomized crossover study, 10 dogs, moderate – severe PHT secondary to degenerative valve disease (2 with concurrent respiratory disease)
- 0.25mg/kg PO q12hrs
- Significant short term (14 days) improvement in TR velocity, QOL, and NT-proBNP
- Only TR velocity remained improved long term (90 days)

Treatment: NO substrates

L-arginine experimentally decreases severity of PHT due to PTE only when administered prior to embolization



Acute PTE models:

- Sildenafil + arginine = sildenafil alone
- Sildenafil + NO donor = sildenafil alone

Treatment: Etc.

Theophylline
- Bronchodilation, PDE inhibition, mucociliary clearance

Clopidogrel and/or aspirin
- Antithrombotic

Furosemide
Enalapril
Spironolactone

Glucocorticoids
Antibiotics

WEIGHT LOSS

Sammie

2 month recheck

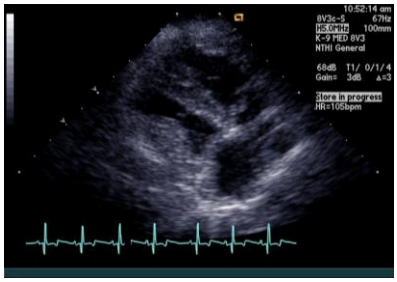
Clinical improvement but persistent mild increase in respiratory effort

Owners having trouble giving sildenafil

TR gradient 92mmHg (previously 109mmHg)

No ascites

Sammie



Prognosis

Median survival time 175 days for severe PHT (Bach study)

Probability of survival 95% at one month, 84% at 6 months, and 73% at one year (Kellum study)

Prior to sildenafil: median survival time 3.5 days

Questions?

SAGE

Thank you!

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Ryan Garcia, DVM, DACVIM (SAIM)

3/19/17

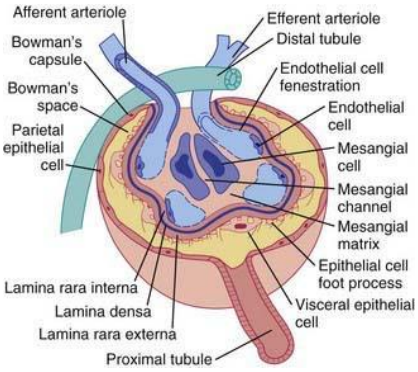
Canine Proteinuria: The Devil Is in the Details

Overview:

Proteinuria, or the inappropriate appearance of protein in the urine, is an often-silent condition that is being increasingly recognized in our canine patients. It has been recognized in up to 19% of certain canine populations.[1] Left unchecked, proteinuria can have serious and even fatal consequences.

Normal Anatomy:

The kidneys receive 20% of normal cardiac output and they daily produce many liters of ultrafiltrate.[2] The glomerulus is the point of filtration. The glomerulus is a complicated anatomic configuration made up of a renal arteriole and venule with a capillary tuft. This tuft contains the glomerular basement membrane (GBM; the endothelial layer through which small molecules and water flow) and podocytes (cells which provide structural rigidity to the glomerulus and create the slit diaphragm; SD a second anatomic barrier to diffusion into Bowman's capsule and the tubule). The combined anatomy of the GBM and SD create a barrier allowing only small and neutral (uncharged) molecules through[2]. Larger, negatively charged molecules, such as albumin (69 Kilodaltons) and other proteins are generally excluded from Bowman's capsule. The small amount of protein that ends up in the ultrafiltrate is removed by endocytosis by the cells of the proximal tubule. Excessive endocytosis may ultimately lead to tubular damage and renal dysfunction. [3]



http://clinicalgate.com/wp-content/uploads/2015/03/005029_on502-004-97814377075571.jpg

Proteinuria:

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A very small amount of protein in the urine of dogs is a normal finding. Excessive amount of urine protein can even be seen in some normal states (strenuous exercise, hyperthermia from exertion) though this should be transient[2]. Pathologic states such as fever can also be associated with proteinuria; this should also be transient.

Proteinuria is assessed by analysis of the urine. On a standard urinalysis, protein is expressed on a semi-quantitative scale (negative through trace to 3+). As a general rule, the significance or severity of proteinuria is inversely proportional the concentration of the urine (trace proteinuria in isosthenuric urine is more likely to be significant than trace proteinuria with a urine specific gravity of 1.052).

Hemoglobin/hemorrhage and myoglobin from muscle can also cause proteinuria, though the amount that these increase protein in the urine appears to be minimal. [4]

Microalbuminuria is a test offered by certain labs to look for the presence of small amounts of albumin in the urine. Its presence should trigger the same clinical approach as proteinuria found on a routine urinalysis.

Persistence defined:

More persistent proteinuria has been noted with various pathological states. Proteinuria is defined as being persistent if it is present on three or more separate occasions over a two-week (or greater) period of time. [5]

Localization of proteinuria:[5]

Proteinuria can be anatomically divided as to its location of origin. Given the importance of the glomerulus in proteinuria/protein exclusion, this is the most common anatomic divider. Dividing the proteinuria by anatomic location helps aid in the work up of proteinuria

Preglomerular localization:

This group of lesions are due to problems "upstream" of the glomerulus where the glomerulus is normal. The list of causes is shorter than the other anatomic localizations. These include increased amounts of serum albumin (dehydration), globulins (chronic inflammation, monoclonal/neoplastic causes) and systemic hypertension. Proteinuria is generally mild to moderate with this source.

Glomerular localization:

This grouping of causes leads to actual damage/lesions within the glomerulus. These lesions are varied and named by where the damage is occurring within the glomerulus. These diseases are all kidney-biopsy diagnosed. These lesions are broadly grouped into various types of glomerulonephritis (these can be further divided into immune vs non-immune mediated types) vs renal amyloidosis vs glomerulosclerosis. The proteinuria associated with these can be minimal to massive.[2]

Post-glomerular localization:

This grouping includes parts of the kidney "downstream" of the glomerulus. This includes the remainder of the kidneys (tubules, collecting duct), kidney pelvis, ureters, urinary bladder and urethra. This grouping is generally subdivided into the remainder of the kidney and the ureters and the lower urinary

tract (bladder, urethra, prostate and external genitalia). Clinical signs and urinary protein loss can be varied and proteinuria can vary from minimal to moderate.

Clinical signs:

Signs of proteinuria can be dramatically varied. Proteinuria may be an incidental finding on pre-anesthetic or routine blood work. It may be found in a patient showing lower urinary signs (stranguria/pollakiuria/dysuria +/- hematuria), signs associated with renal failure (vomiting, hyporexia, PU/PD) or hypoproteinemia (pitting edema, less commonly tachypnea secondary to pleural effusion). Finally, significantly proteinuric dogs can be procoagulable and will rarely present for signs of thromboembolism.[6]

Clinical consequences:

Proteinuria is significant for multiple reasons. Persistent proteinuria is a marker of an underlying issue that is ignored at our peril. Persistent proteinuria can lead to hypoproteinemia or thromboembolism.[6] Protein loss into the tubules also damages the nephrons within the kidneys, and can lead to kidney failure. Proteinuria at the time of diagnosis of chronic kidney disease in dogs has been associated with a shorter survival time than in a nonproteinuric cohort.[7]

Diagnostic work up:

The goals of the diagnostic work up of proteinuria is to:

- Prove persistence of proteinuria
- Attempt to anatomically localize the proteinuria
    - Preglomerular, glomerular, post-glomerular
- Assess the magnitude of proteinuria
- Attempt to identify the cause of proteinuria
- Guide therapy for proteinuria
- Decide if referral for further treatment or renal biopsy is indicated

The work up for proteinuria is going to depend largely on the signalment, presenting signs and severity of the proteinuria.

Proving persistence:

Proteinuria is again going to be documented on a urinalysis. Persistence is defined as proteinuria on at least three separate samples collected over two at least a two-week period.[5] A dipstick in hospital is a reasonable screen for proteinuria though urine should be submitted to an outside lab for analysis and confirmation. All commercial labs will perform a Sulfasalicylic acid (SSA) test on urine to confirm or refute proteinuria. Microalbuminuria may be tested for at a reference lab (Antech). The Heska point-of-care test is no longer available. If persistence of proteinuria is confirmed and an obvious cause of proteinuria is not found (e.g. fever, urinary tract infection), further work up is indicated.

Attempting to localize the proteinuria:

Localizing the proteinuria (assuming it is persistent) usually involves combining information from the owner's history, physical exam, basic blood work and urine testing. Further refinement may require imaging (radiographs, ultrasound) and specialized testing (urine culture, specific infectious testing etc) to look for specific causes of disease.

Post Glomerular Proteinuria:

This includes the lower urinary tract and renal/post glomerular (tubules and ureters). The lower urinary tract again refers to the urinary bladder, urethra, prostate and for our purposes, the external genitalia. A lower urinary tract cause generally will have associated urinary signs such as: stranguria (straining/painful urination), pollakiuria (urinating small volumes frequently; not to be confused with polyuria), dysuria (abnormal urine stream) or hematuria (this is not exclusively a lower-urinary tract sign). Lower urinary tract causes can include processes such as bladder or prostate infections (bacterial being the most common), lithiasis (urinary stones), foreign bodies, tumors or less commonly, sterile inflammatory causes. Blood work would generally be expected to be normal (assuming no urinary obstruction or ascent of infection into the kidneys) and urine will often show hallmarks an "active sediment": inflammation (pyuria {elevated white blood cells}, hematuria {blood in the urine} with variable protein and urine concentration. Indicators of the cause of the signs (bacteria, rafts of transitional cells with transitional cell carcinoma or possibly representative crystals with stones) may be present. Though not commonly performed with an active sediment, the UPC (see below) is expected to be <2.0.[5]

Ureteral disease (generally stones) may also result in an active sediment (variable) on urinalysis but no associated lower urinary tract signs will be appreciated. Signs will generally be nonspecific if present, and may manifest as just lethargy unless the ureteral disease results in renal failure/dysfunction and resultant clinical signs (inappetence, PU/PD, vomiting). Labs will likely reflect whether renal dysfunction is present and localization generally requires imaging (radiographs to look for stones and ultrasound to look for dilation/renal involvement). The UPC would be expected to be <2.0 if measured.

Renal tubular (post glomerular) disease may be caused by infection (pyelonephritis, Leptospirosis amongst others), ischemia/dehydration due to trauma/shock, GI losses (vomiting/diarrhea from various causes), drugs/medications (NSAIDS, aminoglycoside antibiotics, Amphotericin B etc), Fanconi syndrome (tubular dysfunction leading to protein/glucose in the urine), renoliths (kidney stones), toxins (ethylene glycol, grapes/raisins) or secondary to acute or chronic kidney disease. Clinical signs are variable and generally are proportional to the degree of azotemia, if present. Classic signs may include hyporexia, PU/PD vs oligo/anuria, vomiting, and depending on chronicity, weight loss. Given the variety of causes, lab work may be highly variable. Leukocytosis/neutrophilia may be present with infectious causes. The hemogram may show hemoconcentration (from dehydration) or anemia (from anemia of inflammation/decreased erythropoietin generation from kidney failure) and thrombocytopenia should raise concern for possible Leptospirosis.[8] Chemistry may demonstrate varying degrees of azotemia (BUN, creatinine, SDMA elevations) and resultant metabolic derangements (hyper/hypokalemia, metabolic acidosis, hyperphosphatemia etc). Urine would likely show subhypersthenuric urine (<1.030 USG) unless glucose is present and varying degrees of active urine sediment in a UA.

Telltale signs of renal tubular dysfunction include the presence of glucose in the urine with a normal peripheral glucose and the presence of granular or casts (debris "molded" in the shape of renal tubules) in the urine. Radiographs may show mineralization within the kidneys (if present) and possibly

irregularity to the kidneys. Ultrasound may find renal pelvic dilation and changes to the renal cortex (hyperechoic cortices, renal cysts) depending on the cause. UPC would be expected to be <2.0. Dogs with a post-glomerular, renal cause of protein loss are not considered to have a protein-losing nephropathy (PLN), a catch-all term for a renal glomerular disease causing excessive protein loss and often resulting in azotemia.[2] However, it bears discussing that a dog with interstitial nephritis (the most common cause of CKD) can be proteinuric and would be impossible to definitively differentiate from a dog with a PLN without renal/glomerular biopsy.

Pre-glomerular Proteinuria:

This proteinuria is caused by either elevated plasma proteins (hyperglobulinemia), systemic hypertension (various causes) or hyperadrenocorticism (it also has effects at the glomerulus). The signs associated based on these conditions are going to largely be based on the underlying process and resultant lab abnormalities. Hyperglobulinemia from neoplastic causes (commonly multiple myeloma, plasma cell neoplasia, uncommonly lymphoma) generally will result in vague signs of lethargy, weight loss, hyporexia etc. Other signs (PU/PD, bleeding tendencies, reluctance to move) may be seen secondary to disease-associated renal failure, globulin-effects on platelet function or osseous lytic lesions. A monoclonal gammopathy would be expected on a protein electrophoresis. A monoclonal hyperglobulinemia has also been associated with chronic Ehrlichiosis in dogs, and may manifest similarly. Hyperglobulinemia is diagnosable with a chemistry panel to an outside lab. Protein electrophoresis may be of benefit to prove a monoclonal gammopathy. Polyclonal gammopathies may be seen with any significant chronic inflammatory condition (infectious or inflammatory/immune). UPC can be variable but is expected to be <2.0.

Arterial (systemic) hypertension may or may not have any associated clinical signs depending on the underlying disease process. Common causes include: renal failure, hyperadrenocorticism and diabetes mellitus. Blood pressure should be measured in every dog with proteinuria and treated if systolic blood pressure is >160 mmHg systolic or >100 mmHg diastolic.[9] We recommend following the ACVIM consensus statement on systemic hypertension with regards to measuring blood pressure (see list below). UPC would be expected to be <2.0 in a dog with isolated systemic hypertension as the cause of proteinuria.

ACVIM Consensus Recommendations for blood pressure measurement:[9]

- The accuracy (calibration) of the BP device should be tested semi-annually
- The procedure must be standardized.
- The environment should be isolated, quiet, away from other animals, and generally with the owner present. The patient should not be sedated and should be allowed to remain quietly in the measurement room for 5–10 minutes before attempting BP measurement.
- The animal should be gently restrained in a comfortable position, ideally in ventral or lateral recumbency to limit the distance from the heart base to the cuff (if more than 10 cm, a correction factor of +0.8 mm Hg/cm below the heart base can be applied).
- The cuff should be approximately 40% of circumference of the cuff site in dogs1 and 30–40% in cats.4 The cuff size should be noted in the medical record for future reference.

- The cuff may be placed on a limb or the tail, and will vary with animal conformation and user preference. The site for cuff placement should be recorded in the medical record.
- The same individual (preferably a technician) should perform all blood pressure measurements following this standard protocol. Training of this individual is essential.
- The patient should be calm and motionless.
- The first measurement should be discarded. At least 3, and preferably 5–7, consecutive, consistent (20% variability in systolic values) values should be recorded.
- Repeat as necessary, changing cuff placement as needed to obtain consistent values.
- Average all values to obtain the BP measurement.
- If in doubt, repeat the measurement subsequently.
- Written records should be kept on a standard form and include cuff size and site, values obtained, rationale for excluding any values, the final (mean) result, and interpretation of the results by a veterinarian.

Glomerular Proteinuria:

Glomerular disease is characterized by various lesions striking the glomerulus and can result in massive proteinuria. The lesions are named/characterized by biopsy-collected histopathologic changes are noted within the different parts of the glomerulus. From a practical standpoint, glomerular lesions can be characterized into one of three large groupings: glomerulonephritis (GN), amyloidosis or glomerulosclerosis.[2]

Glomerulonephritis is a disease characterized by inflammatory lesions involving the glomerulus. These can be due to antigen/antibody complexed outside the kidney depositing in the glomerulus or antigen/complement binding to specific proteins within the glomerulus. GN can be subdivided into genetic/heritable or acquired GN.[2] Heritable GN often causes clinical signs in younger dogs and several breed-associated GN conditions have been reported. Consulting with an internist is recommended if there is suspicion for a heritable proteinuric condition.

Acquired GN can be further subdivided into immune-mediated and non-immune mediated. This subdivision is again based on histopathology and is important as therapy decisions (immunosuppression or not) are based on presence/absence of immune attack. Like all immune diseases, immune mediated GN can be further subdivided into primary (no identified cause) and secondary immune GN (underlying infection, inflammation, neoplasia). Unfortunately, definitive diagnosis of any glomerular disease (including immune-mediated GN) requires renal biopsy. A proteinuric dog should undergo specific testing in an attempt to identify possible secondary causes of immune GN. This is discussed in detail below.

Amyloidosis: Amyloidosis is characterized by insoluble beta-pleased sheets of amyloid protein that may manifest in both familial (Shar peis) and acquired forms secondary to chronic inflammatory conditions. Acquired amyloidosis often causes massive proteinuria and concurrent deposition in the liver/spleen may cause organ fracture/hemorrhage.[2]

Glomerulosclerosis (GS): Glomerulosclerosis is sclerosis/fibrosis of parts or the entire glomerulus. The incidence of GS increases with age and can be seen secondary to chronic glucocorticoid administration, diabetes mellitus or as an end stage change with any glomerular or renal tubular disease.

Proteinuria with glomerular lesions can be highly variable, and may range from mild elevations in UPC (<1.0) to massive proteinuria (>5.0). UPCs of >2.0 are generally only seen with glomerular lesions and UPC of >5.0 is essentially pathognomonic for glomerular disease.

Clinical signs associated with glomerular proteinuria can vary from the dog being aclinical to signs secondary to azotemia or nephrotic syndrome (combination of hypoproteinemia, proteinuria, hypercholesterolemia and clinical evidence of hypoproteinemia; usually pitting edema). Interestingly, dogs with severe proteinuria associated with glomerular lesions often have associated GI signs (especially hyporexia) in the absence of concurrent azotemia or excess of what is expected with the degree of azotemia. Patients with glomerular lesions causing protein loss are classified as having a protein-losing nephropathy (PLN).

Assessing the Magnitude of proteinuria; the urine protein creatinine ratio (UPC):

Proteinuria is detected on a urinalysis. If the urinalysis finds proteinuria in the absence of an active sediment (pyuria, bacteriuria, hematuria), there should be consideration for assessing the degree of proteinuria. This is done with the urine protein creatinine ratio (UPC).[7] This unitless test controls for protein loss relative to the amount of filtration being done by the kidneys and is available through all major reference laboratories. Means of collection (cystocentesis vs free-catch in hospital) has not been shown to significantly affect the UPC[1] though hospital-collected samples were slightly higher relative to home-caught samples.[10] Catheterization could potentially increase proteinuria and cystocentesis for collection would be recommended over catheterization.[5] Blood contamination (as tested by the addition of whole blood to urine samples) has been shown to minimally effect UPC.[4] Sperm and prostatic fluid can also significantly increase the UPC, and submission from an intact male dog is not recommended within several hours of ejaculation.[11]

UPCs has been shown to fluctuate greatly from sample-to sample within the same dog. This variation can be up to 80% at lower protein levels and 35% at significantly higher protein levels.[12] Due to this, multiple samples of urine are ideally collected for an averaging of UPCs. Because of the associated cost of running multiple samples, it has been shown that submitting a “pooled” UPC is equivalent to averaging multiple UPCs over a several-day period.[13] This pooled UPC can be performed by having an owner collect multiple (>2) samples in individual cups over a 24-36h period (refrigerate) and bring them to your practice. An equal volume (1 ml is adequate) is collected from each sample cup and placed in a single separate container and this is submitted for the pooled UPC.

Normal ranges for UPC have been well-established for dogs.[5] UPC <0.2 are normal/nonproteinuric. 0.2-0.4 is borderline proteinuria and ≥0.5 is proteinuric. As discussed above, nonglomerular causes of proteinuria will generally have a UPC <2.0 (as can glomerular disease) and a UPC >5.0 will only be seen with glomerular diseases.

Actionable Levels:

The ACVIM has established recommendations for monitoring/assessing/treating a dog based on a combination of UPC (presuming persistence confirmed) and degree of azotemia. This was established in a consensus statement published in 2005. [5]

Three levels of action were developed for proteinuric patients:

Monitor: This involves serial monitoring of renal values and urine protein levels (via UPC) with periodic (monthly to quarterly) blood work and urine assessment. This is indicated for nonazotemic (Creatinine <1.4) patients with 0.5≤UPC<1.0 and all azotemic patients regardless of UPC. This does not involve specific testing for underlying causes nor introduction of specific therapies for proteinuria.

Investigate: This level of action involves specific diagnostic testing attempting to elucidate underlying causes for proteinuria. Specific therapies for any contributory causes elucidated would be treated and ongoing monitoring (as above) of renal values and UPC is pursued. Diagnostic testing is discussed below. Investigation is recommended for nonazotemic dogs with UPC≥1.0 and all azotemic dogs regardless of UPC.

Intervene: This level of action entails therapy expressly aimed to treat/minimize the magnitude of proteinuria. This is detailed in the therapies section below. Intervention is indicated for any nonazotemic dog with a UPC≥2.0 or azotemic dog that is proteinuric (UPC ≥0.5). Concurrent monitoring of azotemia/proteinuria and investigation into cause is to be simultaneously undertaken.

A Practical Clinical Approach to Work Up of Proteinuria:

The work up of proteinuria is going to vary by the patient, clinical signs and lab findings. Patients with an active urinary sediment (pyuria/bacteriuria) and/or lower urinary tract signs are going to require different diagnostics and therapies than the dog with proteinuria and quiet urinary sediment.

Patient with active urinary sediment or lower urinary signs:

This patient would be approached similarly to any dog with lower urinary signs. Minimum diagnostics would include a complete physical exam (with digital rectal exam and digital vaginal exam as indicated. Complete urinalysis (to an outside lab) with urine culture is mandatory. Cystocentesis is the ideal route of urine collection. Brief ultrasound prior to cystocentesis to disprove an obvious transitional cell carcinoma (due to risk of seeding with cystocentesis) is preferred if available. Further testing would include abdominal radiography (to r/o obvious mass effects and radiodense lithiasis) and abdominal ultrasound are indicated. Cell counts and chemistry panel (to screen for concurrent azotemia etc) is indicated for a patient that is systemically ill or showing signs not relegated to the lower urinary tract (PU/PD, hyporexia). Performing UPC or work up for glomerular disease are not indicated in a patient whose signs or urine testing are consistent with a post glomerular/post-renal lesion.

Patient with "quiet" urinary sediment and persistent proteinuria:

This patient is going to require screening for preglomerular, glomerular and post-glomerular (renal) causes (investigation as described by ACVIM consensus).[15] Complete review of history (medications,

travel history) physical exam, CBC, chemistry, urinalysis/culture and arterial blood pressure measurement with UPC are indicated. Imaging (thoracic/abdominal radiographs and abdominal ultrasound) are also recommended to screen for sources of inflammation, infection or neoplasia. In California without travel history, testing for rickettsial disease (Ehrlichia, Anaplasma, Borrelia/Lyme) and Dirofilaria infection is indicated. An antibody ELISA test (4DX SNAP test by Idexx) is generally sufficient but this should always be repeated 2-3 weeks following initial testing as this antibody test may be negative initially in the face of acute rickettsial infection.[15] Any patient with a history of travel to or residing in another geographic location should be tested for any regional endemic/epidemic diseases.

Specific testing for Leptospirosis (PCR of blood and urine, serology) would be indicated if azotemia, hepatopathy, thrombocytopenia or tubular dysfunction (glycosuria with a normal peripheral glucose or casts) is present.[8] Testing for hyperadrenocorticism in a systemically-well patient with consistent exam, lab findings and a lack of another etiology may be appropriate. Attention should be paid to chronic sources of inflammation that may drive an immune glomerulonephritis. These commonly include chronic (severe) skin disease, pancreatitis, gastrointestinal inflammatory disease or even severe dental disease. [15]

Further specific testing of any exam abnormalities (peripheral lymphadenopathy, focal bone pain, any palpable masses) is indicated on a case-by-case basis as determined by exam and lab/imaging findings. UPC in this group of cases can be highly variable depending on the cause and localization, from 0.5 to >5.0

Referral to an internist is recommended if no cause for proteinuria is found following standard initial screening (CBC, chemistry, urinalysis/culture, radiographs, arterial blood pressure, 4Dx).

Therapy For the Proteinuric Patient:

Post-glomerular/post renal:

Therapy for a patient with post-glomerular, post renal cause is going to be focused on the underlying cause of the signs/disease, whether that be infectious causes, urinary stones, neoplastic or sterile inflammatory causes. Since renal causes of proteinuria have been excluded (or are being masked by the lower urinary tract disease manifestations), renal-specific therapies (as below), are not necessary unless the patient is concurrently azotemic.

Pre-glomerular:

Similarly, therapy for the patient with a pre-glomerular cause of proteinuria (hyperglobulinemia, systemic hypertension) is going to be focused at the underlying cause of the abnormalities and not renal-specific therapies unless there is concurrent azotemia or hypoalbuminemia. In these cases, there should be concern for concurrent renal (glomerular/post-glomerular) causes and consultation/referral to an internist (or oncologist as appropriate) would be recommended.

Glomerular/post-glomerular renal proteinuria:

ACVIM Consensus Therapies:

The American College of Veterinary Internal Medicine (ACVIM) released a consensus statement on management of patients with renal proteinuria in 2013.[15] The following therapies are all considered the standards of care for a patient with renal proteinuria whose magnitude rises to the level of requiring therapy/management as established in the 2005 consensus (azotemia with UPC ≥0.5 or nonazotemic with UPC ≥2.0). [5]

Diet Modification:

In the patient with proteinuria without clear post-renal or preglomerular causes, feeding a protein restricted diet is recommended and considered a standard of care. This is usually accomplished by the means of feeding a commercially available veterinary prescription renal diet. Feeding a protein-restricted renal diet is indicated for all patients with proven renal (or unknown) causes of proteinuria, regardless of their azotemia status. Protein-restricted diets have been shown to lessen proteinuria and resultant renal tubular insult.[16,17] Renal diets also have the benefit of being phosphorus restricted, which slows progression of all-causes of chronic kidney disease (CKD) in dogs.[17] Furthermore, renal diets are fortified with additional omega fatty acids, which have been shown to be of benefit for dogs with CKD[18] and possibly protein losing nephropathies. Working with an internist and a boarded veterinary nutritionist to construct a home-cooked diet is often needed for patients with nutritional needs not met by a commercial renal diet, such as fat restriction for a dog with pancreatitis or a patient with a finicky appetite.

Angiotensin-converting enzyme inhibitors (ACE inhibitors; ACEi):

ACE inhibitors are a class of drugs that block the conversion of angiotensin-I to angiotensin II in the renin-angiotensin-aldosterone system (RAAS). This complex hormonal system helps control renal perfusion, arterial blood pressure and sodium/potassium balance via the end-pathway production of aldosterone. Angiotensin II has multiple effects on the glomerulus, renal tubules and overall renal perfusion. Dogs with proteinuria and/or CKD have upregulation of RAAS and resultant direct increases in protein loss through the glomerulus, remodeling/scarring of the glomerulus and increases in arterial blood pressure.[19] Because of these reasons, ACE inhibitors are recommended in the treatment of all patients with renal proteinuria and are commonly employed as weak antihypertensives.[15,19] ACE inhibitors have been shown to prolong survival in dogs with PLN[19] and proteinuria[20] due to RAAS inhibition and other beneficial effects on the glomerulus.

The two most commonly used ACE inhibitors in veterinary medicine are enalapril and benazepril. Enalapril is renally excreted and there has been concern over increased active metabolites in azotemic patients.[21] Benazepril is excreted via the biliary system and its metabolites do not increase with azotemia.[21] Despite these theoretical concerns, there does not appear to be a comparative advantage to benazepril use over enalapril, even in azotemic patients. Furthermore, a recent study showed a greater reduction of proteinuria with enalapril compared to benazepril in dogs with proteinuric CKD.[22]

The standard canine starting dose of enalapril or benazepril is 0.5 mg/kg PO q24h.[15] If a patient is significantly azotemic (Creatinine >2.0), initiating at a lower dose of 0.25 mg/kg PO q24h may be desirable. Following initiation or adjustment in dose of an ACEi, it is important to monitor the patient for progressive azotemia, hyperkalemia or hypotension. Recheck renal values with electrolytes and blood

pressure is generally performed 1-2 weeks following initiation/dose adjustment.[15] A significant elevation in creatinine (>30% increase over baseline if creatinine is <2.0 or 10% increase if creatinine is >2.0) or hyperkalemia (>6.0 mmol/L) is reason to dose reduce the ACEi.[15] Since the antihypertensive effects of an ACEi are mild (generally <20 mmHg drop), hypotension is a rare complication of therapy. Repeat pooled UPC is performed generally 2-3 weeks following initiation of ACEi therapy. The target goal of ACEi therapy is to reduce the UPC <0.5 or if that is not feasible, a >50% reduction in pre-therapy UPC.[15]

Enalapril and benazepril may be upwardly titrated to 1 mg/kg/day dose divided and maximum dose of 2 mg/kg/day divided.[15] It is unclear if higher dose ACEi therapy has benefit over lower dose therapy. A consultation with an internist is recommended prior to aggressive dose escalation.

Angiotensin Receptor Blockers (ARBs):

Even with administration of ACE inhibitors, human and canine patients have been shown to undergo incomplete blockage of RAAS (so called "RAAS escape").[23] This activation of RAAS has deleterious effects as above. ARBs were invented to help complete RAAS inhibition. Losartan and telmisartan are ABRs that have been used in dogs with PLNs that have been refractory to ACEis.[24] These drugs are often used in conjunction with ACEis.[23] Losartan was the first studied drug in this family though telmisartan is more commonly used as losartan has poor oral bioavailability.[25] A starting dose of 0.5 mg/kg/day has been described.[24] Monitoring is required as with ACEi use. Recent studies in humans have shown a higher incidence of renal failure and death in patients on combined ACEi/ARB therapy;[26] it is unknown if this same phenomenon will occur in dogs. Consultation with/referral to an internist would be recommended if there is consideration for ARB use in a patient with refractory PLN.

Omega Fatty Acids (OFAs):

N-3 polyunsatured fatty acids (PUFAs) have been shown to have beneficial effects in dogs with chronic kidney disease[18] and humans with glomerular disease.[27] There is scant information in using OFAs in dogs with PLN. Given the relatively low risk of PUFA use in reasonable amounts, the ACVIM consensus did recommend the addition of OFAs to the diet of dogs with PLNs.[15] Again, commercial prescription renal diets meet the recommended ratio of N-6/n-3 to 5:1 or less. Supplementation of additional n-3 PUFA has been suggested by some in an amount of 0.25–0.50 g/kg/day in the forms of eicosapentaenoic acid and docosahexaenoic acid.[15] The additional PUFAs are at risk for oxidation and keeping cool at <20®C and using by any expiration date is recommended.

Antihypertensives:

Systemic arterial hypertension is commonly encountered in proteinuric patients regardless of degree of azotemia.[9] Any persistently elevated systolic blood pressure (>160 mmHg) or diastolic pressure (>100mmHg) is an indication to treat to avoid target organ damage (renal, CNS/retinal, cardiac).[9]

ACEi drugs have weak antihypertensive effects but are standard therapies for proteinuria regardless or hypertension status. ACE inhibitors can be used to reduce blood pressures with an upward titration of dose as used for protein sparing effects.[19] Recheck of blood pressures can be done every 3-14 days (earlier if significantly azotemic) as dosing is adjusted.

The calcium channel blocker amlodipine is recommended if a patient is found to have hypertension that is refractory to ACE inhibitor therapy or if there is evidence of a hypertensive crisis. Crises include

extremely high blood pressures (systolic >200 mmHg) or evidence of target organ damage (CNS signs/stroke, retinal separation).[15] Amlodipine is administered at 0.1-0.25 mg/kg PO (or per rectum) and the dose can be repeated every 2-4 hours for a maximum dose of 0.7 mg/kg/day until normotensive.[15]

It is strongly recommended that any patient undergoing a hypertensive crisis be immediately referred to a specialty center with 24 hour monitoring and internists and critical care. Refractory hypertension is also an indication for referral (on a non-emergent basis).

The goals of antihypertensive therapy are to lower systolic blood pressure to <150 mmHg and diastolic <95 mmHg while avoiding hypotension (systolic <110 mmHg or diastolic <60 mmHg).[9] Recheck of renal values are recommended concurrent to repeat blood pressures to ensure the antihypertensives have not destabilized azotemia.[15]

Anticoagulants:

Dogs with significant proteinuria have been shown to be hypercoagulable due to multiple reasons. Loss of antithrombin (III) in the urine and vascular changes (as noted in proteinuric people) are postulated as causes.[28] This hypercoagulability can lead to either arterial or venous thromboembolism and is reported in up to 25% of dogs with PLN.[6] Recent studies have shown poor correlation between antithrombin levels, serum albumin and overall coagulation status,[29] so it is now recommended that all dogs with suspected glomerular proteinuria be treated with antithrombotics.[15] It is unknown whether platelet inhibitors (aspirin, clopidogrel {Plavix}) or heparin analogues, singly or paired, is ideal. Given its low cost and relative safety, the current consensus is that all dogs with glomerular proteinuria (UPC>2.0) receive 1-5 mg/kg/day of aspirin.[15]

Miscellaneous therapies:

Edema/fluid retention:

This can be seen either secondary to venous thromboembolism or secondary to nephrotic syndrome. This is a combination of proteinuria, hypoalbuminemia/hypoproteinemia, hypercholesterolemia (mechanism unknown) and peripheral edema/effusion.[30] Therapy for mild effusion/edema is generally not recommended.[15] Judicious use of diuretics, including furosemide (1 mg/kg q6-12h) is necessary for significant edema or compromising effusion. though there is a high risk of renal insult and progressive azotemia in the nephrotic patient. Their status may be further complicated by the fact that dogs with nephrotic syndrome may be overhydrated interstitially but be underloaded in the vascular space and require fluid resuscitation.[30] Consultation or referral is recommended for the nephrotic patient.

Azotemia:

Standard therapies that would be employed for a nonproteinuric azotemic patient is employed in the proteinuric, azotemic patient with the same degree of azotemia. This may include the use of phosphate binders (Aluminum hydroxide, lanthanum carbonate), oral bicarbonate therapy, erythropoietin analogs (darbepoetin {Aranesp}) and even subcutaneous fluids depending on the individual case.[31] A word of caution is necessary for subcutaneous fluids as the risk of resultant edema/effusion is significantly higher in the proteinuric patient,[15] and consultation/referral to an internist is always prudent.

Renal biopsy:

Renal biopsy is the definitive diagnostic test for a dog with PLN.[15] It is the diagnostic standard of care in humans with renal proteinuria and the histopathologic diagnosis determines prognosis and guides specific immunotherapy. There is a push in veterinary medicine to pursue renal biopsy whenever possible to help better characterize PLNs in dogs and to help determine best practices with regards to therapy. Renal biopsy requires general anesthesia and are procured via ultrasound-guided tru-cut biopsies or laparoscopic-acquired biopsy. Specialized handling of the biopsies and submission for specialized histopathology (immunohistochemistry, electron microscopy) to specific nephropathologists requires that renal biopsy only be performed at certain referral practices and ideally at the University level.[15]

The ACVIM consensus statement recommended consideration for renal biopsy in certain situations. Renal biopsy should be considered with: substantial proteinuria (UPC>3.5), proteinuria that is refractory to or progressive in the face of standard therapies, progressive azotemia despite standard therapies and barring end-stage azotemia.[15] Renal biopsies are not without risks, and they are not recommended in patients with stage IV CKD (creatinine≥5.0), significant comorbidities or where biopsies are unlikely to change clinical or treatment course. Consultation with an internist is strongly recommended to determine if an individual patient would be a candidate for referral and renal biopsy.

Prognosis:

The prognosis for patients with proteinuria depends on the underlying etiology. A previous lack of standardized renal histopathology makes drawing firm conclusions about diseases challenging. However, these conditions generally seem to carry a guarded to poor prognosis, depending on several factors. In retrospective studies, the higher the magnitude of proteinuria, the presence of hypoalbuminemia, nephrotic syndrome and degree of azotemia have all been found to carry poorer prognoses. [6,7, 17, 30.] Further studies, employing appropriate renal histopathology, will better elucidate true prognoses over this grouping of diseases.

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Managing and Treating Canine Hyperadrenocorticism (HAC)

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Dechra Veterinary Products

Pathophysiology

Hyperadrenocorticism (Cushing's syndrome or disease) is relatively common in older dogs, increasingly recognized in cats, and rare in other domestic animals. The symptoms of HAC are the results of excessive, chronic production of circulating glucocorticoids by the adrenal glands, which are located at the cranial pole of each kidney. Each adrenal gland is divided into two functionally distinct parts, the cortex and medulla. The adrenal cortex comprises 80 – 90% of the entire gland and produces glucocorticoids, mineralocorticoids, and androgens. The medulla comprises 10 – 20% of the adrenal gland and produces catecholamines.[1, 2]

Cortisol is released by the adrenal gland in response to stress. A classical negative feedback loop operates to regulate endogenous production. The hypothalamus secretes corticotrophin releasing hormone (CRH) that travels to the anterior pituitary regulating the secretion of adrenocorticotropic hormone (ACTH), which regulates the secretion of cortisol by the adrenal cortex. Both cortisol and ACTH have negative feedback effects on higher centers.

HAC can be spontaneous or iatrogenic. The spontaneous cases are associated with a tumor in either the pituitary gland or the adrenal gland. 80 – 85% of cases are due to pituitary tumors with 80 – 85% being microadenomas (< 1 cm). 10 – 20% of pituitary tumors are macroadenomas (> 1 cm) and these patients are prone to neurological signs. In pituitary dependent hyperadrenocorticism (PDH), a tumor in the anterior pituitary autonomously secretes ACTH in excess, which triggers excessive cortisol production. This results in bilateral adrenal gland hyperplasia due to constant stimulation by excessive ACTH. In adrenal dependent hyperadrenocorticism (ADH), the adrenal tumor secrets cortisol autonomously. The cortisol production results in a negative feedback loop reducing the production of ACTH. The contralateral adrenal gland atrophies due to down regulation from the lowered ACTH stimulation levels. 50% of adrenal tumors are malignant, while the other 50% are benign. Determining the tumor location (adrenal vs. pituitary) allows for the following: 1) determination of the proper treatment, 2) a more specific prognosis, and 3) greater prediction of addition clinical signs.[1, 2]

Iatrogenic HAC results from prolonged exogenous corticosteroid administration – topical, oral or injectable sources. Therapy results in decreased ACTH secretion and bilateral adrenocortical atrophy. Therapeutically, corticosteroids are used in massive doses relative to physiological levels. If treatment is prolonged, it may take months for the hypothalamic-pituitary-adrenal axis (HPAA) to return to normal function after these drugs are stopped.[1, 2]

Meal or food-induced HAC has been reported in young small breed dogs. The incidence is relatively low. It appears to be a congenital defect that results in aberrant expression of

receptors for glucagon inhibitory peptide (GIP) on the adrenal gland. In these patients, GIP stimulates the production of cortisol from the adrenal gland. Given that GIP is produced by the stomach at every meal, these dogs have transient hypercortisolemia after every meal from a young age.[3, 4]

Atypical HAC is a controversial diagnosis with an unclear etiology. These dogs have a history, physical exam findings, CBC, biochemical chemistry profile, urinalysis results, and adrenal imaging consistent with HAC; however, routine screening tests are negative. Screening tests for HAC were introduced in the 1970s and 1980s (30 plus years ago). The 2012 ACVIM consensus statement for diagnosing HAC suggest that the current reference ranges, and their cut-offs, should be reevaluated and possibly adjusted. More appropriate ranges, and cut-offs, can help avoid misdiagnosis and increase detection of milder cases of HAC with lower cortisol hypersecretion and an increased sensitivity of the HPA axis to dexamethasone. In some of these patients, measurement of sex hormones can be considered. An ACTH stimulation test with a pre & post adrenal panel can be sent to the University of Tennessee's endocrinology lab to evaluate for elevations in androstenedione, progesterone or 17-hydroxyprogesterone. Standard therapeutic regimes of trilostane or mitotane result in resolution of clinical signs.[4]

Clinical Signs

Excessive cortisol in the body is responsible for the numerous clinical signs associated with HAC. The variety of clinical signs are due to cortisol's diverse effects on the body. For example, cortisol acts to maintain blood glucose concentrations by increasing production of glucose from non-carbohydrate sources. Protein and fat catabolism are stimulated to provide amino and fatty acids for this process. Cortisol also counteracts the effects of insulin. The catabolic actions of glucocorticoids on protein, results in muscle wastage and weakness. They also result in the increased formation of hepatic gluconeogenic enzymes, which act on amino acids to produce glucose. The catabolic actions on fat stores are countered by insulin, which inhibits lipolysis and stimulates lipogenesis. As a result adipose tissue tends to be redistributed to the abdomen and back of the neck in dogs with excess concentrations of glucocorticoids.[1, 2]

Most of the clinical signs associated with HAC are not immediately life threatening, however, they do cause a decline in quality of life for the pet and the owner. Owners can easily get frustrated with a dog who is constantly urinating, often times in the house, or who is constantly panting and possibly disturbing the owner's sleep. The clinical signs seen with HAC will get worse if treatment is not provided. Owners may not immediately report these clinical signs as something wrong with their pet, they often assume the signs are simply due to old age.

HAC is rarely seen in dogs < 6 years of age. Males and females are equally represented, as well as many breeds. There are some breeds that appear to have increased predilection, such as Dachshunds, various terrier breeds, German shepherd and Labradors.[1, 2]

HAC is considered a clinical diagnosis that is supported by laboratory data, as such, it starts in the exam room. Common clinical signs include polyuria (> 50 ml/kg/day) and polydipsia (>100

ml/kg/day), which lead to dilute urine concentrations. Thinning of hair coat, polyphagia, panting, weakness/lethargy, and chronic infections (urinary tract and skin) are also commonly reported by owners. Alopecia may be seen and is usually bilaterally symmetrical, mainly on the trunk, and spares the head and legs. It is non-pruritic typically, unless there is a secondary pyoderma. A pot-bellied appearance secondary,to weakness of the abdominal muscles and the accumulation of fat within the abdomen, and thinning/inelastic skin, particularly on the ventrum, are often found on physical examination.[1, 2] While not common, calcinosis cutis lesions (thick, hard raised plaques on the surface of the skin) can be found; this sign is almost pathognomonic, but can also be seen in renal failure patients.[5] Calcinosis cutis lesions may not improve with treatment due to the severity of the skin damage and the calcification. If these lesions are seen, rule-out iatrogenic HAC first. Poor wound healing post-injury or surgery may also be observed, as well as poor hair regrowth after shaving. Myotonia (persistent, active muscle contractions even after the stimuli is gone) can be seen and, occasionally, older, inactive dogs will rupture a cruciate ligament. Clinical signs can be in any combination. Not all are present in every patient, but they are all due to the deleterious effects of excess cortisol. In some cases, skin lesions may be the only clinical signs of HAC. The presence of non-pruritic, truncal alopecia and/or thin skin, and/or the presence of poorly responsive skin infections without any systemic signs of HAC warrant screening for this disease.[6]

Additionally, some clinical signs are not always evident on physical examination alone. Hypertension is found in more than 50% of dogs with HAC and is not well controlled with medications until the HAC is under control. Proteinuria is also seen, and has been correlated to hypertension; the higher the blood pressure, the greater the amount of protein lost in the urine, likely from glomerular damage.[7] Hypercoagulability can also be found, and some dogs with spontaneous HAC are at risk of developing thromboembolic complications; placing these pets on an anticoagulant may be necessary.[8, 9]

Diagnostic/Differentiation Tests

As with clinical signs, findings on routine laboratory screening tests can be variable in HAC patients. Complete blood counts can show increases in hematocrit and thrombocytosis (>600,000), which may contribute to the hypercoagulability. Stress leukograms are common - neutrophilia without a left shift and monocytosis are secondary to demargination of the cells from capillaries; lymphopenia is due to lympholysis, and eosinopenia is due to sequestration.

Routine biochemical profile findings can include hyperglycemia (likely due to gluconeogenesis and insulin resistance), increased alkaline phosphatase (ALKP), cholesterol and triglycerides.[1, 2] Occasionally, hyperphosphatemia can be seen, which has been associated with decreased survival times (statistically found to be a negative prognostic indicator).[10] Urinalysis often reveals a low urine specific gravity (often less than 1.010), but not all dogs will have this finding. Glucosuria and proteinuria can also be seen, and occult urinary tract infections are common and often require urine culture and sensitivity to successfully diagnose and treat.[1, 2]

Before proceeding with endocrine testing for HAC, ensure the patient has clinical signs consistent with HAC that cannot be explained by other disease conditions. For example, an elevated ALKP in isolation with no clinical signs is not reason enough to pursue endocrine testing. In the 2012 ACVIM consensus statement notes 'the primary indication for pursuing a diagnosis of HAC is the presence of one or more of the common clinical signs and physical examination findings.' It is important to keep in mind HAC is a clinical diagnosis.[11]

In the diagnosis of HAC, there are two questions to answer: 1) is HAC present; and 2) what is the source? Therefore, to answer the first question, the clinician needs to demonstrate either an increased cortisol production or a decreased sensitivity of the HPA axis to negative glucocorticoid feedback. Any exogenous steroid use should be discontinued for at least 24 hours prior to any endocrine testing. Screening test for HAC include the urinary cortisol:creatinine ratio (UCCR), the low-dose dexamethasone suppression test (LDDST) and ACTH stimulation test. Any screening test may be negative in a patient with HAC. If a test is negative but suspicion for HAC remains, another test should be performed. If more than one test is negative, either consider the patient does not have HAC, or alternatively, re-evaluate the patient in 3 – 6 months if clinical signs progress.

Creatinine is excreted in the urine at a constant rate; cortisol is not. The urine cortisol to creatinine ratio (UCCR) is a sensitive test to detect cortisol hypersecretion. It is imperative the dog is not stressed for the urine sample collection. It is recommended the owner collect the sample at home and bring to the practice. Ideally, wait at least 48 hours after a hospital visit. The owner can collect one to three days' worth of urine (ideally the first morning sample) and pool it to increase chances of observing an elevated cortisol due to daily variation. The test is relatively inexpensive and the patient does not have to come to the veterinary clinic. Stress and non-adrenal illness can cause increases in urine cortisol levels; therefore, false positives can and will occur – specificity can be as low as 20 – 25%. However, a normal ratio can be considered truly negative and HAC can be ruled-out.[1, 2, 11]

If food-induced HAC is suspected, the UCCR can be helpful in the diagnosis by collecting pre-prandial urine sample after a 12 hour fast and 4 hour post-prandial urine sample; a 100-fold increase between the pre- and post- samples is considered diagnostic for food-induced HAC.[3]

With the LDDST, cortisol (in the form of dexamethasone) is added to the system to test the regulatory mechanism, the negative feedback system. If the system is intact there will be suppression of CRH, ACTH, and ultimately cortisol production, at 4 & 8 hours. A normal dog will suppress cortisol production within 2 – 3 hours and remain suppressed for 16 – 24 hours or more.

The LDDST has a high sensitivity (85 – 90%), so a negative provides a high confidence the dog is normal. Unfortunately, it has a low specificity, so a positive is not confirmatory for HAC. 27 – 66% of dogs will be false positives as a result of non-adrenal illness or stress; this test should not be used if a patient has a history of exogenous steroid administration.

LDDST can help differentiate PDH from ADH if there is at least 50% suppression from base line cortisol levels. To perform this test, IV dexamethasone (0.01 mg/kg) is administered after a baseline blood sample is obtained. Please note, if using Dex SP formulation, it only has 3 mg/ml of active dexamethasone. Blood samples are then collected at 4 and 8 hours. Positive patients will have an 8 hour cortisol level of greater than 1.4 µg/dL. An inverse pattern, where the 4 hour post-dexamethasone was increased, but the 8 hour post-dexamethasone was below the cut-off value, has also been seen in PDH and does warrant further testing for HAC.[1, 2, 11]

The ACTH stimulation test is evaluating for adrenocortical reserve, i.e. dogs with hyperplastic adrenal tissue have exaggerated cortisol response to ACTH. The test is performed by administering 5 µg/kg (max dose 250 µg) synthetic ACTH IV or IM (IV is the preferred method) after a base-line blood sample is collected. Peak cortisol excretion occurs 60 – 90 minutes after injection. A 2nd blood sample is collected at 1 hour post-ACTH administration. A diagnosis for HAC is made when cortisol levels post-stimulation are greater than 22 µg/dL (grey zone 15 – 22 µg/dL). With the ACTH stimulation test, there is considerable overlap in HAC and normal patients. Some dogs with HAC will have normal results (20 – 30% false negative results), and some normal dogs will have an exaggerated response consistent with HAC; thus, the LDDST is preferred over the ACTH stimulation tests. For suspected iatrogenic HAC, though, the ACTH stimulation test is the gold standard for diagnosis; patients will have a flat-line response similar to hypoadrenocorticism patients.[1, 2, 11]

Once a diagnosis of HAC has been confirmed, determining the source (pituitary or adrenal based tumor) is the next step. Approximately 60% of the time, the LDDST shows at least a 50% suppression below baseline at 4 hours; this is diagnostic for a pituitary based tumor, and in these cases, a secondary test is not necessary. If no suppression occurs, then a secondary test is needed to differentiate PDH and ADH. 25% of dogs with PDH will not suppress. The high dose dexamethasone suppression test (HDDST) is no longer preferred as a secondary test as 25% of PDH dogs will still not suppress even with higher dose – these patients likely have macroadenomas. Ultrasound is now preferred. [11]

On ultrasound, the adrenal glands can be evaluated for size, presence of adrenal masses, +/- calcification, and presence of local tumor invasion. Additionally, the abdominal cavity can be evaluated for distal metastasis. PDH patients have bilateral hyperplasia of the adrenal glands, and ADH patients have a unilateral mass and often hypoplasia of the contralateral gland. Not all adrenal masses produce hormones; clinical signs of HAC must also be present to make a diagnosis of ADH from an ultrasound. CT scans and MRI can be used to evaluate adrenal and pituitary glands.

And finally, endogenous ACTH levels can be used to differentiate PDH from ADH. Pituitary tumors are producing ACTH; therefore, PDH patients have high ACTH levels. ADH patients have an active negative feedback loop and ACTH production is turned off, therefore ACTH levels will be low. This test may not be practical in a general clinical practice setting, as ACTH breaks down quickly and needs special handling; contact the laboratory before running this test.

Treatment/Monitoring

Many dogs are euthanized because of clinical signs associated with HAC. Treatment will help prevent euthanasia due to these clinical signs that interrupt the human-animal bond. Treatment also decreases the risk of chronic infections (skin and/or urinary tract), diabetes, and improves the chance of resolving high blood pressure and proteinuria, which can have deleterious side effects all their own. If treatment for HAC does not resolve the hypertension and/or proteinuria, additional medications can be used to control them. These medications are more likely to be effective when cortisol is being controlled.

The aims and expectations of treatment need to be established beforehand and discussed with the owner to avoid unexpected disappointments. The clinical signs of PDH caused by pituitary microadenoma can be managed with medical therapy, but the drugs will not affect the pituitary tumor.

Hypophysectomy can be offered to those dogs with an enlarged pituitary who are in good clinical condition and have a long life-expectancy. The surgery is effective, especially in the long term, with remission for up to seven years.[12] This surgery is currently offered at the University of Washington's College of Veterinary Medicine in Pullman, WA, but can be cost prohibitive for many clients. Inoperable pituitary tumors (macroadenomas) can be treated by radiotherapy. Radiotherapy is effective in reducing the size of such pituitary tumors, but with a quiet variable delay, from 1 to 16 months. The reduction in size is gradual in onset but can continue for a year or more after completion of therapy. The improvement in clinical signs of HAC is associated with the reduced pituitary ACTH secretion.[12]

The treatment of choice of unilateral ADH is adrenalectomy, because successful removal eliminates both the tumor and the associated clinical signs of glucocorticoid excess, without the need for lifelong medication. The postoperative complication rate for adrenalectomy is about 20% and the skill of the surgeon and rest of the team affects the outcome; therefore, it is recommended this procedure be performed at a referral center with intensive care facilities. The median survival time after adrenalectomy is about 2 years, although some dogs survive more than 4 years.[12]

There are at least four options for medical management of HAC: trilostane, mitotane, selegiline and ketoconazole. Mitotane is not approved for use in dogs, but for many years was the first and best choice for managing HAC in dogs. It is a human cytotoxic/anti-neoplastic drug that works by causing cellular death in the adrenal gland. The plasma terminal half-life in people ranges from 18 – 159 days. It has been suggested by Utrecht University College of Veterinary Medicine as the treatment for inoperable, benign, adrenal tumors since it causes the destruction of adrenocortical tumor tissue. They do note, however, that experience has shown adrenal tumors are more sensitive to trilostane than are hyperplastic adrenal glands and trilostane is the recommended palliative treatment if there is metastasis of a functional adrenal tumor.[12]

Selegiline is FDA approved for uncomplicated PDH. It increases dopamine concentration, which in turn down-regulates ACTH concentration. Its efficacy is fairly low, with only about 10 - 15% of patients showing improvement in clinical signs.[1]

Ketoconazole is a fungistatic drug that blocks several enzymes in the P-450 enzyme system, thus effectively blocking the synthesis of glucocorticoids and androgens with negligible effects on mineralocorticoids. For the treatment of HAC, it takes higher doses than for most yeast/fungal infections, and side effects can be significant. It is effective in about 50% of HAC cases at controlling clinical signs.[1]

VETORYL® Capsules (trilostane) is the only FDA approved drug for the treatment of both PDH and ADH in dogs. It is a short acting, reversible, enzyme inhibitor. It primarily inhibits the 3β-hydroxysteroid dehydrogenase enzyme in the adrenal cortex, thus blocking the production of cortisol, and to a lesser extent, aldosterone and the sex hormones.[13, 14] The effect on aldosterone production is usually clinically insignificant at the doses required to control cortisol production in dogs. Effects only last as long as the half-life of the drug, so if over-suppression occurs, the drug can simply be discontinued and hormone production usually returns to normal. The clinician can then decide to restart Vetoryl at a lower dose or potentially discontinue its use if clinical symptoms of HAC do not return.

Maximal suppression of cortisol production occurs 3 – 8 hours post Vetoryl administration. ACTH stimulation test should be performed 4 – 6 hours post-administration for proper assessment. If the test is done too early or too late, the cortisol levels will be higher, and the clinician may make an inappropriate dosage change. For the most accurate dosage trending data, consistency in post-administration ACTH stimulation timing is helpful, i.e. if the first test was performed 4 hours post-pill, then future ACTH stimulation test are performed 4 hours post-pill.

The approved dose for Vetoryl is a range of 1 – 3 mg/lb (2.2 – 6. 7 mg/kg). Always start low and if the calculated patient dose falls between currently available strengths, round the patients dose down to a whole size capsule. Available capsule sizes include 5 mg, 10 mg, 30 mg, 60 mg and 120 mg. There is individual variation in patient response to Vetoryl; inform owners there will be dose adjustments until the optimal dose is identified. In general, small dogs will need larger doses, and big dogs will need lower doses. For most patients, initially administer Vetoryl once daily in the morning with food; food increases absorption of the Vetoryl by up to three times. Twice daily administration is recommended for food-induced HAC patients who are fed twice daily. It is also generally recommend to start diabetic/hyperadrenocorticism patients on twice daily Vetoryl therapy as well. When starting Vetoryl, it is generally recommended to reduce insulin doses by approximately 50% to prevent hypoglycemia as cortisol levels return to normal.

Close monitoring is essential when a patient is initially started on Vetoryl. If the owner notices any changes or abnormalities, they should call the veterinarian immediately.

Lethargy/weakness, anorexia, vomiting and diarrhea are the four most commonly seen side effects. The first recheck should be done 10 – 14 days after starting Vetoryl (sooner if there are concerns or problems). The owner should be questioned about improvement of clinical signs, i.e., water intake, appetite, urination, panting, activity level, etc.

At the first recheck, blood work should include an ACTH stimulation test 4 – 6 hours post-pill administration, and a chemistry panel with electrolytes. Cortisol levels drop precipitously in the first 10 – 14 days; they will continue to drop over the next several weeks, but not as dramatically. The post-ACTH stimulation cortisol target range for Vetoryl patients is 1. 45 – 9.1 µg/dL. This initial monitoring should not be used for a dosage increases, generally, but only use this result to discover if the dose is too high and patient is over-suppressed.

Over-suppressed patients can present with weakness, lethargy, anorexia and vomiting; this may be a result of a glucocorticoid and/or mineralocorticoid deficiency and needs to be addressed immediately. Some patients can experience a cortisol withdrawal syndrome, and patients usually respond well to discontinuing Vetoryl for approximately 7 days and then restarting at a lower dose. In the rare event of an Addisonian crisis, stop Vetoryl, institute immediate symptomatic/supportive therapy as required. Electrolytes will differentiate the conditions. Electrolytes will be normal in a patient with cortisol withdrawal. Hyponatremia, hyperkalemia, and a low sodium potassium ratio (< 27) will be present in patients having an Addisonian crisis.

Assuming all post stimulation cortisol levels are appropriate and no dose adjustments are made, a second ACTH stimulation test is done 4 weeks from the initiation of therapy, then at 12 weeks, and every 3 months thereafter. Anytime a dose adjustment is made, a recheck ACTH stimulation test should be performed 10 – 14 days later. The resolution of clinical signs of HAC is the goal of therapy; ensure the owner reports improvement.

Sometimes the post-ACTH stimulation cortisol result is above 9.1 µg/dL, but the dogs is clinically doing well. In these cases, do not increase the dose to chase the number – the goal is resolution of clinical signs. Clinical improvement should occur rapidly. Within the first two weeks of Vetoryl therapy, owners should have noticed the dog is drinking and urinating less, is less ravenous, and excessive panting should also have reduced (usually a 40 – 50% improvement these common clinical signs). Lethargy is another clinical sign of HAC that rapidly responds to Vetoryl treatment; even at the first recheck, many owners have noticed that their dog has more energy and often is almost like a puppy again. Hair loss may appear to worsen initially, as large amounts of the hair follicles are in the telogen growth phase and are shed before regrowth starts. By 12 weeks, abdominal girth starts to reduce, so the pot-bellied appearance diminishes. Patients show increased muscle tone and strength. Some hair regrowth may be noticeable. Hair regrowth is one of the last things to improve; ensure client expectations are appropriately set. Six months after starting treatment, most clinical signs of HAC should have improved or resolved. Dechra's 6 month clinical trial of 60 dogs had no more than 15% of dogs exhibiting any of the clinical signs associated with HAC.[13]

Do not expect ALKP to return to normal. Most dogs will have some level of persistent hepatic vacuolar changes driven by cortisol. Monitoring ALT activity is a better indicator of hepatocellular injury, and modest increases are much more important. As these are usually older patients, consider ultrasonography of the abdomen in patients where hepatic enzymes are of concern. Rule-out liver masses with an ultrasound, or if a gallbladder mucocele is present, as hypercortisolism is a predisposing factor for the development of gallbladder mucoceles. Dogs with HAC are 29 times more likely to develop a gallbladder mucocele than dogs who do not have HAC.[15]

Additionally, practitioners should be aware dogs with hypercortisolism tend to have higher canine pancreatic lipase immunoreactivity (cPLI) than clinically healthy dogs with normal ACTH stimulation test results. Therefore, cPLI results should be interpreted cautiously in dogs with HAC to avoid falsely diagnosing concurrent pancreatitis.[16]

Continued elevation of cortisol levels on an ACTH stimulation can be due to many things. Timing of pill administration can affect the test. The ACTH stimulation test needs to be performed during Vetoryl's peak effect (we recommend 4-6 hours after administration); if the client gave the pill in the evening vs. morning, then the ACTH stimulation test will not be able to be performed unless it is done overnight. Absorption of Vetoryl is greatly enhanced by food; if the pet was fasted the morning of the ACTH stimulation test, cortisol levels will be affected. Additionally, consider if the client is actually giving the medication consistently and following the administration instructions.

Once client factors have been ruled-out, ensure the ACTH stimulation tests itself is being performed appropriately. Many internist discourage the use of compounded ACTH gels, as these gels have inconsistent activity and often lead to confusing data. Additionally, ACTH can be frozen into 50 µg aliquots in plastic syringes and placed in a deep freezer without an auto-defrost mode; do not store for longer than 4 months. If the ACTH is stored in glass vials or is allowed to defrost during storage, its potency can be variable.

A recently published study in dogs authenticated a 1 µg/kg dose for ACTH stimulation tests for monitoring patients receiving either mitotane or trilostane; this dose cannot be used for diagnosing HAC. Caveats to using this low dose for monitoring purposes include the dose has to be administered IV and the post stimulation blood sample must be taken at the 60 minute mark.[17]

Finally, compounded trilostane should be used with caution, as it may jeopardize the management of dogs with HAC and potentially impact patient safety. A study published in 2012 evaluated 96 batches of compounded trilostane; 38% of compounded batches were below acceptable criteria for content and the average % label claim for each batch ranged from 39 – 152.6% with 20% of compounded batches failing to meet dissolution criteria. Compounding trilostane could result in dogs being under- or over-dosed, and some batches can't even be

absorbed by the patient.[18] If compounding is necessary for an individual patient, it is generally recommended to have Vetoryl compounded into another size vs. compounding trilostane.

On average 4 out of 5 patients can be managed with once daily Vetoryl therapy. There are roughly 20% of patients who will need twice daily therapy. Patients with persistent HAC clinical signs, either throughout the day or, are well controlled during the day but "breakthrough" only in the evening, and the post-ACTH stimulation cortisol levels fall within the target zone (1.45 – 9.1 µg/dL), increasing the dosing interval from once daily to twice daily will usually resolve the clinical signs. Additionally, if once daily dosing dose not result in managing concurrent hypertension or proteinuria, twice daily Vetoryl therapy should be considered.

Be aware, long-term changes in dose requirements do occur in many patients. It is relatively common for dogs who have been taking Vetoryl for 1.5 – 2 years to need dose decreases. Therefore, continued, long-term monitoring is needed for patients.

Precautions/Side Effects

It should be noted, if urination does not improve with control of cortisol levels, remember to rule-out UTI as the cause. Also note, polydipsia can be a result of pyelonephritis, diabetes mellitus or even central diabetes insipidus; in cases of pituitary macroadenomas, secretion of vasopressin from the anterior pituitary may be disrupted resulting in central diabetes insipidus. Patients with macroadenomas rarely have neurological signs at the time of presentation, but neurological signs can develop during the initial treatment of PDH with either trilostane or mitotane. Clinical signs are likely due to the removal of the negative feedback inhibition of cortisol on the pituitary and hypothalamus. This allows some pituitary tumors to enlarge rapidly, causing edema and increased intracranial pressure. Clinical signs include depression, disorientation, ataxia, wandering, loss of learned behavior, blindness, seizures, anisocoria, anorexia, head pressing, and circling.[19]

When cortisol levels are normalized, underlying corticosteroid-responsive diseases may be unmasked. For example, the clinical signs of osteoarthritis and allergic skin disease may become more apparent to the owner.

ACE-inhibitors, such as benazepril or enalapril, should be used with caution in patients who are taking Vetoryl. ACE-inhibitors inhibit the signal to produce aldosterone. Concomitant use of Vetoryl with an ACE-inhibitor could result in hyperkalemia. Spironolactone, a potassium sparing diuretic, competitively inhibits aldosterone receptors and is contraindicated for use in patients taking Vetoryl, as hyperkalemia is likely to occur.

Do not use Vetoryl in patients with a known hypersensitivity to trilostane. Functional hepatic and renal tissue are needed for metabolism and clearance of Vetoryl; to be safe, animals with primary hepatic or renal disease should consider therapy other than Vetoryl for HAC. Vetoryl has not been approved for use in pregnant, nursing or breeding animals. Caution should be used in animals less than 3 kg. Do not empty the capsule, or divide its contents, as this

increases the risk of ingestion of trilostane by humans which may lead to systemic effects and skin/eye irritation/sensitization.

Adrenal necrosis has been reported in patients receiving Vetoryl. It is a rare side effect of trilostane and was seen in < 2% of dogs in the clinical trials and in far less since launch. Keep in mind that mitotane is a cytolytic drug and its mode of action is to irreversibly destroy the adrenal cortex. While this may be an idiosyncratic reaction to Vetoryl, there are references supporting the adrenal necrosis associated with Vetoryl is a result of elevated ACTH levels, not trilostane.[20] Additionally, there have been a few cases reported to have had adrenal necrosis occur after the ACTH stimulation test, which may further support elevated ACTH levels as the causative factor. Although this side effect is rare, it underscores the need for diligent monitoring.

Conclusion/Key Points

Hyperadrenocorticism is a clinical diagnosis. Get the diagnosis right; do not treat if the patient is asymptomatic. Remember, your best monitoring tool is resolution of clinical signs; if the patient is asymptomatic, then it is difficult to monitor therapy appropriately.

When using Vetoryl, start at the low end of the dose range. The majority of patients will do well with once daily dosing, but some patients will need twice daily dosing. Round down to a whole sized capsule and give with food. Small dogs tend to take higher doses than large dogs.

Early monitoring, 10 – 14 days after starting Vetoryl, can help identify patients who are sensitive to Vetoryl and may be over-suppressing before a crisis occurs. Early signs a patient may be over-suppressed include lethargy/weakness, anorexia, vomiting and diarrhea. If an owner sees these clinical signs, they should stop the medication and bring the patient into the hospital for evaluation that includes electrolytes and an ACTH stimulation test.

Typically, dose increases are not made until the 30 day mark. Dose changes are made based on clinical signs, electrolytes and ACTH stimulation results. Do not chase a number, but instead utilize the ACTH stimulation test results as a guide. If clinical signs are well controlled even though the post-ACTH stimulation cortisol levels are above the target range, a dose increase is not warranted. The goal is not to hit a number, but instead, to manage clinical signs for a full 24 hours.

Beware of long-term changes in dose requirements. Continue monitoring patients on regular intervals to ensure patients continue to do well.

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23. http://endocrinevet.blogspot.com

Track 4

Pet Obesity: Advocate for Your Patients

Heather Prendergast, RVT, CVPM, SPHR; Synergie Consulting, Las Cruces, NM

Nutrition is often a forgotten topic during examination room conversations. We have so many things to talk about: vaccine protocols, spaying/neutering, dental care, heartworm disease, fleas and ticks. The list is endless! However, nutrition is life long; puppy to senior; healthy or sick. Not only is this a critical conversation that we are not having, we are losing business to pet stores, who are often making specific recommendations for our patients. The veterinary healthcare team must remember that clients feed their pets' everyday, and poor nutrition can lead to nutrient deficiencies, toxicities or obesity, and overall, a poor quality of life. The goal for the veterinary healthcare team is to help patients live a long, healthy, and happy life. Let's get on board with discussions about nutrition every time the pet comes in to the hospital – ***every pet, every time, with every client.***[1]

5th Vital Assessment

The American Animal Hospital Association (AAHA) recommends five vital assessments of patient health during every examination to ensure the highest standard of care. Nutrition, being the newest edition, is added to temperature (T), pulse (P), respiration (R), and pain. Veterinary technicians are already responsible for TPR and pain recognition; adding nutrition to your essential task list adds a new challenge, job satisfaction, increased client compliance and great medical care for the pet. Nutritional assessments and client education are every veterinary technician's responsibility. Let's start thinking nutrition – ***every pet, every time!***

Screening Evaluations include asking the right questions, including:

- What food does your pet eat?
- What type of food is fed – canned, dry, both?
- How much does your pet eat? (Do you measure the food, and what size is your measuring cup?)
- How often do you feed your pet?
- Does your pet receive any treats? What kind and how much/many?
- Who is responsible for feeding the pet(s) in your household?
- Does your pet receive any human foods?
- Does your pet have access to any other food source(s)?

Next, we must assess the patients' condition:

- Body Condition Score (BCS)
- Muscle Condition Score (MCS)
- Hair coat quality
- Age
- Activity level

If we see any abnormalities, such as obesity, we need to intervene immediately, and delve into an extended evaluation.

Studies Proving Obesity

54% of the patients we see in practice are overweight or obese.[2] Extended evaluations are essential for these patients. The biggest concern: clients perceive their pet is an ideal weight, when in fact the pet is

[1] Every Pet Every Time; http://www. everypeteverytime.com/docs/en-us/Pet_Nutri- tion_Ref_Manual.pdf
[2] Association for Pet Obesity Prevention; http://www.petobesityprevention.org/pet-obesity-fact-risks/

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overweight or obese. 33% of dog owners and 46% of cat owners (in the above-mentioned study) characterized their pet as being at normal weight. Client education is essential to change this perception – and it is up to the veterinary technicians to educate! **Clients don't know if we don't tell them!**

Causes of Obesity
Proper nutrition throughout the various life stages is critical to disease prevention, as well as assisting in disease management. Clients may not understand the life stage concept. Veterinary technicians must educate clients with regard to metabolism changes that occur, essential nutrients and potential excesses or deficiencies, and that overall caloric intake that should be monitored on a daily basis. Clients expect a nutritional recommendation from the veterinary healthcare team. You are the expert. In a recent study completed by AAHA, 90% of clients wanted a nutritional recommendation; however, only 15% perceived that they received one from the veterinary team.[3] Make a specific recommendation for that patients' life stage requirements – every time they come into the hospital.

Overfeeding
Many clients do not grasp the concept that the total number of calories counts for our pets too! It is not until recently with the invention of aps for phones that consumers have become calorie conscious for themselves. Teach clients how many calories their pet should consume based on species, age, weight and activity level. Then explain that every bag of food has a different amount of kcal/cup.

Many clients free-feed their dogs and cats…a leading factor of obesity. Meals MUST be measured, every time.

Treats: Many clients feel they need to give their pet treats to show them "love". Remind clients that the total number of calories counts. They are going to give treats regardless of our recommendation- so let's make a specific recommendation for low calorie treats (approximately 15kcal/treat). You may also consider vegetables instead of treats.

The Science of Obesity

We're all familiar with the mechanical aspects of obesity. We know that the excess body weight places additional stress on joints and increases cardiac workload. However, it's now recognized that fat (or adipose tissue) is actually a very active endocrine organ that secretes hormones and inflammatory mediators. The result is insulin resistance and chronic systemic inflammation. This in turn contributes to the increased incidence of osteoarthritis and diabetes that we see in obese patients.

Management of Obesity
To get a handle on the obesity epidemic, we must understand the disease as a team. What commitment is your team willing to make, to reduce these numbers? Educate team members regarding BCS, DER for each patient and kal/cup of food. Once all team members are on the same page, client education can begin.

What Does the Client Need to Know?

- Specific Recommendations (How many cups to feed of *XX* brand)
- Measuring Cup
- BCS
- Nutrition Brochure discussing the effects of obesity

Difficult conversations
Conversations about obesity can be difficult for clients. They are in denial that their best friend is

[3] Data on file with AAHA.

overweight, or, they may not understand the implications of obesity. Perhaps the clients are obese themselves. Don't let emotions control this conversation; rather, use science and educate your clients why a leaner weight is healthier. After all, we want *our pets to live longer, happier lives!* A groundbreaking 14-year study by Nestle Purina showed that dogs fed to an ideal body condition throughout their lives had a median lifespan of 1.8 years longer — and were considerably healthier — than their littermates.[4] And although the dogs in the study generally developed the same chronic conditions as they aged, treatment for those conditions was delayed approximately two years for the lean-fed dogs.

Implementing Success

Create a program that is going to be easy for team members to discuss and clients to follow. The simpler the program, the higher success the hospital will have in helping pets become leaner. By providing the clients with the tools mentioned above, you will be headed in the right direction. In addition, implement monthly weight checks, activities for pets and clients, and celebrate success. Following up with clients on a weekly basis will ensure program success.

[4] R.D. kealy, etal, Effects of Diet restriction on lifespan and age related changes in dogs, *JAVMA*, Vol. 220, No. 9, May 1, 2002, pp. 1315–1320.

How to perform in-house hematology

Dennis B. DeNicola, DVM, PhD, DACVP
Chief Veterinary Educator – IDEXX Laboratories
Adjunct Full Professor – Purdue University College of Veterinary Medicine

Outline

- The Complete CBC
  - When and why?
  - What does it include?
    - Data, Dots and Cells
- Cytograms
  - Generation and interpretation
    - Red blood cells and platelets
    - White blood cells
- Case examples

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CBC – What is the value?

- ***OBJECTIVITY***
  - Animals commonly "hide" disease
  - Owners oftentimes do not identify problems until relatively late in a disease process
    - Sometimes the owner is not totally truthful
  - The physical examination has limitations in detecting disease

It is extremely difficult to predict the presence of disease or to identify improvement or worsening of a disease condition simply by performing a physical examination.

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CBC – When and Why?

- Evaluation of the sick animal
  - Anemia
  - Inflammatory disease
  - Platelet disorders
- Monitoring the managed sick animal
  - Trending of data – progression or regression

How often should a CBC be repeated???

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Dog Presenting with Inflammation

- 7 year-old
- Intact male
- Mixed breed dog
- Clinical presentation
  - Several days of fever, apparent painful urination, decreased appetite, abdominal pain on palpation
  - Enlarged prostate
- Clinical impression – prostatic abscess

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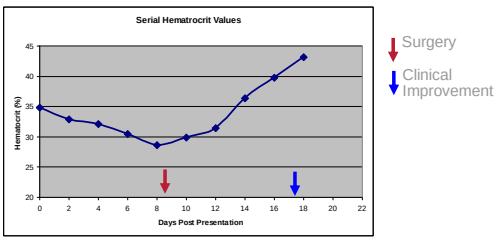
Dog Presenting with Inflammation



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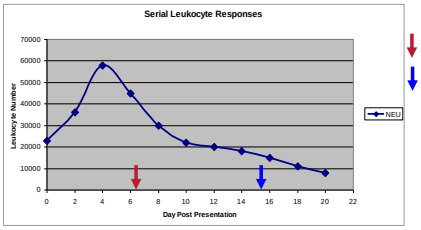
Dog Presenting with Inflammation



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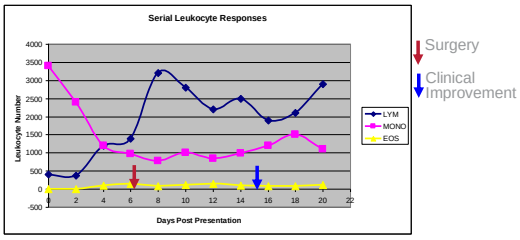
Dog Presenting with Inflammation



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CBC – When and Why?

- Evaluation of the sick animal
  - Anemia
  - Inflammatory disease
  - Platelet disorders
- Monitoring the managed sick animal
  - Trending of data – progression or regression
- Screening for health status abnormalities
  - Pre-anesthetic testing
  - Preventative care programs

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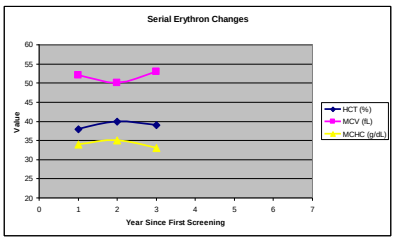
Clinically “Near Normal” Cat



- Yearly evaluation in wellness clinic
- Presented “healthy” each year until year 6

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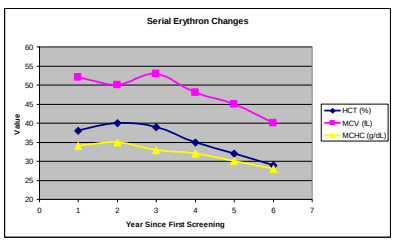
Clinically “Near Normal” Cat



- Yearly evaluation in wellness clinic
- Presented “healthy” each year until year 6

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What is included in a CBC

- Data – report with numbers
- Graphs and Dots – graphic representation of how analyzer performed
- Cells – rapid (less than 1-3 minutes) microscopic evaluation of the blood film

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What is included in a CBC

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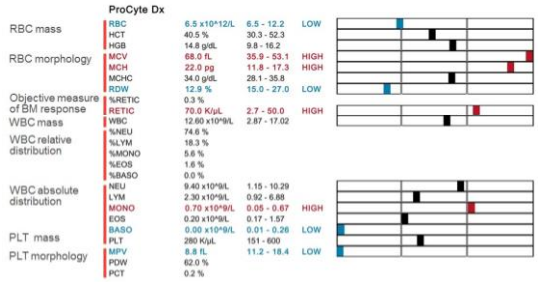
CBC – Data Evaluation



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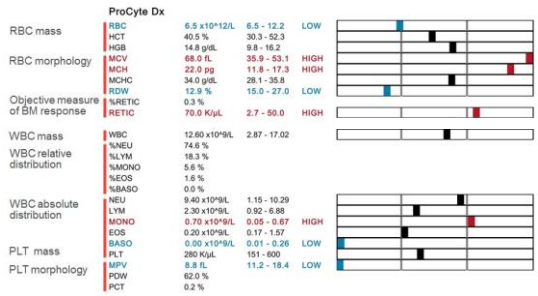
CBC – Data Evaluation



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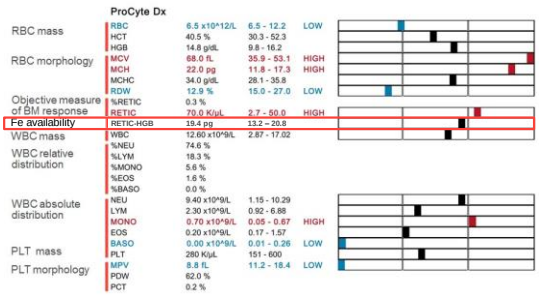
CBC – Data Evaluation



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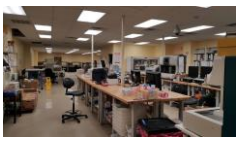
Hematology Options

In-Clinic

Reference Laboratory



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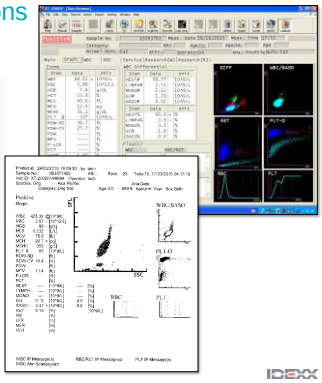
Hematology Options



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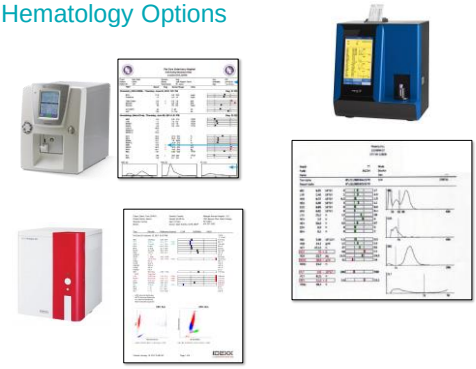

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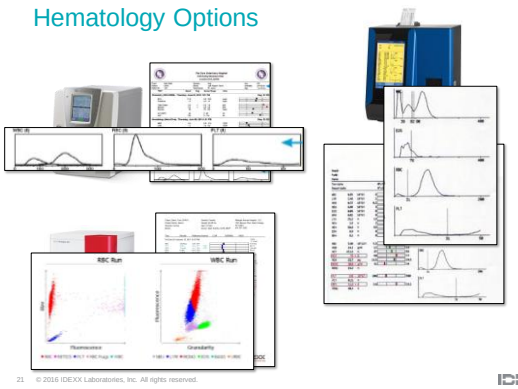
Hematology Options



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What is the value of cytogram review?

- Immediate validation of results building confidence in the CBC
  - Are the various groups / clusters of properly characterized?
    - Hills and valleys appropriately identified
    - Clusters of dots appropriately separated and colored
- Recognition of morphologic abnormalities not identifiable in the numbers
  - Abnormal histogram and dot-plot patterns strongly support sample abnormalities
  - Assist in recognizing when blood film evaluation is essential

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What is included in a CBC

- Data – report with numbers
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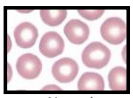
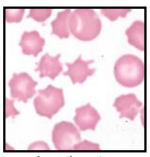
CBC: Cells

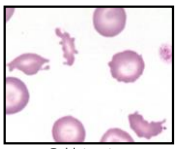


Normal

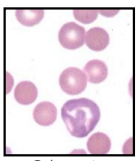
- Erythrocytes
  - Confirm count: clumping/agglutination
  - Confirm reticulocyte count with scan
  - Examine morphology of erythrocytes



Acanthocytes



Schistocytes



Spherocytes

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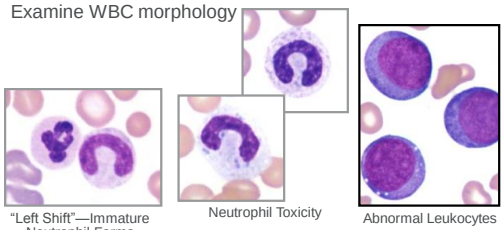
CBC: Cells

- Validate WBC count
- Validate leukocyte distribution
- Examine WBC morphology



"Left Shift"—Immature Neutrophil Forms

Neutrophil Toxicity

Abnormal Leukocytes

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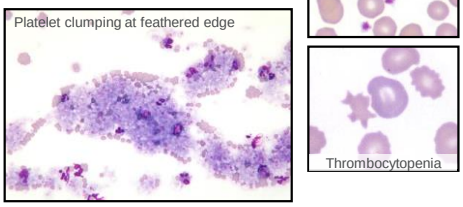
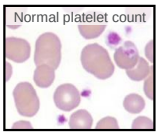
CBC: Cells

- Confirm count
  - Inspect for clumping
- Characterize morphology





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Impedance Counting Analyzers

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Impedance Analyzers

- Improved precision and accuracy of cell counts
- Ability to produce accurate MCV values
- True hemoglobin measurement
  - Allows MCHC calculation
- Partial differential counting
  - Typically a three part differential
    - Granulocytes, Lymphocytes and Monocytes
- Potential problems
  - Nucleated red blood cells
  - Platelet clumping and size
    - Inaccurate counts, misidentified as RBC

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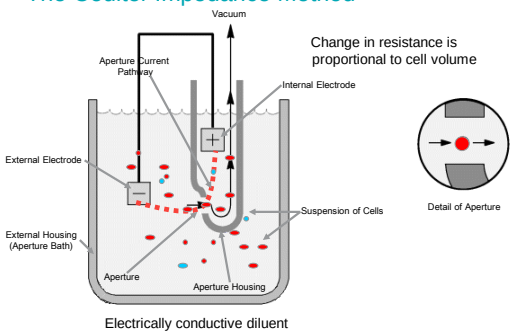
The Coulter Impedance Method



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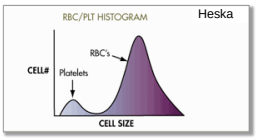
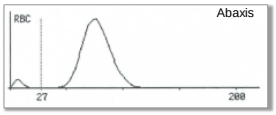
Impedance technology





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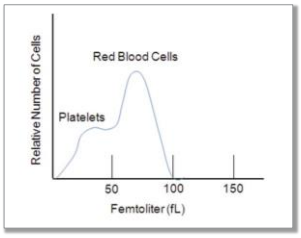

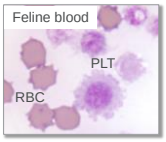

Problematic samples when platelets and red blood cells are similar in size

Many feline samples present with this problem and typically have an overestimation of platelet numbers

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Case study – Sasha

Sasha

Patient
9 year old f/s German Shepherd Mix

Presenting Complaints
- Partial anorexia and "ADR"

Physical Examination
- TPR WNL
- CRT - < 2 seconds
- Thoracic auscultation – no significant abnormalities
- Abdominal palpation – painful upon palpation

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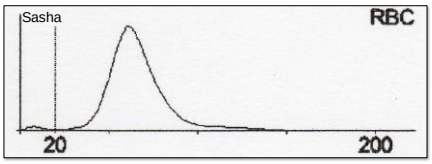
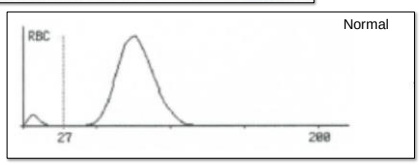
Sasha - Impedance





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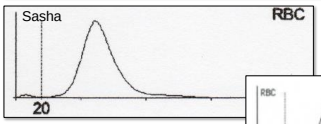
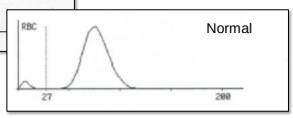
Sasha - Impedance

RBC	5.49 - $10^6/\mu l$	5.50 – 8.50
HGB	13.7 g/dl	12.0 – 18.0
HCT	36.62 - %	37.00 – 55.00
MCV	67 fl	60 – 77
MCH	24.9+ pg	19.5 – 24.5
MCHC	37.3 g/dl	31.0 – 39.0
RDWc	17.0 %	
RDWs	43.0 fl	





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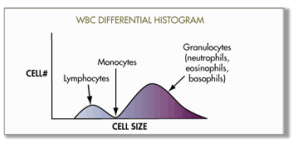
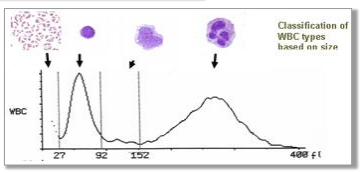
Impedance technology



Heska

Difficult to accurately count monocytes even with normal samples



Abaxis

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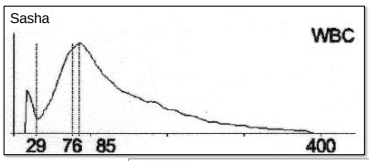
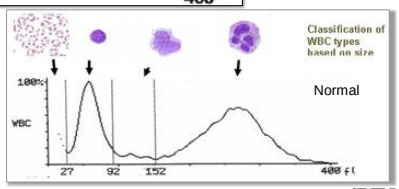
Sasha - Impedance





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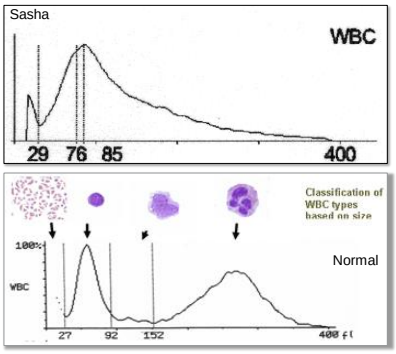

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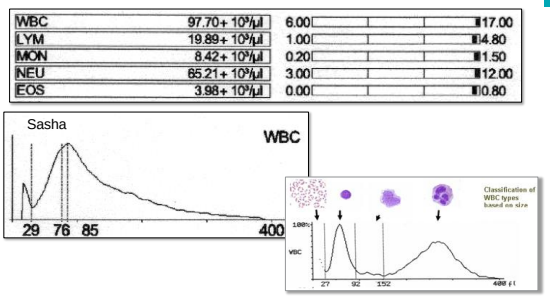
Sasha - Impedance



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Sasha – Impedance results

- Erythrogram
  - Confidence in results
- Thrombogram
  - Confidence in results
- Leukogram
  - No confidence in differential
  - Histogram review essential to make sense of the leukogram
  - Blood film review crucial

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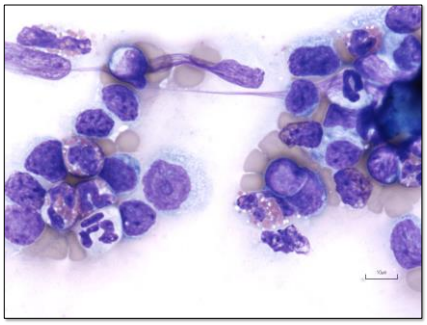
Sasha – Blood film



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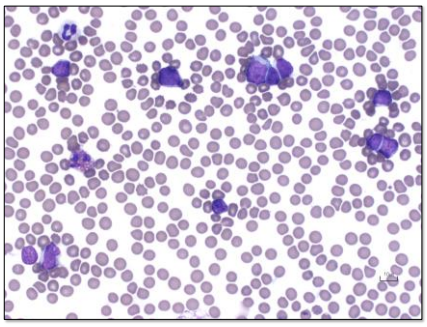
Sasha – Blood film



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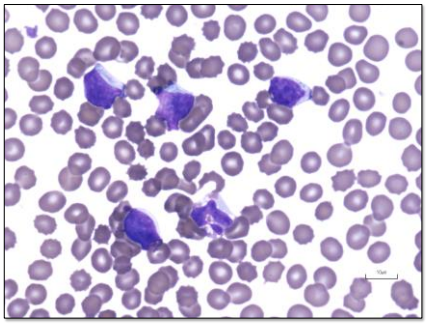
Sasha – Blood film



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Sasha

- Final diagnosis
  - Lymphoid leukemia

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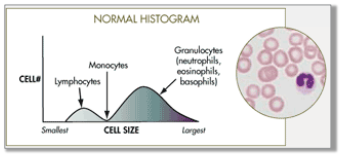
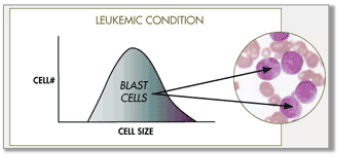
Impedance technology





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Flow Cytometry Analyzers

LaserCyte

LaserCyte Dx

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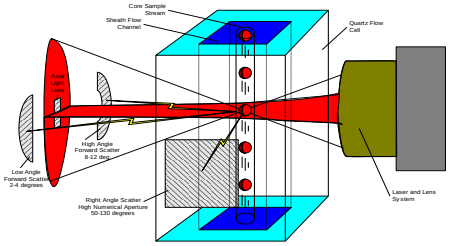
Schematic LaserCyte Technology



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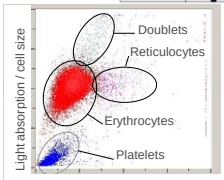
Sadie Shaeffer – 11yr, F Shep Mix (07-09-08)

RBC	4.77 M/µL	LOW	(5.50 - 8.50)
HCT	35.4 %	LOW	(37.0 - 55.0)
HGB	13.8 g/dL		(12.0 - 18.0)
MCV	74.2 fL		(60.0 - 77.0)
MCH	28.82 pg		(18.50 - 30.00)
MCHC	38.9 g/dL	HIGH	(30.0 - 37.5)
RDW	16.1 %		(14.7 - 17.9)
%RETIC	0.9 %		
RETIC	43.0 K/µL		



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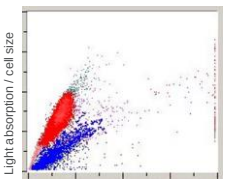
Rufisee - Feline

PLT	273. K/µL	(175. - 600.)
MPV	18.73 fL	
PDW	20.7 %	
PCT	0.5 %	



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Rufisee - Feline

PLT	273. K/µL	(175. - 600.)
MPV	18.73 fL	
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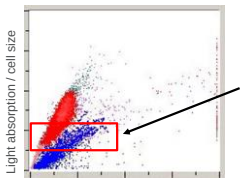

Overlapping sizes guarantees inaccurate RBC and PLT counts

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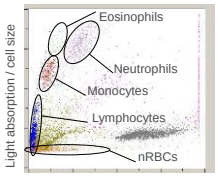
Sadie Shaeffer – 11yr, F Shep Mix (07-09-08)

WBC	4.37 K/µL	LOW	(5.50 - 16.90)
NEU	1.50 K/µL	LOW	(2.00 - 12.00)
LYM	2.04 K/µL		(0.50 - 4.90)
MONO	0.66 K/µL		(0.30 - 2.00)
EOS	0.14 K/µL		(0.10 - 1.49)
BASO	0.03 K/µL		(0.00 - 0.10)



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Poco – 3 yr old, Female, Norfolk Terrier

- Clinical presentation
  - Mild weight loss
  - Decreased appetite
  - Mild depression
- Physical examination
  - Depressed
  - Painful abdomen on palpation
  - Enlarged liver and spleen

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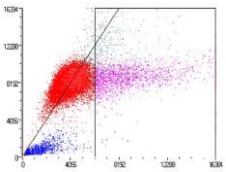
Poco – 3 yr old, Female, Norfolk Terrier

RBC	4.79 M/µL	5.50 - 8.50	LOW
HCT	35.4 %	37.0 - 55.0	LOW
HGB	10.1 g/dL	12.0 - 18.0	LOW
MCV	73.8 fL	60.0 - 77.0	
MCH	21.0 pg	18.5 - 30.0	
MCHC	28.4 g/dL	30.0 - 37.5	LOW
RDW	18.5 %	14.7 - 17.9	HIGH
%RETIC	5.8 %		
RETIC	279.6 K/µL	10.0 - 110.0	HIGH



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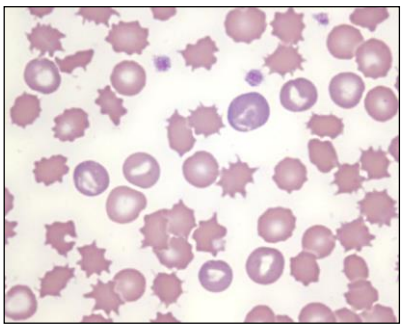
Poco – 3 yr old, Female, Norfolk Terrier



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Poco – 3 yr old, Female, Norfolk Terrier

- Case outcome
  - Aspirates of liver and spleen
    - Malignant lymphoma, large cell type, high grade
  - Owner elected euthanasia because of extend of disease

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Advanced Flow Cytometry Analyzers

ProCyte Dx

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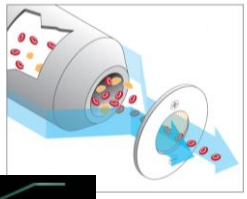
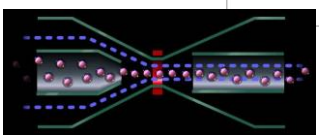
Advanced Technology

- Laminar flow impedance
  - Better alignment of cells being analyzed
  - Allows fast, precise and accurate cell counts





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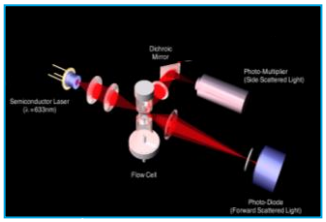
Advanced Technology

- Laser Flow Cytometry
  - Advanced cellular interrogation



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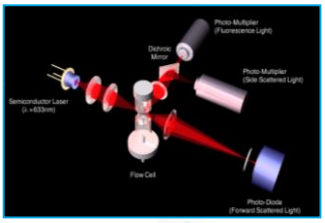
Advanced Technology

- Laser Flow Cytometry
  - Advanced cellular interrogation
- Optical fluorescence
  - Reticulocyte count
  - Feline platelet count
  - Additional specificity for leukocyte identification



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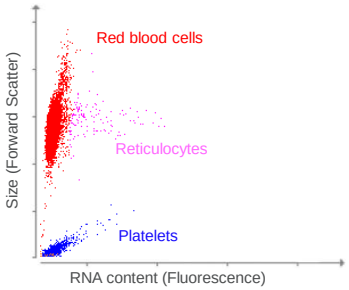
CBC: RBC-PLT Dot Plot



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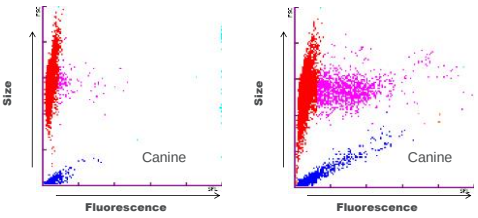
Reticulocytes

- The ProCyte Dx analyzer uses a fluorescent stain to more precisely identify reticulocytes.



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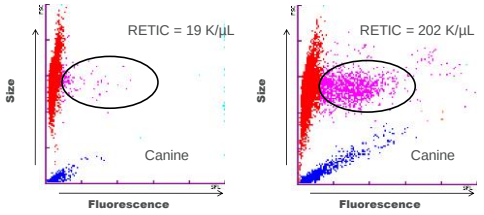
Reticulocytes

- The ProCyte Dx analyzer uses a fluorescent stain to more precisely identify reticulocytes.



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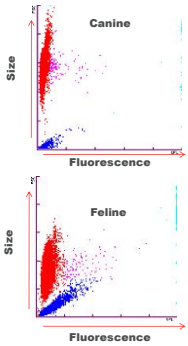
Platelet counting

- Laminar flow impedance
  - Accurate counting and sizing for most species
- Optical fluorescence
  - Accurate platelet counting for cats



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Case study – Sasha

Sasha

Patient
9 year old f/s German Shepherd Mix

Presenting Complaints
- Partial anorexia and "ADR"

Physical Examination
- TPR WNL
- CRT - < 2 seconds
- Thoracic auscultation – no significant abnormalities
- Abdominal palpation – painful upon palpation

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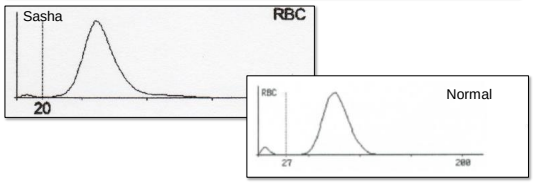
Sasha - Impedance

RBC	5.49	10^6/µl	5.50 – 8.50
HGB	13.7	g/dl	12.0 – 18.0
HCT	36.62	%	37.00 – 55.00
MCV	67	fl	60 – 77
MCH	24.9+	pg	19.5 – 24.5
MCHC	37.3	g/dl	31.0 – 39.0
RDWc	17.0	%	
RDWs	43.0	fl	



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Sasha - Erythrogram

Abnormal low
Within ref interval
Abnormal high

Parameter	Impedance	Flow Cytometry + Optical Fluorescence
RBC (M/µL)	5.49	5.93
HCT (%)	36.62	36.5
HGB (g/dL)	13.7	12.8
MCV (fL)	67	61.6
MCH (pg)	24.9	21.6
MCHC (g/dL)	37.3	35.1
RDW (%)	17	18.2
RETIC (K/µL)	Not available	Not reported

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Sasha - Erythrogram

Abnormal low
Within ref interval
Abnormal high

Parameter	Impedance	Flow Cytometry + Optical Fluorescence
RBC (M/µL)	5.49	5.93
HCT (%)	36.62	36.5
HGB (g/dL)	13.7	12.8
MCV (fL)	67	61.6
MCH (pg)	24.9	21.6
MCHC (g/dL)	37.3	35.1
RDW (%)	17	18.2
RETIC (K/µL)	Not available	Not reported

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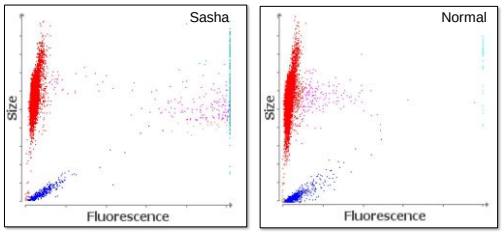
Sasha – Flow cytometry + optical fluorescence



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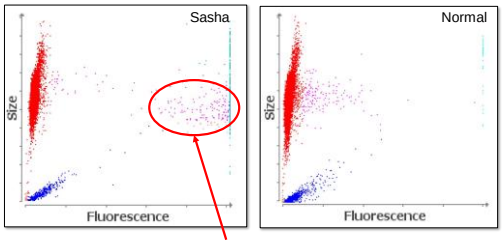
Sasha – Flow cytometry + optical fluorescence



Colored as "reticulocyte", but not connected to mature RBCs and reticulocyte count not reported

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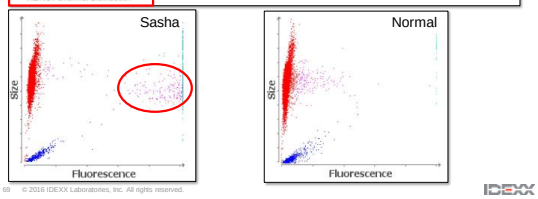
Sasha – Flow cytometry + optical fluorescence

Test	Results	Reference Interval	LOW	NORMAL	HIGH
ProCyte Dx (January 19, 2017 5:47 PM)					5/3/16 11:14 AM
RBC	5.93 M/µL	5.65 - 8.87			6.72 M/µL
HCT	36.8 %	37.3 - 61.7	LOW		43.1 %
HGB	12.8 g/dL	13.1 - 20.5	LOW		15.4 g/dL
MCV	61.6 fL	61.6 - 73.5			64.1 fL
MCH	21.6 pg	21.2 - 25.9			22.9 pg
MCHC	35.1 g/dL	32.0 - 37.9			35.7 g/dL
RDW	18.2 %	13.6 - 21.7			18.7 %
%RETIC	--.- %				0.6 %
RETIC	--.- K/µL	10.0 - 110.0			39.0 K/µL
RETIC Abnormal Distribution					



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"Sable" – 10 yr, Fs, Mixed breed dog

- Not feeling well" for about a week
  - Not eating well
  - Slight depression
- Physical examination
  - Good body condition and hair coat
  - Pink mucous membranes
  - Tender abdomen on palpation

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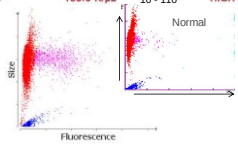
"Sable" – 10 yr, Fs, Mixed breed dog

Test	Results	Reference Interval	LOW	NORMAL	HIGH
ProCyte Dx					
RBC	6.2 x10^12/L	5.7 - 8.9			
HCT	43.2 %	37.5 - 61.7			
HGB	14.4 g/dL	13.1 - 20.5			
MCV	69.4 fL	61.6 - 73.5			
MCH	23.1 pg	21.2 - 25.9			
MCHC	33.3 g/dL	32.0 - 37.9			
RDW	19.1 %	13.6 - 21.7			
%RETIC	3.6 %				
RETIC	188.9 K/µL	10 - 110			HIGH



Normal RBC mass

Normal RBC indices

Mild-to-moderate reticulocytosis

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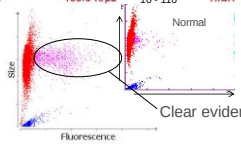
"Sable" – 10 yr, Fs, Mixed breed dog

Test	Results	Reference Interval	LOW	NORMAL	HIGH
ProCyte Dx					
RBC	6.2 x10^12/L	5.7 - 8.9			
HCT	43.2 %	37.5 - 61.7			
HGB	14.4 g/dL	13.1 - 20.5			
MCV	69.4 fL	61.6 - 73.5			
MCH	23.1 pg	21.2 - 25.9			
MCHC	33.3 g/dL	32.0 - 37.9			
RDW	19.1 %	13.6 - 21.7			
%RETIC	3.6 %				
RETIC	188.9 K/µL	10 - 110			HIGH



Normal RBC mass

Normal RBC indices

Mild-to-moderate reticulocytosis

Clear evidence of reticulocytosis

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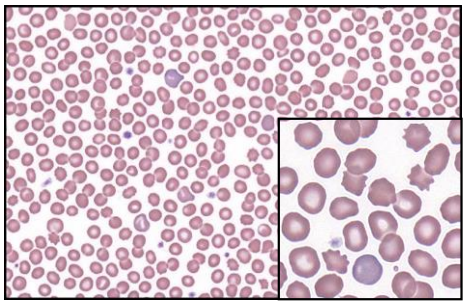
“Sable” – 10 yr, Fs, Mixed breed dog



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“Sable” – 10 yr, Fs, Mixed breed dog

- Case Outcome
  - Diagnostic imaging of abdomen
    - Radiographs revealed enlarged spleen and liver
    - Ultrasound suggested blood-filled cavities
      - Suspect splenic hemangiosarcoma
      - Suspect hepatic metastases
  - Owner elected surgical exploration
    - Large splenic mass with evidence of hepatic metastases
  - Owner elected euthanasia at surgery
  - Final diagnosis - hemangiosarcoma

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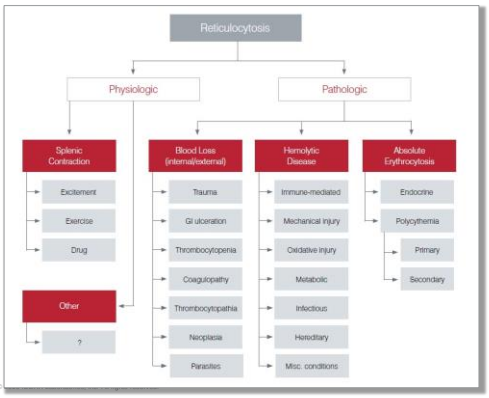

Onyx: 6-year-old, Mn, Cocker spaniel

- Several days of weakness, decreased exercise tolerance and decreased appetite
- No significant previous clinical problems
- Current on all vaccinations and parasite controls
- Good general body condition
- Slightly pale mucous membranes

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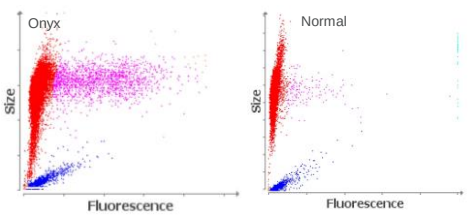
“Onyx” – 6 yr, Mn, Cocker spaniel



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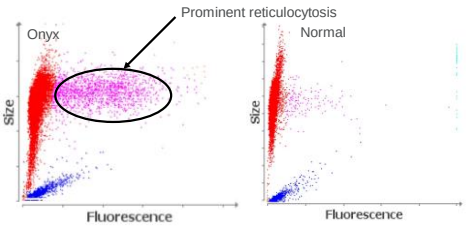
“Onyx” – 6 yr, Mn, Cocker spaniel



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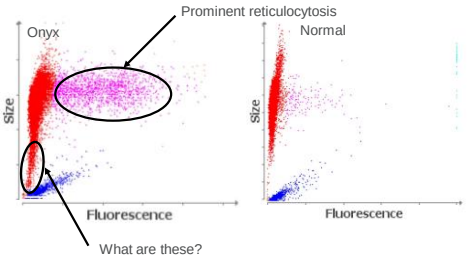
“Onyx” – 6 yr, Mn, Cocker spaniel



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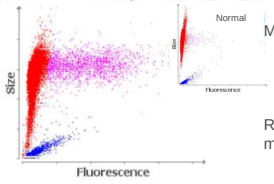
“Onyx” – 6 yr, Mn, Cocker spaniel

Test	Results	Reference Interval	LOW / NORMAL / HIGH
RBC	2.3 x10^12/L	5.7 - 8.9	LOW
HCT	22.6 %	37.3 - 61.7	LOW
HGB	7.8 g/dL	13.1 - 20.5	LOW
MCV	98.3 fL	61.6 - 73.5	HIGH
MCH	33.9 pg	21.2 - 25.9	HIGH
MCHC	34.5 g/dL	32.0 - 37.9	
RDW	27.1 %	13.6 - 21.7	HIGH
%RETIC	7.5 %		
RETIC	173.2 K/µL	6.0 - 100.6	HIGH



Moderately severe anemia
- Macrocytic
- Anisocytosis
  - Probable large and normal

Regenerative – either blood loss or mild/early hemolytic disease

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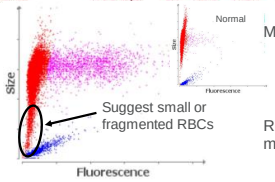
“Onyx” – 6 yr, Mn, Cocker spaniel

Test	Results	Reference Interval	LOW / NORMAL / HIGH
RBC	2.3 x10^12/L	5.7 - 8.9	LOW
HCT	22.6 %	37.3 - 61.7	LOW
HGB	7.8 g/dL	13.1 - 20.5	LOW
MCV	98.3 fL	61.6 - 73.5	HIGH
MCH	33.9 pg	21.2 - 25.9	HIGH
MCHC	34.5 g/dL	32.0 - 37.9	
RDW	27.1 %	13.6 - 21.7	HIGH
%RETIC	7.5 %		
RETIC	173.2 K/µL	6.0 - 100.6	HIGH



Moderately severe anemia
- Macrocytic
- Anisocytosis
  - Probable large and normal

Regenerative – either blood loss or mild/early hemolytic disease

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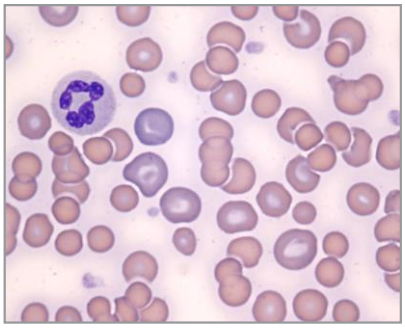
“Onyx” – 6 yr, Mn, Cocker spaniel



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Onyx: 6-year-old, Mn, Cocker spaniel

- Case outcome
  - Immune-mediated hemolytic anemia
    - Unidentified cause
    - Inflammation
  - Responded well to treatment
  - Laboratory values returned to baseline within 2 weeks

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Case study – Nova

Nova

Patient
12 year old F/S DSH

Presenting complaints – September 2016
- Walking a little weird
- Laying near the water fountain a lot
- Seemed to improve on her own in a few days

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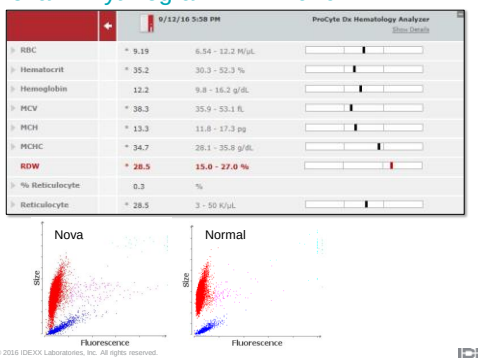
Nova – Erythrogram 12-2-2016



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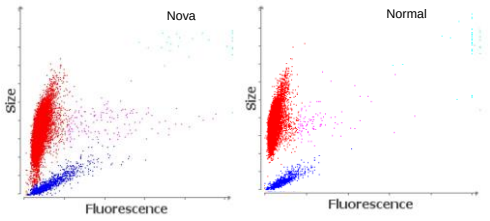
Nova – Erythrogram 12-2-2016



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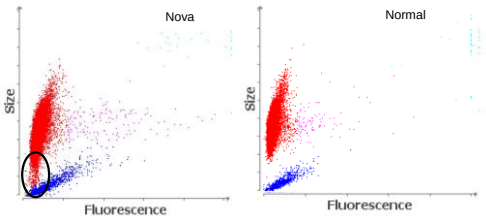
Nova – Erythrogram 12-2-2016



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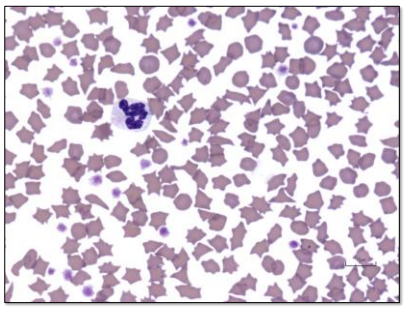
Nova – Blood film 12-2-2016



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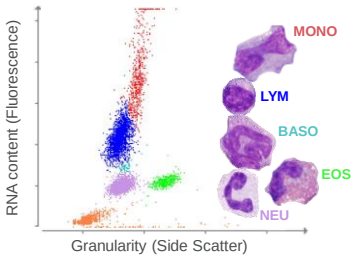
CBC: WBC Dot Plot



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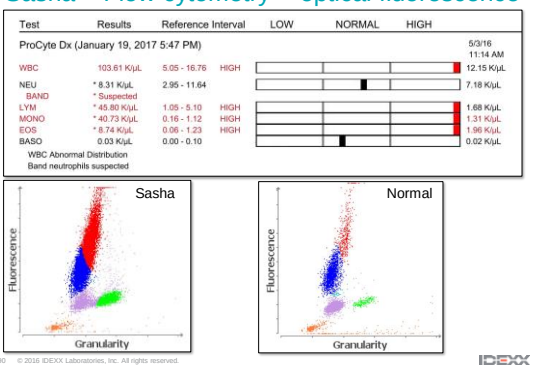
Sasha – Flow cytometry + optical fluorescence



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Sasha - Leukogram

Abnormal low
Within ref interval
Abnormal high

Parameter	Impedance	Flow Cytometry + Optical Fluorescence
WBC (K/µL)	97.70	103.61
NEU (K/µL)	65.21	*8.31
BAND	Not Available	Suspect Presence
LYM (K/µL)	19.89	*45.80
MONO (K/µL)	8.42	*40.73
EOS (K/µL)	3.98	*8.74
BASO (K/µL)	0.20	0.03

Leukocytosis, Neutrophilia
Lymphocytosis, Monocytosis

WBC abnormal distribution
Bands neutrophils suspected

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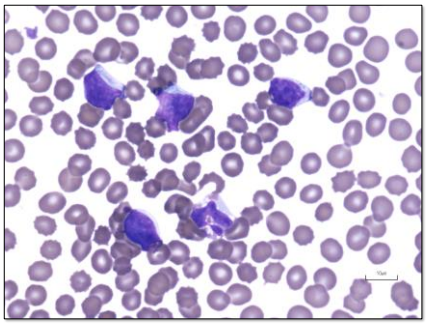
Sasha – Blood film



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Sasha

- Final diagnosis
  - Lymphoid leukemia

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Abby – 6yr, Female, Labrador Retriever

- Original presentation
  - Normal behavior but presented with recurring nose bleeds (without associated trauma)
  - Physical examination
    - Good body condition
    - Palpable slightly enlarged spleen
  - Laboratory findings
    - Marked thrombocytopenia (< 30 K/µL)
    - SNAP 4Dx negative
- Being treated for immune-mediate thrombocytopenia of unidentified etiology

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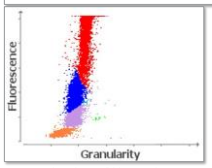
Abby – 6yr, Female, Labrador Retriever

Test	Results	Reference Interval	LOW	NORMAL	HIGH
ProCyte Dx					
WBC	26.52 K/µL	5.05 - 16.76	HIGH		
NEU	* 5.51 K/µL	2.95 - 11.64			
BAND	* Suspect presence				
LYM	* 3.34 K/µL	1.05 - 5.10			
MONO	* 17.63 K/µL	0.16 - 1.12	HIGH		
EOS	0.02 K/µL	0.06 - 1.23	LOW		
BASO	0.02 K/µL	0.00 - 0.10			
WBC Abnormal Distribution					
Band neutrophils suspected					



Moderate leukocytosis
Automated differential
Monocytosis / Eosinopenia
Dot Plot evaluation
Abnormal distribution
Qualified results
Mandates blood film review

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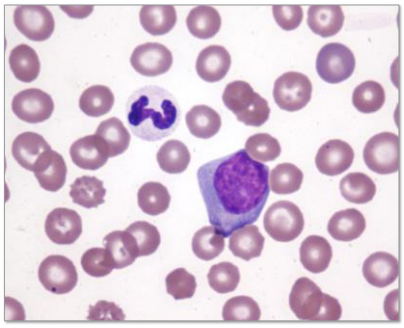
Abby – 6yr, Female, Labrador Retriever



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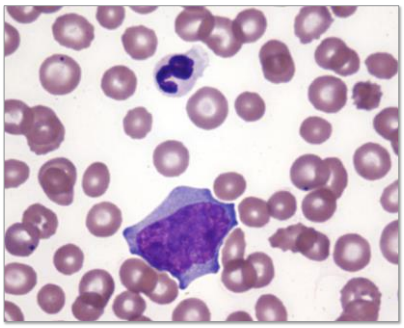
Abby – 6yr, Female, Labrador Retriever



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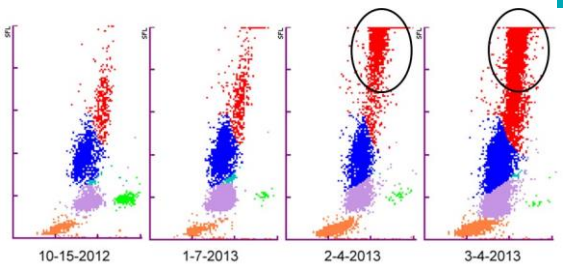
Abby – 6yr, Female, Labrador Retriever



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Blizzard

- 8 year old, intact male, Eng Springer Spaniel
- Clinical presentation
  - Sudden decreased exercise tolerance
  - Difficult breathing
- Clinical assessment
  - Fever, depressed
  - Auscultation – fluid in thoracic cavity
  - Consolidated lungs

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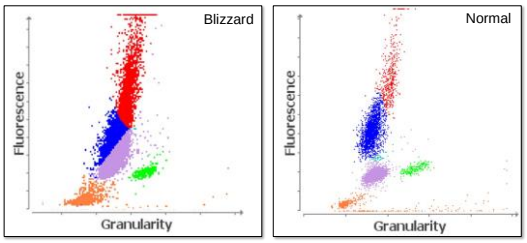
Blizzard



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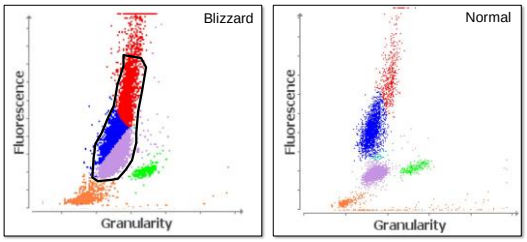
Blizzard



- Abnormal leukocyte distribution
- Continuum of digitized events extending from neutrophils to monocytes

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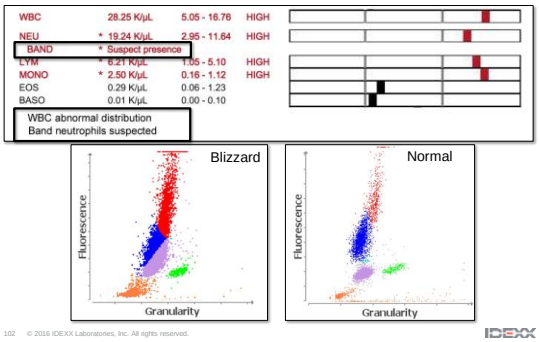
Blizzard



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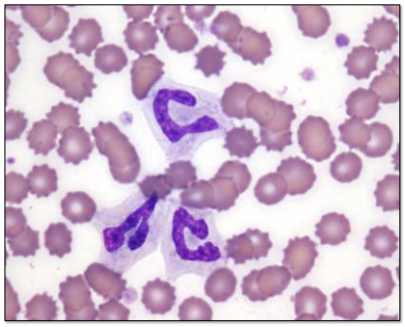
Blizzard



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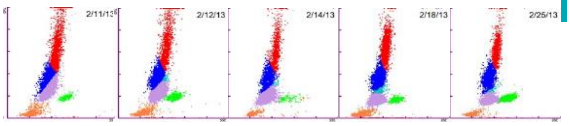
Blizzard



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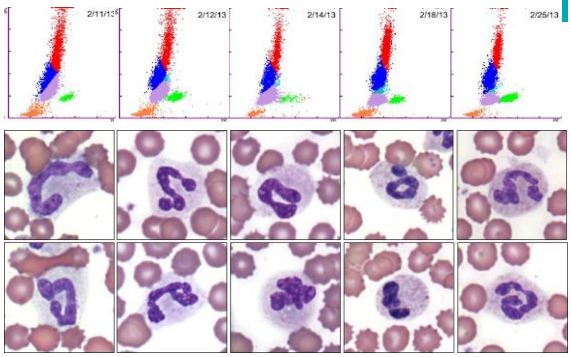
Blizzard



Blizzard

- Case outcome
  - Pyothorax
  - Pulmonary abscess
  - Slow and steady recovery

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Case study – Duncan – 1-23-2017

Duncan

Patient
11 year old m/n black labrador

Presenting Complaints
- Owner called next day
- Coughing and unable to stand

Physical Examination
- Harsh lung sounds – suspect aspiration pneumonia
- Abdominal fluid – identified as hemoabdomen

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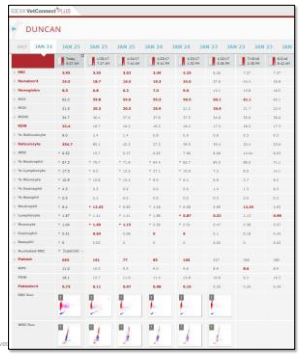
Duncan – Serial hematology data



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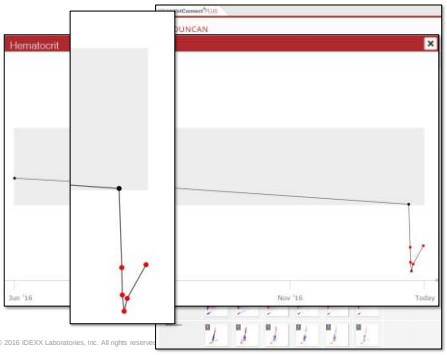
Duncan – Serial hematology data



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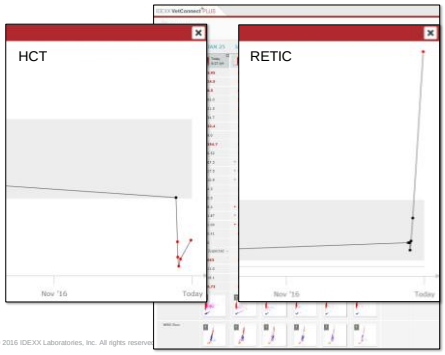
Duncan – Serial hematology data



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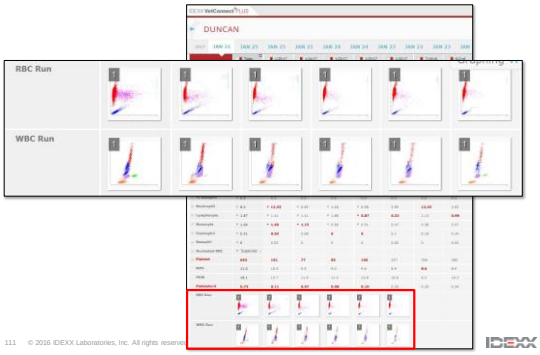
Duncan – Serial hematology data



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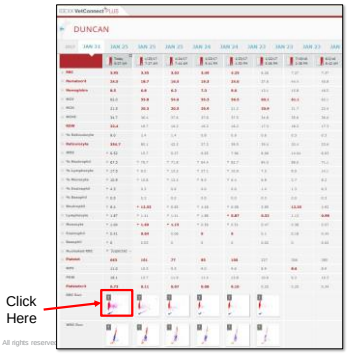
Duncan – Serial hematology data



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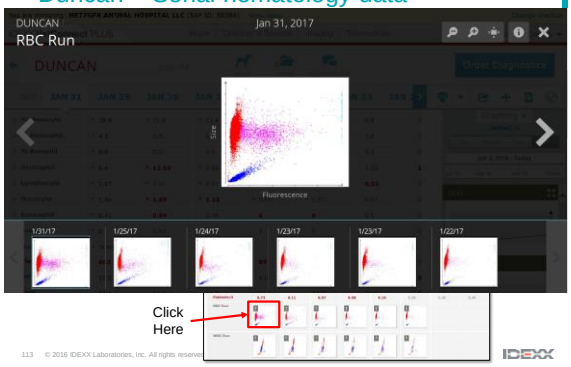
Duncan – Serial hematology data



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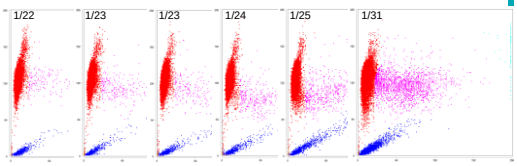
Duncan – Serial RBC dot plots



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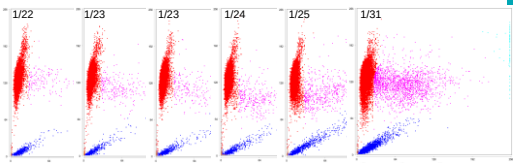
Duncan – Serial RBC dot plots



- Increasing reticulocyte counts in response to the anemia
  - Increasing response as inflammation resolves
- Lowering of reticulocyte cluster during active inflammation
  - Returning to more normal position as inflammation resolves

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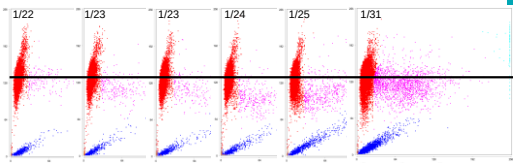
Duncan – Serial RBC dot plots



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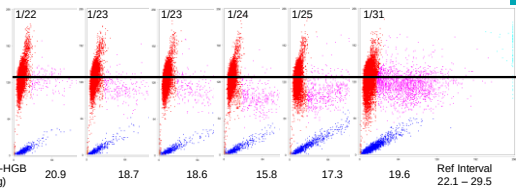
Duncan – Serial RBC dot plots



- Increasing reticulocyte counts in response to the anemia
  - Increasing response as inflammation resolves
- Lowering of reticulocyte cluster during active inflammation
  - Returning to more normal position as inflammation resolves

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RETIC-HGB (reticulocyte hemoglobin equivalent)

1. Biomarker for Iron Deficiency	2. Decreases earlier than MCV/MCHC	3. Measure of both absolute and functional deficiency
Sensitive	MCV/MCHC changes require time – mean values	Fe loss or deficiency
Specific	RET-He changes in 2-4 days – reticulocyte production	Fe availability – inflammation and chronic disease

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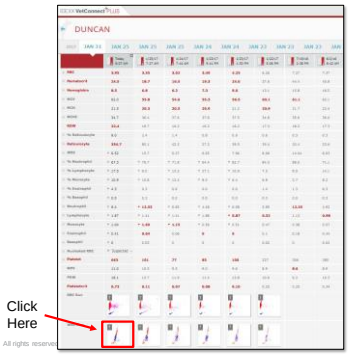
Duncan – Serial hematology data



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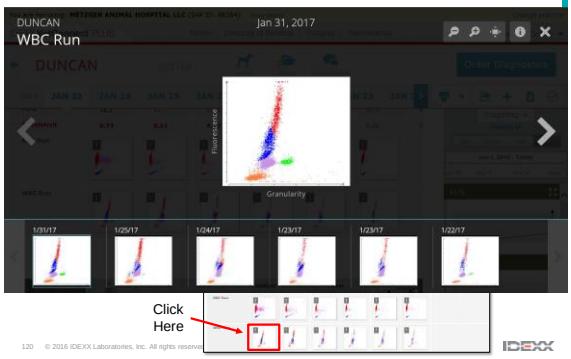
Duncan – Serial hematology data



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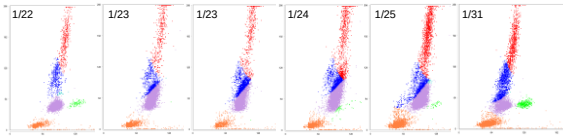
Duncan – Serial WBC dot plots



- Dramatic change from day 1
  - Days 1/23 through 1/25
    - Prominent increase in immature and/or toxic neutrophils
    - Decreased lymphocyte densities
    - Loss of eosinophils
  - Day 1/31
    - Returning to normal
    - Residual slight increase in immature and/or toxic neutrophils

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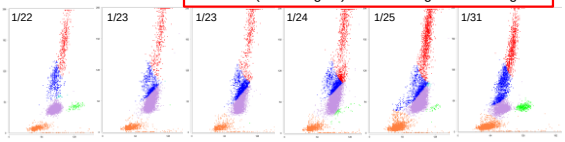
Duncan – Serial WBC dot plots

CDx CRP (RI < 1 mg/dL) 4.4 mg/dL 0.8 mg/dL



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    - Decreased lymphocyte densities
    - Loss of eosinophils
  - Day 1/31
    - Returning to normal
    - Residual slight increase in immature and/or toxic neutrophils

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What is the value of cytogram review?

- Immediate validation of results building confidence in the CBC
  - Are the various groups / clusters of properly characterized?
    - Hills and valleys appropriately identified
    - Clusters of dots appropriately separated and colored
- Recognition of morphologic abnormalities not identifiable in the numbers
  - Abnormal histogram and dot-plot patterns strongly support sample abnormalities
  - Assist in recognizing when blood film evaluation is essential

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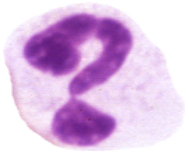
Questions?

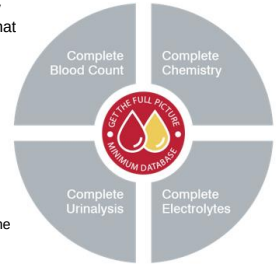


How to perform in-house urinalysis

Dennis B. DeNicola, DVM, PhD, DACVP
Chief Veterinary Educator – IDEXX Laboratories
Adjunct Full Professor – Purdue University College of Veterinary Medicine

Urinalysis – Why pan for Gold

- Most veterinarians and veterinary technicians/nurses were taught that urinalysis is a component of the MDB
- Most patient work-ups do not include a complete urinalysis
  - < 30% of chemistry/hematology profiles also have urinalysis
- The complete urinalysis provides information for more than the urinary system
  - Information needed to interpret the CBC and chemistry profile



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Meeko

- Adult
- Mixed breed
- Work-up in preparation for dental
- No significant abnormalities in CBC and chemistry profile
- No urine collected for analysis initially

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Meeko – urine physical and chemical exam

Physical Exam

IDEXX VetLAB UA
Dev. ID: 51594
Seq.No: 1
Pat.ID:
03.04.2016 04:42 p.m.
Coll. Meth. Voided
Vol 3.0 ml
Color Pale Yellow
Clarity Slight. Cloudy
SG 1.023

Chemical Exam

pH	6	
*LEU	100	Leu/uL 2+
PRO	neg	
GLU	neg	
KET	neg	
UBG	norm	
BIL	neg	
BLD	10	Ery/uL 1+

*Confirm with Microscopy

Interpretation?

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Meeko – urine physical and chemical exam

Physical Exam

IDEXX VetLAB UA
Dev. ID: 51594
Seq.No: 1
Pat.ID:
03.04.2016 04:42 p.m.
Coll. Meth. Voided
Vol 3.0 ml
Color Pale Yellow
Clarity Slight. Cloudy
SG 1.023

Chemical Exam

pH	6	
*LEU	100	Leu/uL 2+
PRO	neg	
GLU	neg	
KET	neg	
UBG	norm	
BIL	neg	
BLD	10	Ery/uL 1+

*Confirm with Microscopy

Next – urine microscopy video
What do you see?

Slightly inappropriate but must investigate hydration status and drinking habit

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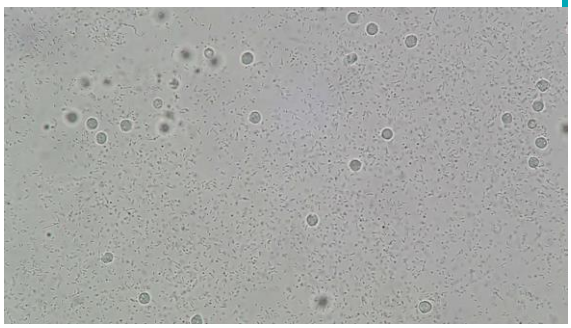
Meeko – urine sediment



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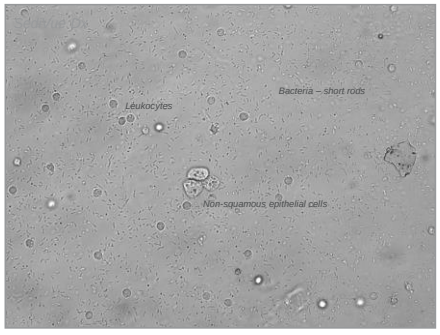
Meeko – urine sediment



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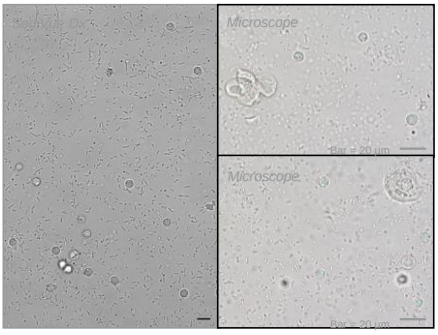
Meeko – urine sediment



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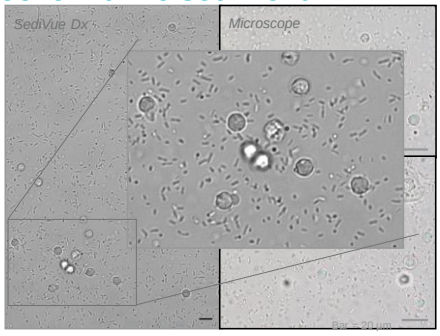
Meeko – urine sediment



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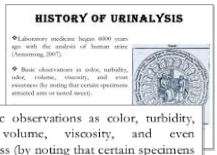
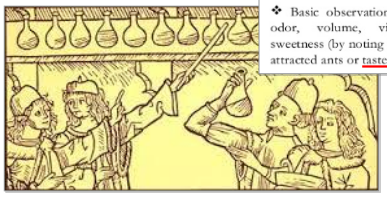
The complete urinalysis—history

The ancient Greek physician Hippocrates said:
"No other organ system or organ provides so much information by its excretion as does the urinary system."





❖ Basic observations as color, turbidity, odor, volume, viscosity, and even sweetness (by noting that certain specimens attracted ants or tasted sweet).

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The complete urinalysis—why and when?

Urinalysis provides insights to:
- Hydration status
- Kidney disease
- Diabetes
- Liver disease
- Acid-Base status
- Anemia
- Inflammation
- Hemolytic disease

Chemistry/CBC alone may miss:
- Kidney or liver disease
- Urinary tract infection (UTI)
- Severity of diabetes
- Bladder cancer
- Acid-Base disturbance

The minimum database includes a chemistry panel (including IDEXX SDMA) + CBC+ complete UA and is relevant across all visit types.

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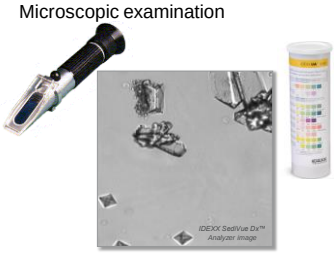
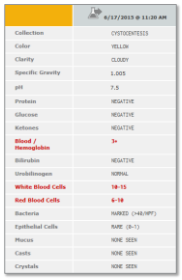
The complete urinalysis—what?

Physical examination
Chemical examination
Microscopic examination





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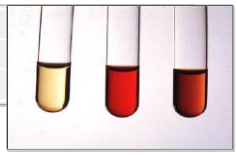
The complete urinalysis—physical examination

Color
Clarity
Specific Gravity



Urine Color	Interpretation
Pale yellow to amber	Normal
Red to red-brown	HGB, RBCs
Red-brown to brown	Myoglobin, RBCs
Orange	Bilirubin
Blue, Green, Purple, etc.	Various drugs

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The complete urinalysis—physical examination

Color	YELLOW
Clarity	CLOUDY
Specific Gravity	1.005

Clarity
- Clear
- Hazy
- Cloudy
- Opaque
- Turbid

Decreasing clarity indicates increased particular matter (cells, bacteria, crystals, etc.).

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The complete urinalysis—physical examination

Color	YELLOW
Clarity	CLOUDY
Specific Gravity	1.005

Hydrometer/urinometer

Refractometer

Dry reagent strips

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The complete urinalysis—physical examination

Color	YELLOW
Clarity	CLOUDY
Specific Gravity	1.005

Refractometer

Calibrate regularly.

Distilled water = 1.000 specific gravity (SG)

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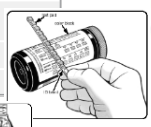
The complete urinalysis—chemical examination

pH	7.5
Protein	NEGATIVE
Glucose	NEGATIVE
Ketones	NEGATIVE
Blood / Hemoglobin	3+
Bilirubin	NEGATIVE
Urobilinogen	NORMAL



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The complete urinalysis—chemical examination

Advantages of automated reading
- Standardizes reporting
- Eliminates timing need
- Color correction possible
- Direct transfer of data
- Assurance of charge capture

Automated reading of dry reagent strip

pH
Protein
Glucose
Ketones
Blood / Hemoglobin
Bilirubin
Urobilinogen

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Chemical analysis — blood / hemoglobin

BLD/HGB

Hematuria

Hemoglobinuria

- Cell-free "heme" groups
- Hemoglobin or myoglobin

- Intact erythrocytes

Hemoglobinuria and myoglobinuria—may be finding even if there is primarily hematuria, but erythrocytes have lysed in a hyposthenuric sample

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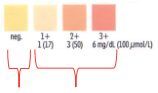
Chemical analysis — bilirubin

Caution with dogs, especially males. Significant bilirubinuria with concentrated urine.

BIL



No detectable bilirubin

Bilirubinuria

- Bilirubinuria usually precedes bilirubinemia.
- Any bilirubinuria in the cat is significant.
- Common in the dog and may have bilirubin crystals with concentrated urine.
- Many causes: **hemolytic disease**, **biliary obstructive disease**, fever, starvation.

- Normal and expected for the normal cat
- Possible but uncommon with very dilute dog urine

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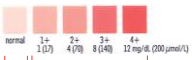
Chemical analysis — urobilinogen

Correlation between liver disease and urobilinogenuria in animals is poor.

UBG



- Intestinal bacteria convert bilirubin to urobilinogen.
- Most are excreted in the feces.
- Some urobilinogen is delivered back to circulation in portal system.
- Potential causes: hemolytic and liver disease.

- Complete lack of urobilinogen rarely seen
- Theoretically associated with complete biliary obstruction

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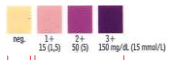
Chemical analysis — ketone

Degree of ketonuria does not correlate to the severity of ketoacidosis.

KET



- IDEXX UA™ Strips mostly sensitive to acetoacetate but also detect acetone.
- Beta-hydroxybutyrate primary cause for acidosis but not detectable with urine test strips.
- Causes: diabetic ketoacidosis, prolonged fasting, starvation, low-carbohydrate diet.

- Ketones normally not detected in urine

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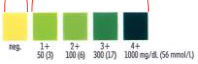
Chemical analysis — glucose

- Glucose normally not detected in urine

- Glycosuria usually associated with serum values above renal threshold:
  - Dogs ~ 180 mg/dL
  - Cats ~ 300 mg/dL
- Potential: tubular dysfunction

GLU



Under normal conditions, glucose in the glomerular filtrate is completely reabsorbed in the proximal tubules.

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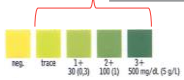
Chemical analysis — protein

- Small amounts of proteinuria may be normal.
- Test most sensitive to albumin.
- Prerenal, renal, or postrenal causes.
- False increases are uncommon (improper strip storage, highly alkaline urine, etc.).

PRO



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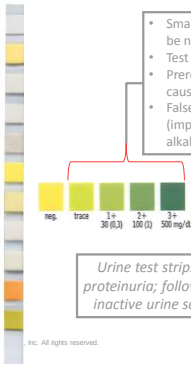
Chemical analysis — protein



- Small amounts of proteinuria may be normal.
- Test most sensitive to albumin.
- Prerenal, renal, or postrenal causes.
- False increases are uncommon (improper strip storage, highly alkaline urine, etc.).

Urine test strips are used to screen for proteinuria; follow-up UPC testing with an inactive urine sample is recommended.

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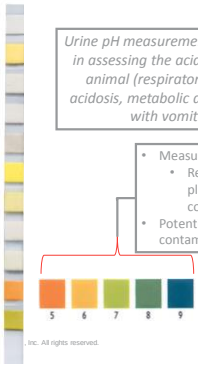
Chemical analysis — pH



Urine pH measurement may prove useful in assessing the acid-base status of an animal (respiratory and metabolic acidosis, metabolic alkalosis associated with vomiting, etc.).

- Measure of hydrogen ion concentration:
  - Reflection of kidneys' ability to regulate plasma hydrogen ion and bicarbonate concentrations
- Potential artificial increases (bacteria, contamination, etc.)

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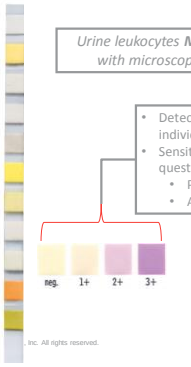
Chemical analysis — leukocytes



*Urine leukocytes **MUST** be confirmed with microscopic examination.*

- Detects leukocyte esterase, not individual leukocytes
- Sensitivity of LEU test pad questionable in veterinary medicine
  - Potential value in the dog
  - Absolutely no value in the cat

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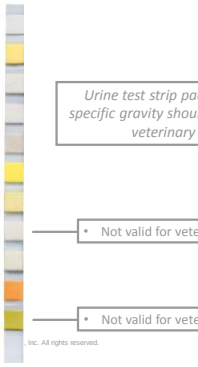
Chemical analysis — nitrite and specific gravity



Urine test strip pads for nitrite and specific gravity should not be used with veterinary samples.

- Not valid for veterinary use
- Not valid for veterinary use

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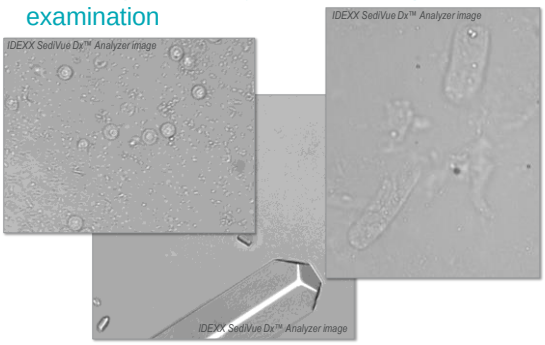
The complete urinalysis—microscopic examination



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Real or perceived problems for in-clinic urine microscopy

- Lack of confidence for accurate and reproducible microscopic evaluation

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Real or perceived problems for in-clinic urine microscopy

- Lack of confidence for accurate and reproducible microscopic evaluation
- Lack of standardization with manual procedure
  - Potential “excess” centrifugation
  - Proper microscope light alignment

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The complete urinalysis—microscopic examination

Variable sample preparation seen in the field:

- Urine volume used is widely variable
  - 1.5, 3.0, 5.0, and 10.0 mL
- Centrifuge size and centrifugal force
- Microscope used for evaluation
- Evaluation of unstained or stained preparation

White Blood Cells	10-15
Red Blood Cells	6-10
Bacteria	MARKED (>40/HPF)
Epithelial Cells	RARE (0-1)
Mucus	NONE SEEN
Casts	NONE SEEN
Crystals	NONE SEEN

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The complete urinalysis—microscopic examination

- 1.5 mL maximum
- Often < 1.5 mL

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The complete urinalysis—automated microscopic examination

UriSed 2

IDEXX SediVue Dx™ Urine Sediment Analyzer

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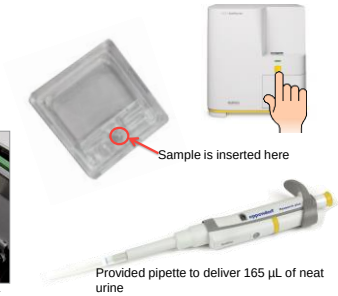
The complete urinalysis—microscopic examination

- Low maintenance
- No reagents
- Small footprint

Sleeve loaded in analyzer



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Reported parameters for the most clinically significant elements

Blood Cells:	Bacteria:	Epithelial Cells:	Crystals:	Casts:
RBC WBC	Rods Cocci	Squamous Non-Squamous	CaOx Dihydrate Struvite “Crystals”	Hyaline Non-Hyaline

All images from IDEXX SediVue Dx™ Analyzer

Real or perceived problems for in-clinic urine microscopy

- Lack of confidence for accurate and reproducible microscopic evaluation
- Lack of standardization with manual procedure
  - Potential “excess” centrifugation
  - Proper microscope light alignment
- Even with an automated microscopy … nothing is perfect
  - Automation provides much greater precision than manual review
  - Human evaluation is far from 100% sensitive or specific for microscopic identification of urine formed elements

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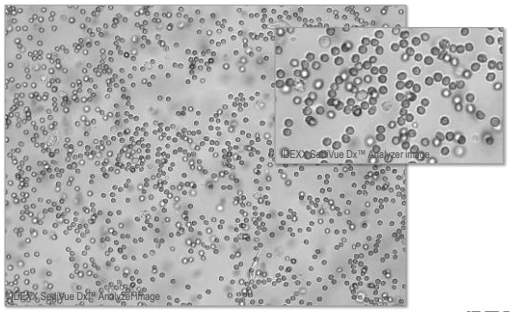
Microscopic examination—erythrocytes



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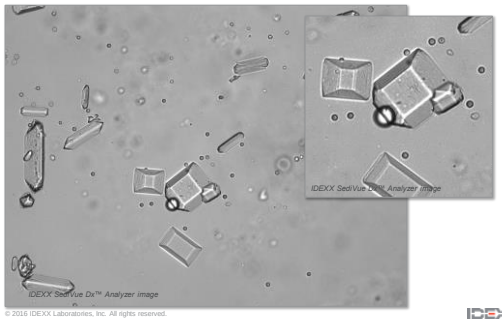
Microscopic examination—erythrocytes



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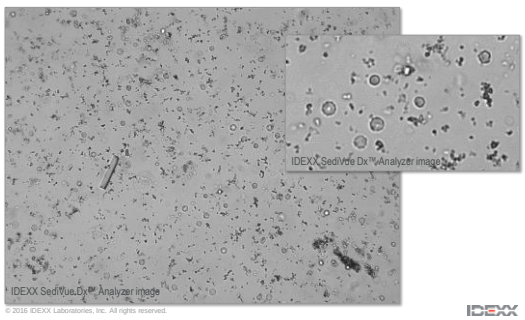
Microscopic examination—erythrocytes



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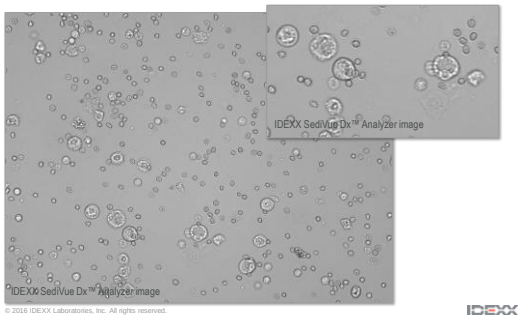
Microscopic examination—erythrocytes



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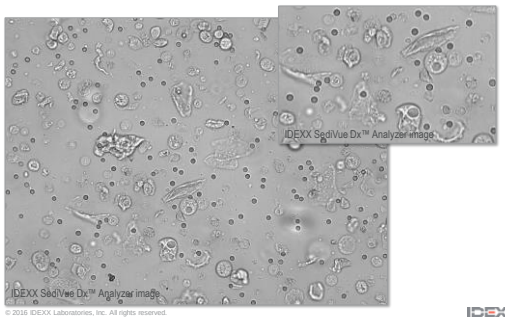
Microscopic examination—erythrocytes



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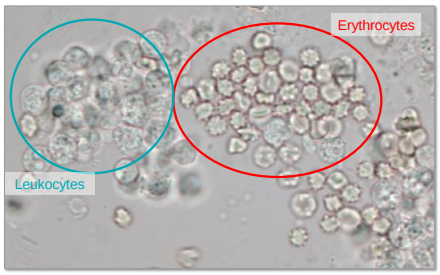
Microscopic examination—erythrocytes



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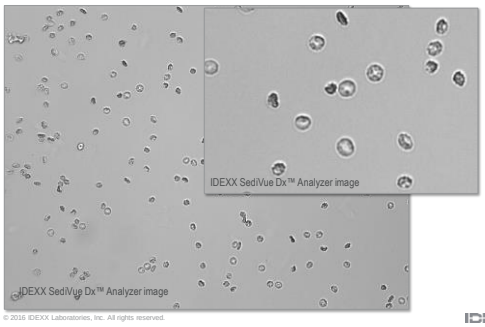
Microscopic examination—erythrocytes



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Microscopic examination—erythrocyte (RBC)

- Common causes for hematuria
  - Low numbers (< 5/HPF) considered to be normal
    - Consider urine specific gravity when interpreting
  - Collection (cystocentesis and catheter)
  - Trauma
  - Inflammation (septic and sterile)
  - Uroliths
  - Transitional cell carcinoma

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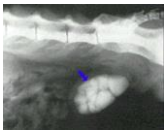
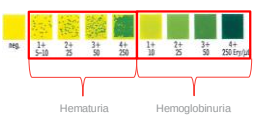
Microscopic examination—erythrocyte (RBC)

- Next steps
  - Review history, clinical signs and physical examination findings
  - Evaluate urine chemistries
    - Hematuria/Hemoglobinuria
  - Detailed evaluation for other formed elements
    - Possible follow-up culture and sensitivity testing
    - Diagnostic imaging investigating for presence of uroliths
  - Repeat urinalysis after treatment





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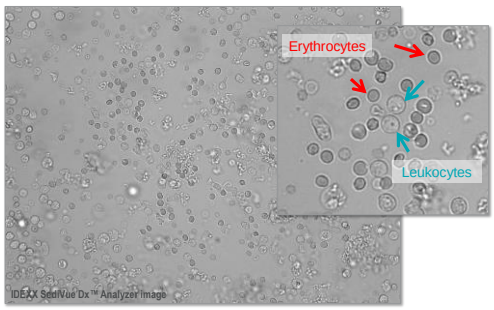
Microscopic examination—leukocytes (WBC)



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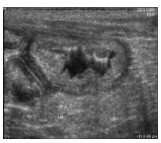
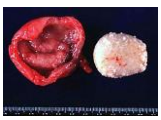
Microscopic examination—leukocytes (WBC)

- Common causes for leukocytes in the urine sediment
  - Low numbers (< 5/HPF) considered to be normal
    - Consider urine specific gravity when interpreting
  - Indicate presence of active inflammation
    - Not localized
      - Kidney → Ureter → Urinary bladder → Urethra → External genitalia
    - Not specific for any particular etiology
  - Cystitis associated with multiple potential causes
    - Bacteria, fungal, calculi, transitional cell carcinoma
  - Pyuria does not mean bacteriuria



Bacterial cystitis with thickened bladder wall



Calculi cystitis

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Microscopic examination—leukocytes (WBC)

- Next steps
  - Examine microscopic material closely looking for bacteria or other infectious agents
  - If not sure looking at wet preparation:
    - Prepare a dry prep ("line smear") as shown previously to help identify infectious agents
  - If infectious agents are identified:
    - Submit for microbiologic evaluation and if bacteria, perform antibiotic sensitivity testing
- Repeat urinalysis after treatment

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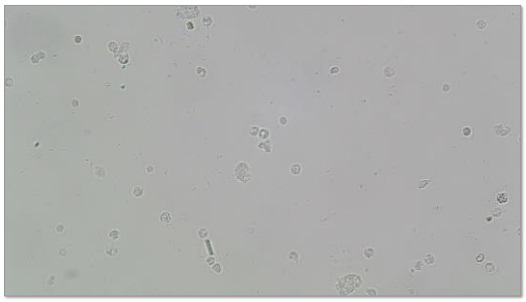
Mild pyuria with bacteria?



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Mild pyuria with bacteria?

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Microscopic examination—"Line Smear"

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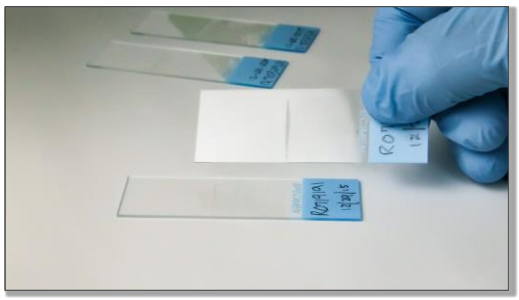
Microscopic examination—"Line Smear"



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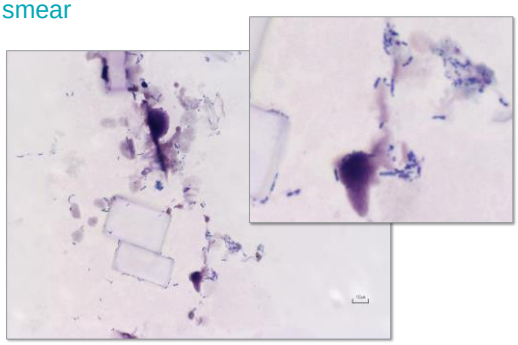
Microscopic examination—stained line smear



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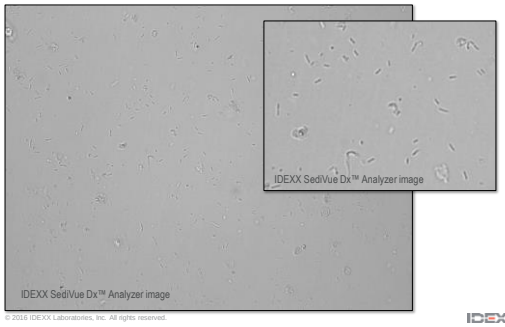
Microscopic examination—bacteria (rods)



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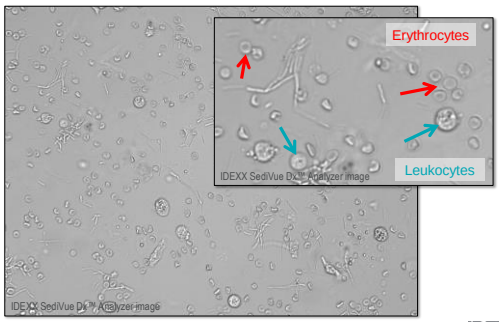
Microscopic examination—bacteria (rods)



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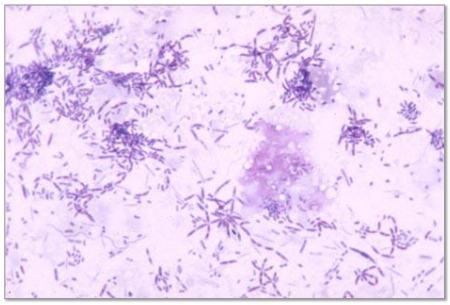
Microscopic examination—bacteria (rods)



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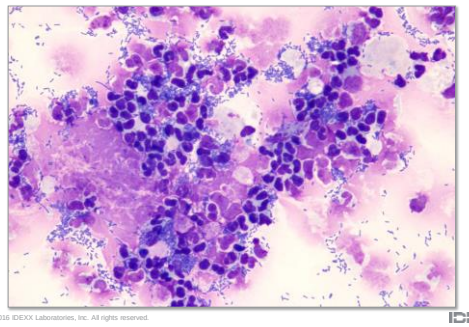
Microscopic examination—bacteria (rods)



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Microscopic examination—bacteria (cocci)

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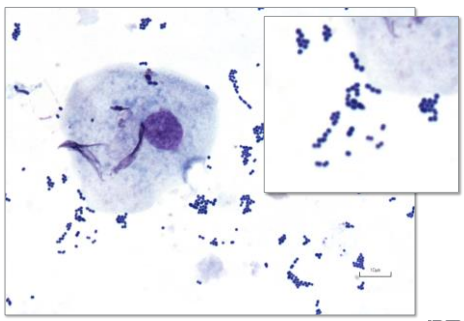
Microscopic examination—bacteria (cocci)



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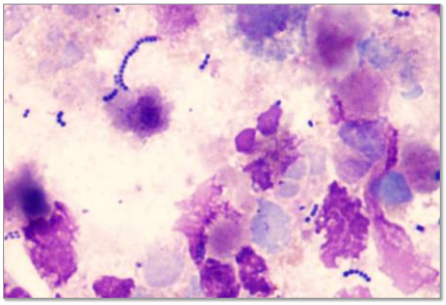
Microscopic examination—bacteria (cocci)



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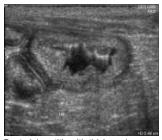
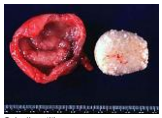
Microscopic examination—bacteria

- Common causes for bacteria in the urine sediment
  - Bacterial inflammation within the urogenital tract
    - Caution with interpretation dependent upon collection technique
      - Cystocentesis, voided, catheterization, off floor
  - Bacterial contamination and overgrowth if not processed soon after collection
  - Bacteriuria without clinical signs
    - Normal?



Bacterial cystitis with thickened bladder wall



Calculi cystitis

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Microscopic examination—bacteria

- Next steps
  - Microbiologic evaluation—culture
  - Antibiotic sensitivity testing
- Repeat urinalysis after treatment

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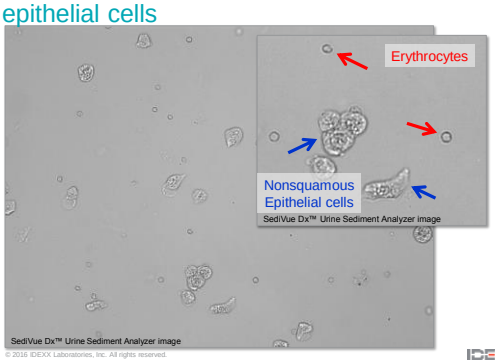
Microscopic examination—nonsquamous epithelial cells



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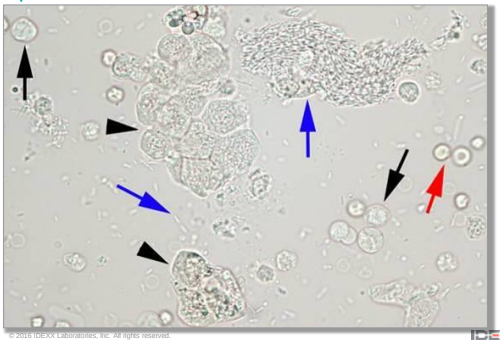
Microscopic examination—nonsquamous epithelial cells



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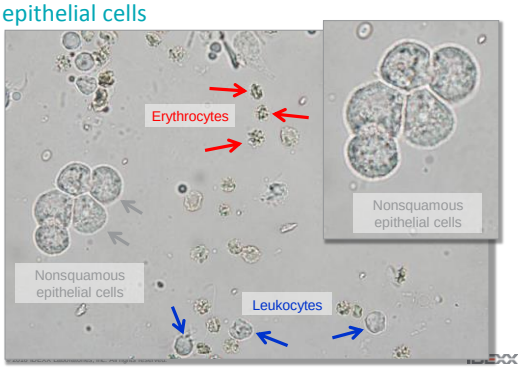
Microscopic examination—nonsquamous epithelial cells



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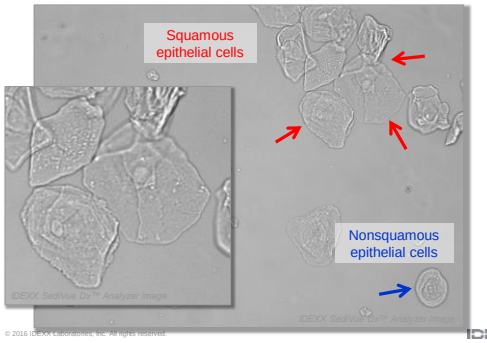
Microscopic examination—squamous epithelial cells



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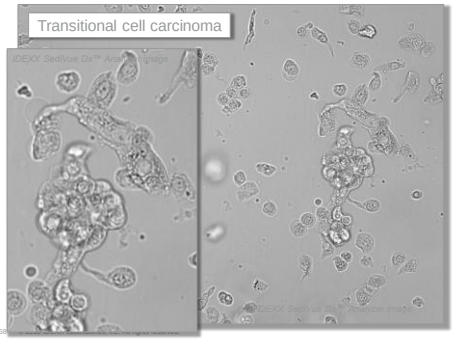
Microscopic examination—nonsquamous epithelial cells



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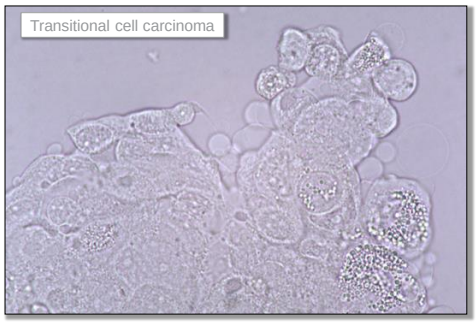
Microscopic examination—nonsquamous epithelial cells



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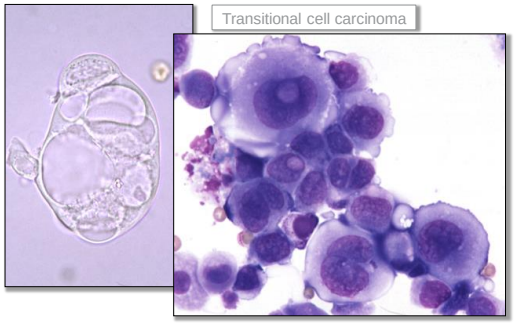
Microscopic examination—nonsquamous epithelial cells



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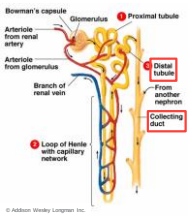
Microscopic examination—urinary casts

- Cylindrical structures formed in the distal convoluted tubules and collecting ducts of the nephron
- First identified by Henry Bence Jones in the 1800s
- Different types associated with different types of renal pathology:
  - Hyaline casts
  - Nonhyaline casts
    - Cellular, granular, and waxy
- All casts have common features:
  - One end is smooth and rounded.
  - One end is irregular and jagged.
- Potential value in differentiating broad versus narrow casts



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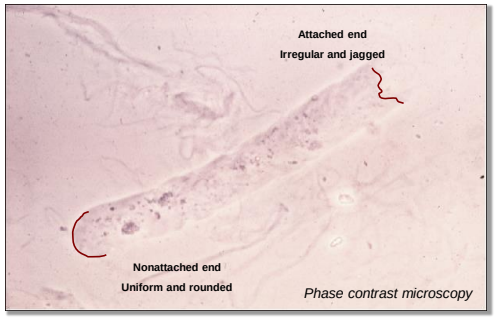
Microscopic examination—hyaline casts



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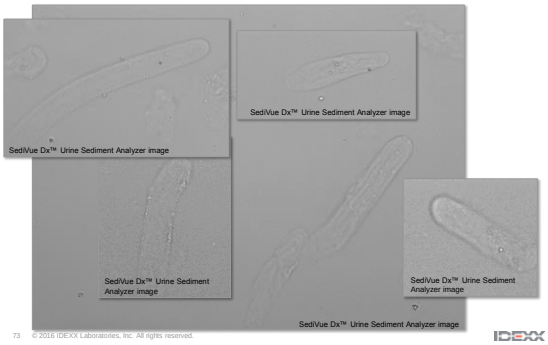
Microscopic examination—hyaline casts



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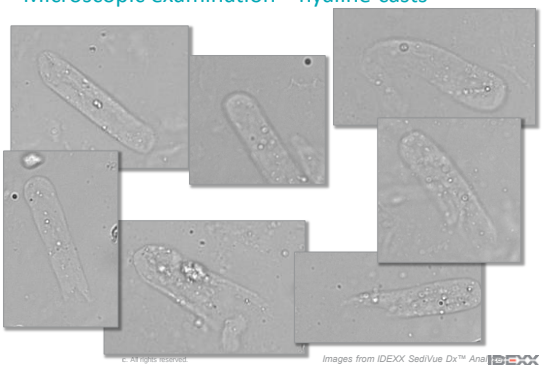
Microscopic examination—hyaline casts



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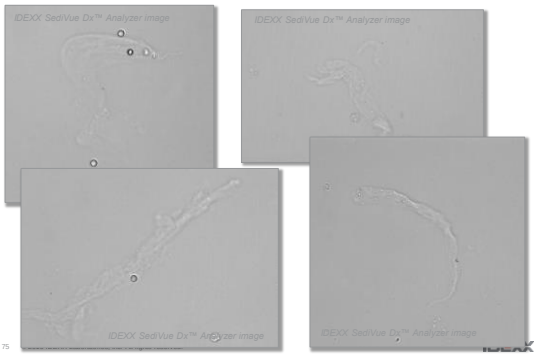
Microscopic examination—mucous thread



Microscopic examination—hyaline casts

- Common causes for hyaline casts:
  - Occasional hyaline cast is normal in dog and cat urine.
  - Simple dehydration may result in increased numbers of hyaline casts:
    - Especially with acid urine
  - High numbers may support significant protein-losing nephropathy.

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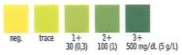
Microscopic examination—hyaline casts

- Next steps
  - Review history, clinical signs, and physical examination findings.
  - Review clinical chemistry profile
    - Renal panel
    - Be sure to include SDMA
  - Evaluate urine chemistries:
    - Proteinuria
  - Detailed evaluation for other formed elements:
    - Nonhyaline casts, blood cells, infectious agents
  - Repeat urinalysis—document persistent proteinuria.
  - Follow-up urine protein to creatinine ratio (UPC) if:
    - Persistent proteinuria
    - Inactive urine sediment



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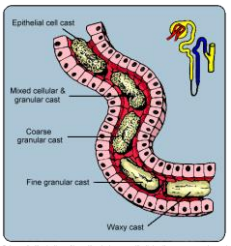
Microscopic examination—nonhyaline pathologic casts

- Cellular casts—rare finding:
  - Renal tubular, red blood cell (RBC), and white blood cell (WBC) casts
- Granular casts—common finding:
  - Indicate renal tubular injury
  - Coarse to fine
- Waxy casts:
  - Well-defined—refractive index
  - Final stage of cast progression



Schematic illustration of transition between epithelial cell, coarse granular and waxy casts formed in the loops of Henle, distal tubules, and collecting ducts (blue area of nephron in upper right-hand corner).*

* Source: Osborne CA, Stevens JB. *Urinalysis: A Clinical Guide to Compassionate Patient Care*. Shawnee Mission, KS: Bayer Corporation; 1999.

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Microscopic examination—nonhyaline cast (epithelial cell and waxy/epithelial cell)

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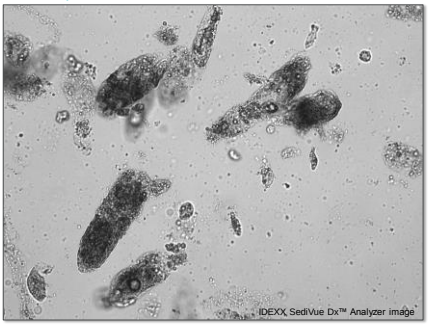
Microscopic examination— Nonhyaline cast (granular)



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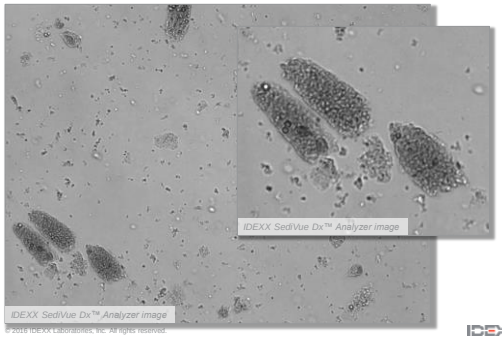
Microscopic examination— Nonhyaline cast (granular)



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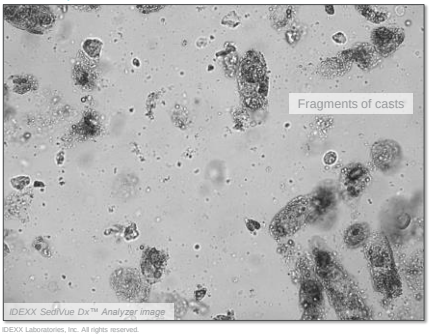
Microscopic examination— Nonhyaline cast (granular)



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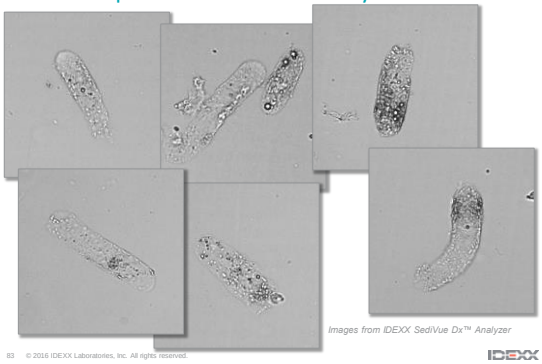
Microscopic examination— Nonhyaline cast



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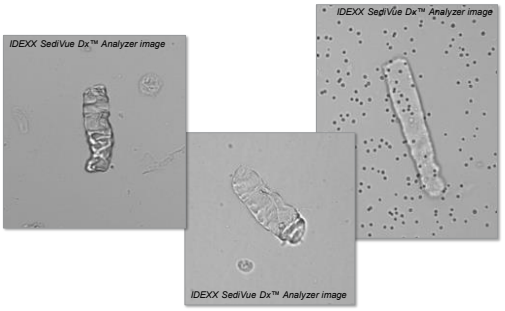
Microscopic examination— Nonhyaline cast (waxy)



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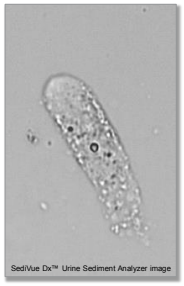
Microscopic examination—nonhyaline casts

- Common causes for nonhyaline casts
  - Occasional nonhyaline cast is normal in dog and cat urine.
  - High numbers may support significant renal tubular injury:
    - Primary—infectious and noninfectious
    - Secondary—prolonged dehydration/ decreased perfusion
  - Different types represent progression of the same thing:
    - Different times retained within the tubule



SediVue Dx™ Urine Sediment Analyzer image

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Microscopic examination—nonhyaline casts

- Next steps
  - Review history, clinical signs, and physical examination findings.
  - Evaluate complete urinalysis results:
    - Urine specific gravity—appropriate?
    - Urine chemistries—protein, glucose
    - Urine microscopy—blood cells, infectious agents
  - Evaluate other components of minimum database:
    - CBC—inflammatory disease?
    - Clinical chemistry profile—other support for renal disease?
      - Be sure to include SDMA
  - Repeat urinalysis—follow progression or regression of disease.

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Microscopic examination—crystals

- Crystal type formation dependent upon:
  - pH
  - Temperature
  - Urine specific gravity
  - Solute concentration
  - Diet
- Presence of crystals does not necessarily mean that the patient has uroliths or a predisposition for urolith formation
  - Ammonium biurate
  - Bilirubin
  - Calcium oxalate monohydrate
  - Calcium oxalate dihydrate
  - Cystine
  - Sulfa metabolites
  - Uric acid
  - Cholesterol
  - Struvite
  - Amorphous debris
  - Calcium carbonate

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IMPACT OF URINE FORMED ELEMENT SETTLING AND SAMPLE ASPIRATION LOCATION ON MICROSCOPIC URINALYSIS

J. Hammond, C. Ericson, C. Myrick, B Clock and D.B. DeNicola.

IDEXX Laboratories Inc., Westbrook, ME, USA.

- Objective - To assess the effect of sample settling and within specimen tube sample aspiration location on the numerical recovery of formed elements.
- Methods
  - Theoretical model developed to predict settling rates for different urine formed elements based on physics principles
  - Counts of formed elements determined with SediVue runs
  - Operating conditions - mixing duration, aspiration time, and location of aspiration within the specimen tube
- Results
  - Sampled from top, middle and bottom of specimen tube
  - Sample timing – immediate and 15 seconds after mixing

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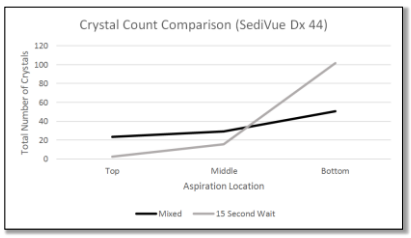

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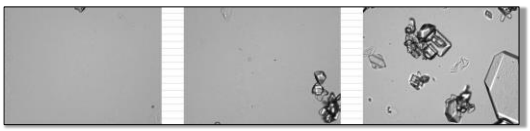

15 sec - Top | 15 sec - Middle | 15 sec - Bottom

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Microscopic examination—crystals and pH

Crystal	Acidic	Neutral	Alkaline
Struvite	±	+	+
Calcium oxalate dihydrate	+	+	±
Calcium oxalate monohydrate	+	+	±
Ammonium urate (biurate)	+	+	±
Bilirubin	+	-	-
Cystine	+	+	±
Uric acid	+	-	-
Cholesterol	+	+	-
Drug crystals	+	±	-
Amorphous crystalline debris	+	±	-
Calcium carbonate	-	±	+

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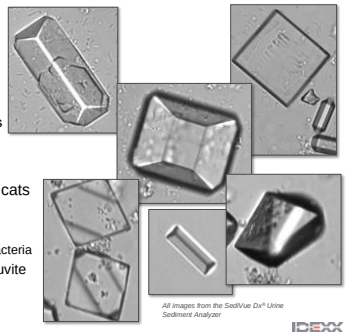
Struvite—magnesium, ammonium, phosphate

- Colorless
- 3- to 6-sided
- "Coffin lid"-like prisms
- Possible aggregates
  - "Fern-like" structures
- Many forms

- Common in dogs and cats
  - Healthy animals
  - Bacterial infection
    - Urease splitting bacteria
  - With and without struvite urolithiasis



All images from the SediVue Dx® Urine Sediment Analyzer

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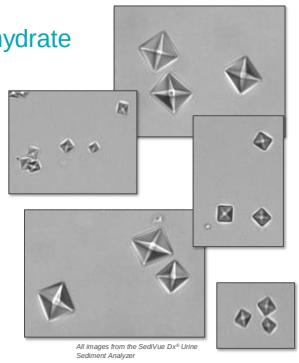
Calcium oxalate dihydrate

- Colorless
- Octahedral
- Double pyramid
- "Envelope" appearance
- Variable sizes—potentially tiny

- Common in dogs and cats
  - Healthy animals
  - May be seen associated with oxalate urolithiasis
  - Less common than monohydrate form with ethylene glycol toxicosis



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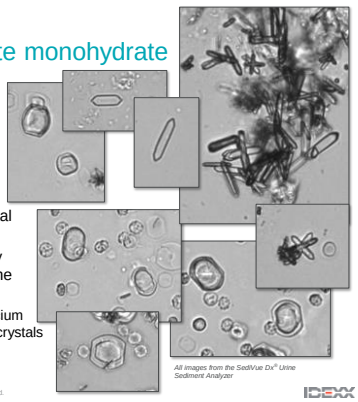
Calcium oxalate monohydrate

- Colorless
- "Picket fence"
- Oval ("hemp seed")
- Dumbbell

- Rarely seen in normal dogs and cats
- High numbers highly supportive of ethylene glycol toxicosis
  - May have few calcium oxalate dihydrate crystals also



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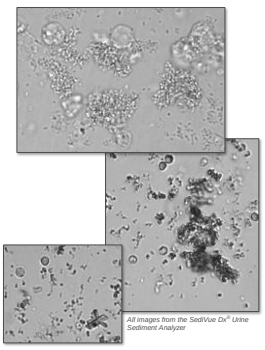
Amorphous crystals

- Colorless to yellow-brown
- Variable composition
  - Urates, phosphates, xanthine
- Aggregates of fine granular material
- Important to differentiate from coccal bacterial forms
- Dry-slide preparation ("line smear") and stain like cytology or blood film



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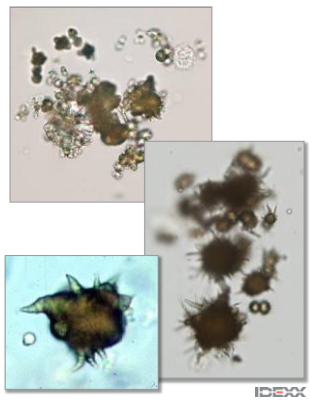
Ammonium biurate

- Brown to yellow brown
- Spherules with or without irregular projections
  - "Thorn apple"
- May be uncommonly seen in normal dog and cat urine samples
- Commonly associated with portal vascular shunts
  - Congenital or acquired
- Potentially seen in normal Dalmatians and bulldogs



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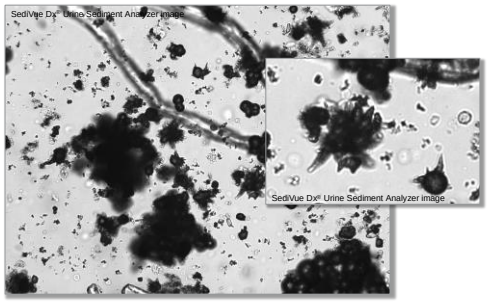
Ammonium biurate



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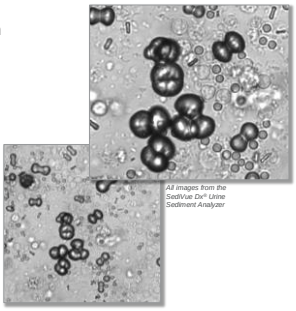
Calcium carbonate

- Colorless to yellow-brown
- Spherules with radial striations
- Variable sizes
- Common in normal:
  - Horses
  - Guinea pigs
  - Rabbits
  - Goats
- Not seen in dog and cat urines



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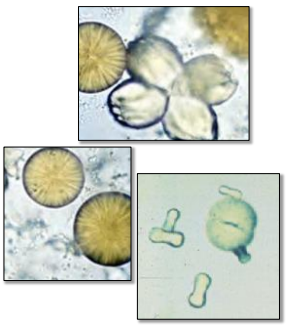

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Bilirubin

- Yellow to golden brown
- Needle-like to granular in shape
- Formed from water soluble conjugated bilirubin
- May be normal finding in the dog, especially with concentrated urine
  - Small amounts of bilirubin normal in the dog
- Any bilirubin positive test or bilirubin crystals in the cat is abnormal

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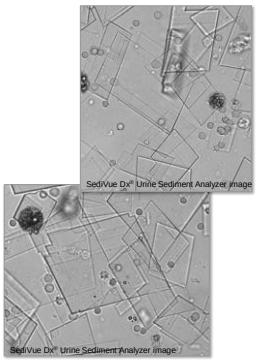
Cholesterol

- Colorless
- Large, flat plates
  - Rectangular
  - Notches at corner(s)
- Uncommon but have been noted in normal canine urine
- In humans, associated with tissue destruction and nephrotic syndrome
  - Interpretation in veterinary medicine unclear



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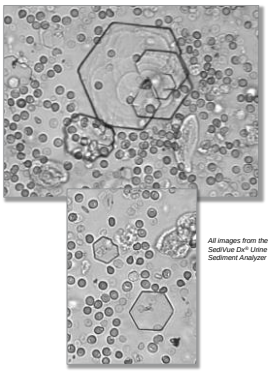
Cystine

- Colorless
- Large hexagonal plates
  - Equal or unequal sides
- Commonly seen in aggregates of layers of crystals
- Can be seen in association with cystine urolithiasis
- Result of metabolic defect of tubular reabsorption
- Sex-linked inheritance
- Many breeds of dog
  - Newfoundland, dachshund, mastiff, basset hound, bulldog



All images from the SediVue Dx® Urine Sediment Analyzer

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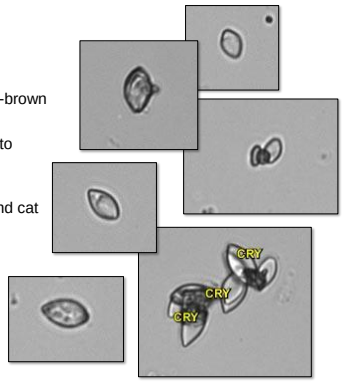
Uric acid

- Pale yellow to yellow-brown
- Variably shaped
- Commonly diamond to rhomboid shaped
- Aggregates possible
- Uncommon in dog and cat
  - Dalmatian
  - Bulldog
  - Russian terrier



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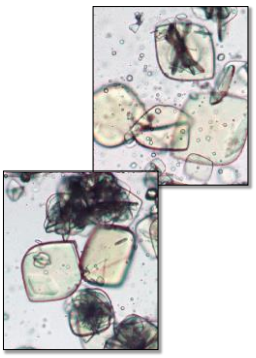

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Microscopic examination—miscellaneous gems

Many other formed elements can be seen sometimes; it is important to identify these so there is no missed interpretation:

- Spermatozoa
- Fibers, threads, mucus
- Fungal spores, fungal hyphae, and yeasts
- Fat (lipid) droplets
- Microfilaria
- Ova: *Capillaria plica*, *Dioctophyma renale*
- Glove powder

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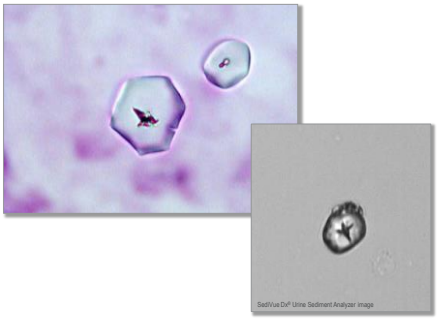
Microscopic examination—glove powder



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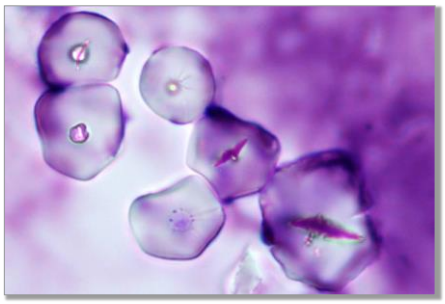
Microscopic examination—glove powder



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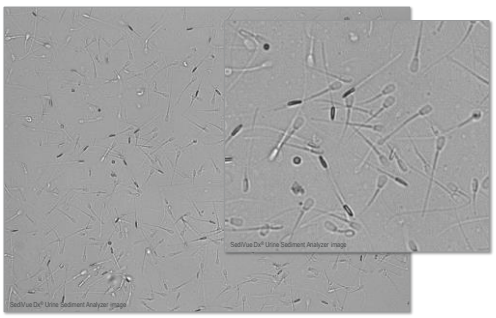
Microscopic examination—spermatozoa



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Microscopic examination—fibers

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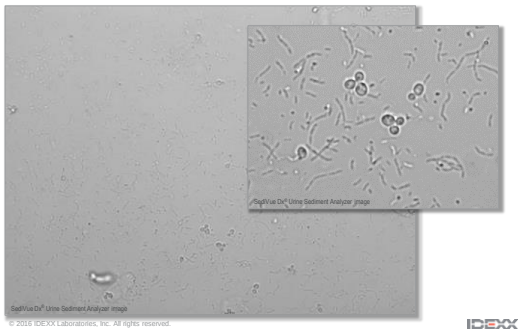
Microscopic examination—yeasts



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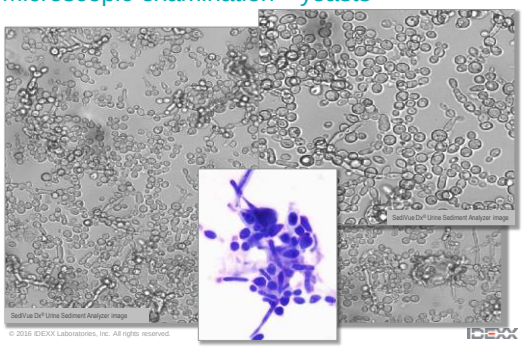
Microscopic examination—yeasts



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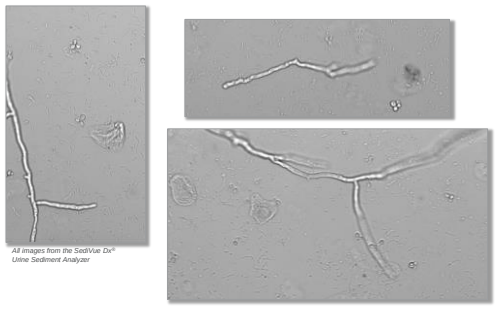
Microscopic examination—fungal hyphae



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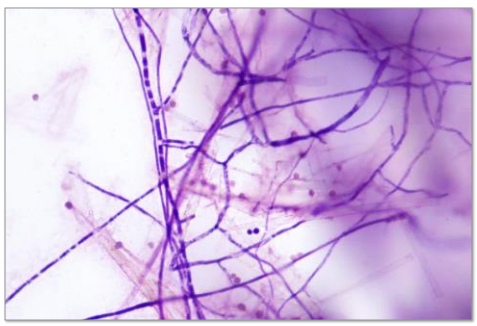
Microscopic examination—fungal hyphae



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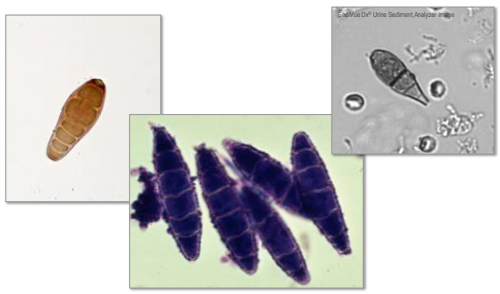
Microscopic examination—fungal spores



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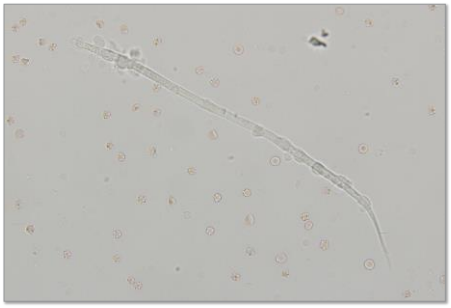
Microscopic examination—microfilaria



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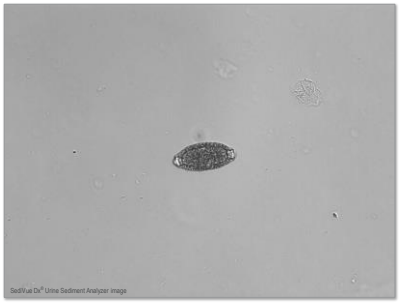
Microscopic examination—parasites



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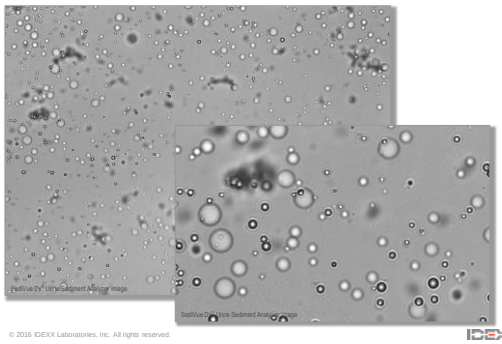
Microscopic examination—lipid droplets



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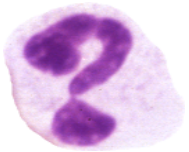
Questions?



Providing Patient Comfort

Kim Adams, RVT
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SAGE Symposium 2017

It is our duty as veterinary professionals to preserve the integrity of these 5 basic rights to life, even in a hospital setting:

The Five Freedoms (Animal Welfare Act)

1. Freedom from Hunger and Thirst - by ready access to fresh water and a diet to maintain full health and vigor.

2. Freedom from Discomfort - by providing an appropriate environment including shelter and a comfortable resting area.

3. Freedom from Pain, Injury or Disease - by prevention or rapid diagnosis and treatment.

4. Freedom to Express Normal Behavior - by providing sufficient space, proper facilities and company of the animal's own kind.

5. Freedom from Fear and Distress - by ensuring conditions and treatment which avoid mental suffering

Drugs and Equipment

- Opiate CRIs, oral medication, epidurals, topical pain patches, or neuroleptanalgesia (ie: an opiate and a neuroleptic like Acepromazine)

- Butorphanol is not adequate pain control. It has moderate sedative effects capable of providing *mild* analgesia, can be used as a cough suppressant, and is relatively safe in patients that need short term sedation without long term pain control (fractious cat that needs an xray, IV catheter placement, blood draw, etc). The sedation often outlasts the analgesia, and is not an appropriate choice for preoperative or postoperative pain control.

- Providing for a comfortable, well-padded surface.
    - Use towels, bedding, yoga mats, pet beds, etc. to provide a comfortable place for the patient to remain while hospitalized. This is especially important with patients who have arthritis or other chronic conditions that are known to cause pain or discomfort.
        - The exception to this is patients who are febrile. In cases of elevated temperature, bedding should be removed in an effort

to prevent any heat insulation of the patient. Temperature should be rechecked at least once per hour until the temperature has returned to normal. This should be in addition to any other required therapies (IV fluids, medications, active cooling including ice baths, ice packs, fans, etc).

- Use materials that will absorb moisture and liquid in an effort to avoid the patient having contact with a wet surface for prolonged periods of time.

- Medicating with Trazodone or benzodiazepines in an effort to reduce a stressful response to stimuli

    - Allowing a patient to scream and struggle whether through dysphoria or otherwise puts the wellbeing of all other patients in the vicinity in jeopardy. Engendering a small amount of sedation is preferred to engendering fear or extreme anxiety.
    - Trazodone is fairly new to veterinary medicine. It is an anti-anxiety medication, not a sedative; although it can have sedating effects. It is generally well tolerated over a wide dose range. It is of the drug class SARI (serotonin antagonists and reuptake inhibitor) and works by increasing serotonin levels in the brain. It can provide and enhance behavioral calming when given either daily or as needed. This is in contrast to something like Fluoxetine (Prozac) that has to be given over time and build up in the system to a therapeutic dose level to be effective. It has been used in cats, but significantly less information is available for dose ranges and safety. This medication is only FDA approved for human use as of 2016, but is prescribed legally by veterinarians for extra-label use.
        - Potential adverse effects of Trazodone can include sedation, lethargy, ataxia, priapism, cardiac conductive disturbances (mainly prolonged QT), increased anxiety, and aggression

- Intra-caths (central lines or sampling catheters) for patients that will need repeated blood draws to minimize excessive restraint, bruising, and vessel scarring/other compromise.

    - Multiple blood draws and/or injections can cause phlebitis, increases the risk of nosocomial infection, and can be self-defeating should you need to set or replace an IV catheter and have compromised all otherwise viable vessels with repeated needle insertions.
    - Advanced catheter technique CE is widely available at most veterinary conferences if support staff is uncomfortable with intra-cath placement.

- Provide an appropriate enclosure size

- Patients need to be able to stand up at their full height, turn around, and lay down without stepping in a food or water bowl, and should be able to get out of their excrement should they urinate or defecate in their enclosure.
- For giant breed dogs, consider getting an X Pen (affordable, hexagon-shaped portable enclosure that folds virtually flat when not in use).
- Just because there are large cages available doesn't mean you have to use them for small patients. In dogs, the more space they are allowed when they are in a stressful setting, the more anxious they become- it's why Thundershirts work.

Environment and Human Behavior

- Provide a calm, quiet environment for patients
  - Remember "inside voices"
- Coordinate treatments to minimize disturbance.
  - Align treatments in a manner as to coordinate the times they are given, ie: TPR, walk, IV catheter patency check, oral medications, and diagnostics all due at the same time to allow the patient to remain unmolested for several hours.
- Owner visitation can have its benefits, but if it is deemed inappropriate, let the owners know why it's compromising their pet's care.
- Ultimately, if the patient is terrified, leave it alone. Pressuring patients to have a more friendly rapport when they are stressed and fearful can be counterproductive and can worsen anxiety driven behavior.
- Take care not to over-restrain. Sometimes less is more.
- Be aware of your environment- bringing a dog-aggressive patient around other dogs, barking dogs near a frightened cat, placing a cat on a wet table near running water, placing pets on the grate of a wet table without a stable surface to stand on, talking loudly or bringing patients around loud noises or areas of high activity can compound patient anxiety.
- Avoid stimulating patients that have been sedated or are being induced for anesthesia- this could reverse the sedation or cause the patient to fight the anesthetic agent, which increases the requirement of medication given for the desired effect.

Take-Home Message:

"We can't always know that our patient does hurt, but we can do our best to ensure that it doesn't hurt." -Dr. Duncan Lascelles, BSc, BVSC, PhD, MRCVS, CertVA, DSAS(ST), Diplomate ECVS, Diplomate ACVS, Chair of Global Pain Council at WSAVA (World Small Animal Veterinary Association)

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Dermatology Tools: The Microscope is Your Friend!

Stacey N. Holz, DVM

Dermatology

SAGE Centers Concord and Dublin

Dermatology Diagnostics

Virtually all patients presenting with dermatological problems such as pruritus, skin lesions, and/or ear issues should have a dermatology minimum data base with a good history, dermatological exam, as well as cytology and usually skin scrapings. The following outlines the tools and methods needed for this data base.

History taking tips for technicians

The key to a good history is knowing the right questions to ask. For example: If asking a pet owner about flea control for their dog, do not simply ask “Do you use flea control?” and end with a yes or no answer. Instead ask more detailed and more insightful questions such as “What flea control product do you use ? When did you last use this for your pet? How often do you usually use this? Do the other pets in the household receive flea control?” Using a more detailed and insightful approach will help reveal key information to aid the patient.

The Microscope

The Microscope is the most important piece of diagnostic equipment we use in dermatology. Using the microscope regularly will help you raise your level of medicine to a higher standard. Become well acquainted with your microscope. Make sure it is clean, in working order, and has a dust cover on it when not in use (a plastic bag or pillow case will do in a pinch).

To look at skin and ear cytologies:

- Turn the light up - “brighter is better”- (this is usually on the right hand side)
- Open the aperture (this is below the stage)
- Look at by focusing on lower powers and then on 100x with immersion oil
- Do not drag the 40 through the oil
- Always clean the oil off of the objective after use with lens paper and lens cleaner

To look at skin scrapings:

- Turn the light down (this is usually on the right hand side of the scope)
- Close the aperture (this is below the stage)
- Look at on 10x (possibly 4x if you have “special eyes”). Always use a cover slip on the slide over the messy mineral oil. This not only gives you a “frame of reference” but is cleaner.

Stains

A clean set of glass staining jars (3 jars) and 3 stains including the #1 fixative, #2 red, and #3 purple Dif Quik are essential. Most stains needs to be changed weekly in a busy practice and the jars cleaned. These steps improve staining and the sample that you ultimately look at.

Diagnostic Methods

Cytology is used most commonly to look for bacteria, Malassezia, or study the inflammatory cell components of affected skin.

- Skin Cytology using Sticky Tape - clear sticky tape is used to press the skin and thus obtain a cytology sample of the superficial skin. Simply press the tape sticky side on to the area you wish to obtain a sample from. This can work quite well in “hard to reach places” such as nail beds, around eyes, in between the toes of a biting Chihuahua! This is then stained in the #2 (red) and #3 (purple) stain of the Dif Quik stains and placed on a microscope slide sticky side down on the slide. This does not need to be fixed in step #1 as the stickiness has already fixed the sample and placing in step #1 will make tape cloudy.
- Skin Cytology via Impression with Slide - a glass microscope slide is used to obtain a cytology sample by holding the slide edges between you thumb and middle finger with your index finger on the back of the slide behind the area you wish to obtain a sample from (you can wear gloves of course) and applying the same amount of pressure you would to obtain a “finger print”. This works very well for obtaining a clear direct impression of skin lesions. The sample/slide can be lightly heat fixed using a lighter. Some clinicians do not heat fix at all. The slide is stained in the 3 step Diff Quik stains for an adequate amount of time in each step (at least 30 seconds to 1 minute).
- Ear Cytology - gently obtain a swab sample from the external ear canal and roll (or write/roll “L” and “R” or a box onto the microscope slide.

Skin scrapings and Trichograms Deep skin scrapings are often used to look for the hair follicle mites Demodex and Superficial skin scrapings are often used to look for non hair follicle mites such as Sarcoptes, etc. Try to free the area of hair as much as possible, i.e. ask the owners to clip the area if performing a deep skin scraping. For the superficial skin scrapings removing the hair is often not warranted.

- Deep "Skin Scraping" Tape method: the area of affected skin is “squeezed” with the index finger and thumb of one hand and then the tape is pressed onto the area with the other hand. The piece of tape/sample is then placed on a microscope slide that has mineral oil on it. Now it has a “cover slip” and you can look at this on lower power (i.e usually 10x). Some previous studies have shown this to procure as many and sometimes more demodex mites than the scalpel method.
- Deep Skin Scraping Scalpel method: a new 10 blade is used (the blade can easily be “dulled” by scraping in on the inside of the blade wrapper it came in with the wrapper on the table away from your other hand or by scraping on a piece of sand paper briefly). Squeeze the skin with your non-dominant hand, apply some mineral oil, and with the other hand use the new but dull blade to gently scrape the skin in a sweeping motion to collect the sample as

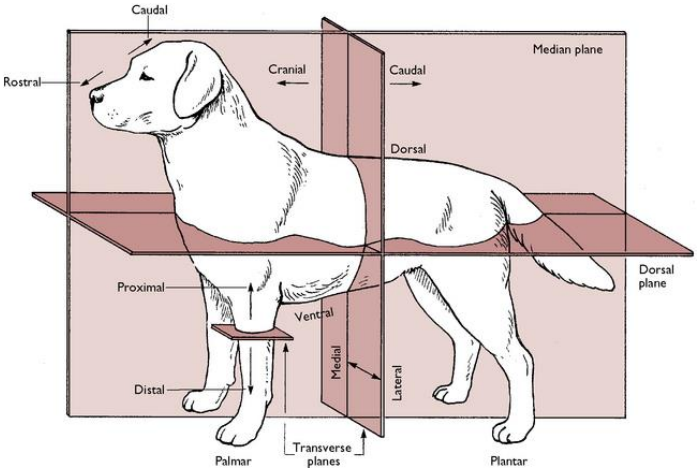
you scrape. Be careful not to scrape too hard or go in the wrong direction. Place the sample on a slide with mineral oil and place a cover slip over the sample to examine on lower power (usually 10x).

- Deep Skin Scraping Spatula method: A medical stainless steel spatula is used with mineral oil to scrape the affected skin and collect sample. This is often used for smaller animals such as rabbits, guinea pigs, and other pocket pets or pets with thinner skin. Don't forget to squeeze the skin.
- Superficial scrapings to look for superficial mites such as Sarcoptes or Cheyletiella can be performed a variety of ways. Spatula or scalpel blade: can be used and scrape gently and very superficially almost like combing. You can also use the clear tape to collect superficial samples or a flea comb to collect fine scale or dander. These samples are looked at on lower power (i.e. usually 10x)
- Trichograms can be used to look for demodex mites, observe hair stage such as Telogen (spear) versus Anagen (club), or examine hair for abnormalities such as Melanin clumping. The hair is plucked using a mosquito forceps and placed in the mineral oil that has been placed on a microscope slide and looked at on lower power (10x).

Radiographic Positioning Techniques
A Look from Cranial to Caudal

Celline Whitley, RVT
Surgery Clinical Lead: SAGE Concord

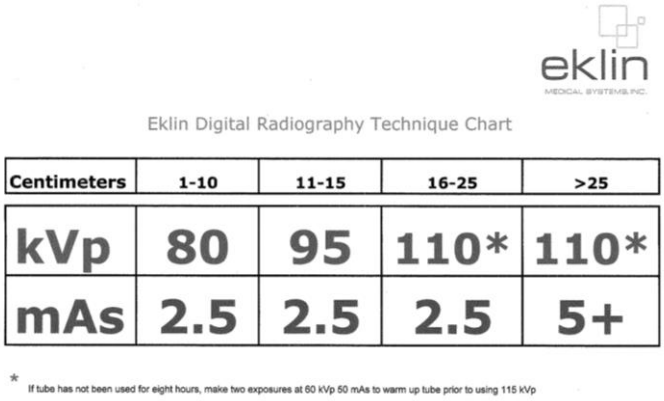
- Overview
  - Advances in technology and veterinary medicine have contributed to the ease at which veterinary technicians can safely perform radiographic studies on small animal patients within a hospital setting.
  - Understanding the components of radiology equipment and how a high quality diagnostic image is produced will allow veterinary technicians to feel more confident when planning a study.
  - Knowledge of radiology safety and necessary safety equipment is essential for every veterinary practice.
  - Formulate a plan of action that is unique to your patient's needs based on available resources and aids.
  - Understand the difference between chemical and mechanical restraint and how one or both can support staff to limit their exposure to radiation.
  - Execute proper positioning of the anatomic region of interest specific to the type of radiographic image desired.
  - Review image before submitting to the doctor to properly orient, crop, and label image.
  - Identify the key landmarks the doctor intends to study and ensure proper parameters are met.
  - Work as a team with fellow staff members to safely and efficiently produce high quality radiographs.
- General terminology



  - Radiographic descriptions describe the direction the x-ray beam passes through your patient and your patient's position on the x-ray table.
  - Examples include: lateral (LAT), recumbency (R) (L) (sternal) (dorsal), ventrodorsal (VD), dorsoventral (DV), anterior-posterior (AP), posterior-anterior (PA), craniocaudal (CrCd), caudocranial (CdCr), mediolateral and oblique.
- Equipment: Digital machine and software
  - Important components of a digital x-ray system include x-ray tube, collimator, generator, table, controls, cassette holder and activating switches
  - Digital radiographs are executed using a capturing software linked to the x-ray table and images are reviewed/manipulated using a viewing software
- Equipment: Safety
  - Safe operating procedures for a veterinary hospital should include a good technique chart, positioning aids, protective lead apparel and personnel monitoring dosimetry devices.
  - Proper personnel protective equipment is required to be worn by any staff members that will be within 6 feet of the x-ray beam.
  - All staff members who will be exposed to radiation are required to wear a dosimeter badge or some form of personnel monitoring equipment to measure the level of ionizing radiation exposure.

- Examples of safety equipment include; lead gowns/gloves/thyroid shield (0.5mm lead equivalent), radiology goggles, dosimeter badges, and restraint tools.

- Equipment: Positioning aids
  - Positioning aids assist staff by supporting the patient in the proper position to alleviate personnel strain while capturing an image.
  - Examples of positioning and restraint aids include; sandbags, foam v-trays, foam eggcrates, bandage tape, foam wedges, angle irons, lead gloves, non-skid liner, spoon/spatula, and R/L position markers.
- Planning your study: kVp vs mAs
  - When planning a radiology study, it is important to set the digital machine to the proper kVp and mAs settings to achieve the highest quality image
  - kVp: Kilovolt Peak
    - Controls the QUALITY of the x-ray beam produced
    - Controls the CONTRAST or GRAY SCALE and penetrating ability
  - mAs: Milliamp Seconds
    - Controls the QUANTITY or AMOUNT of x-ray photons produced
    - Controls BLACKENING or DENSITY of x-ray film
  - Measure the thickness of the anatomic region of interest then compare to technique chart specific to digital machine in use.

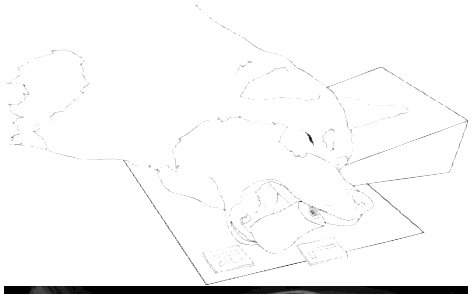


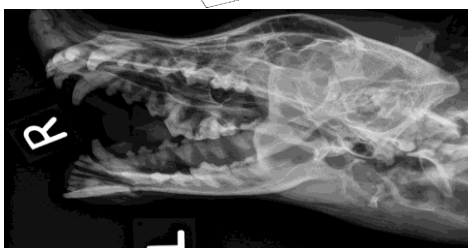
- Planning your study: Radiation safety
  - Essential goal of radiation safety is to prevent injury from exposure to ionizing radiation.
  - Minimize personnel in the radiology room during imaging and rotate personnel if possible to decrease occupational radiation exposure
  - Pregnant women should avoid radiology
  - Annual occupational exposure requirements: Maximum Permissible Dose (MPD) are monitored by personnel monitoring devices (dosimeter badge)

Human Body Region	**REM (roentgen equivalent man)**
Whole Body (total effective dose)	5 rems
Skin and extremities (shallow dose)	50 rems
Lens of eye (ocular dose)	15 rems

- Planning your study: Limiting staff exposure
  - **ALARA** concept simply means that radiation exposure in the workplace should be **A**s **L**ow **A**s **R**easonably **A**chievable.
  - To practice the ALARA concept, staff should utilize a technique chart, become proficient in patient positioning, wear appropriate lead apparel, use chemical restraint when possible, and consistently use positioning aids.

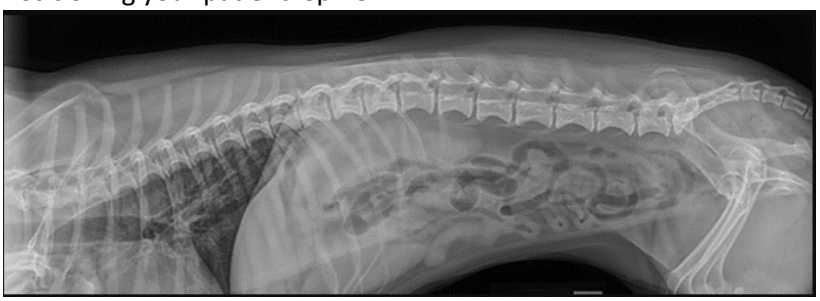
- Planning your study: Restraint
    - Chemical restraint is the use of tranquilizing drugs and/or narcotics to immobilize your patient
        - Strive for lowest possible dose to achieve desired sedation level
        - Safer in general for staff and patient
        - Allows staff to exit room to avoid exposure when combined with mechanical restraint aids
        - ALWAYS monitor patient vitals under sedation and maintain safe restraint techniques
    - Neuroleptanalgesia: sedation achieved by combining a tranquilizer and a narcotic.
        - ie: Dexdomitor/Torbugesic. *Dexdomitor reversible with Antisedan
- Planning your study: Restraint
    - Mechanical restraint is the use of positioning aid devices or physical restraint techniques to achieve accurate positioning of anatomic region of interest
        - Allows for minor adjustments to be made if retakes are necessary
        - Provides comfort to patient while in unique positions
        - Safely restrains patient to avoid injury to patient or staff
- Planning your study: Things to consider
    - Have a plan of action in place before placing patient on radiology table
    - Work from head to tail
    - Case study considerations
        - Patient species
        - Type of case study
        - Size of patient
        - Temperament of patient
        - Available staff
        - Doctor preferences
        - Safety equipment needed
        - Available restraint tools: chemical vs mechanical
- Positioning your patient: Skull



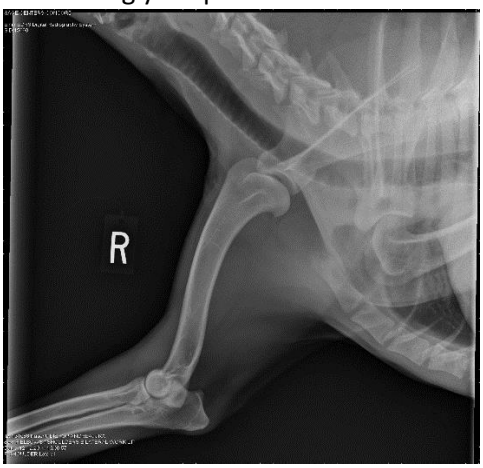


    - Routine views of cranium are lateral and VD or DV
    - Sedation or general anesthesia usually required
    - Unique skull radiographs:
        - Frontoccipital VD
        - Open mouth lateral/VD
        - Frontal sinus VD
        - Open mouth oblique
        - Dental Radiographs

- Positioning your patient: Spine

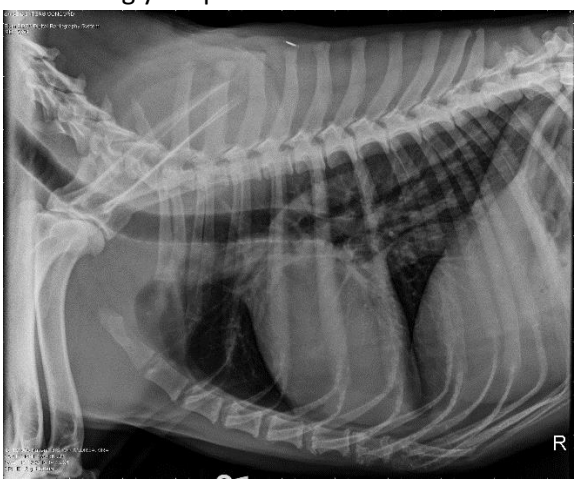


  - Spinal column is divided into sections working from head to tail
    - Cervical
    - Thoracic
    - Lumbar
    - Sacrum
    - Caudal (tail)
    - Thoracolumbar /Lumbosacral (TL and LS spine combines two regions)
  - Key to spinal radiographs is to keep the spinal column as straight as possible
    - Spine should be parallel to the x-ray table
    - Support patient's body with foam wedges and V-tray help keep spine straight and padded
- Positioning your patient: Forelimb

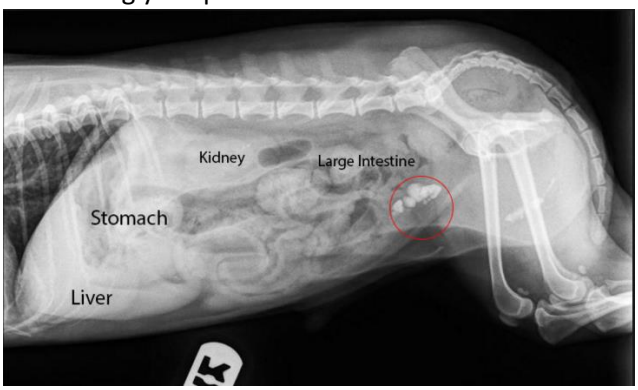


  - Forelimb radiographs are described based on bone or joint of interest
    - Scapula
    - Shoulder
    - Humerus
    - Elbow
    - Radius and Ulna
    - Carpus
    - Metacarpus and digits
  - Isolate the limb away from the rest of the body to highlight the region of interest
    - Can be achieved with manual restraint or positioning aids
    - When imaging a fracture, include the joint above and below the fracture to more easily visualize its exact location
  - Proper angles of the limb should be met depending on the type of forelimb radiograph
    - Natural stance
    - Lateral 90 degrees versus straight AP views
    - Flexion, extension, oblique and stress views

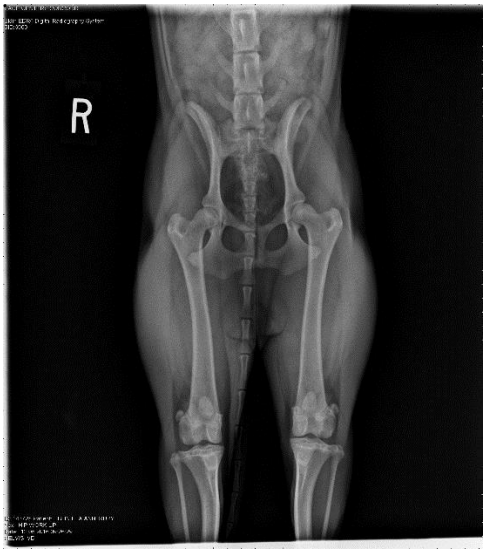
- Positioning your patient: Thorax



    - Routine views for thorax are lateral, VD or DV
        - DV is often better for evaluating the heart
        - VD is often better for evaluating the lungs and looking for metastatic nodules (3 view met check)
    - Inhalation peak to see full lung expansion based on doctor preference
    - Higher kVp and low mAs technique is used to attain proper scale of contrast to visualize structures in the thorax
- Positioning your patient: Abdomen

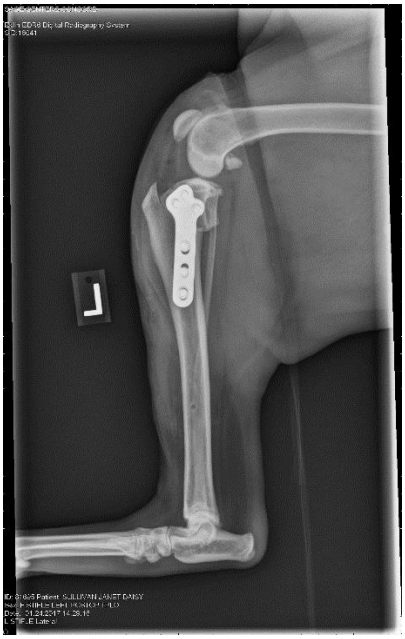


    - Routine views for the abdomen are lateral and VD
        - Pull forelimbs cranially and hind limbs caudally to allow for expansion of the abdomen to identify organs and structures
    - Contrast or barium studies are used to highlight and visualize abnormalities within abdomen.
- Positioning your patient: Pelvis



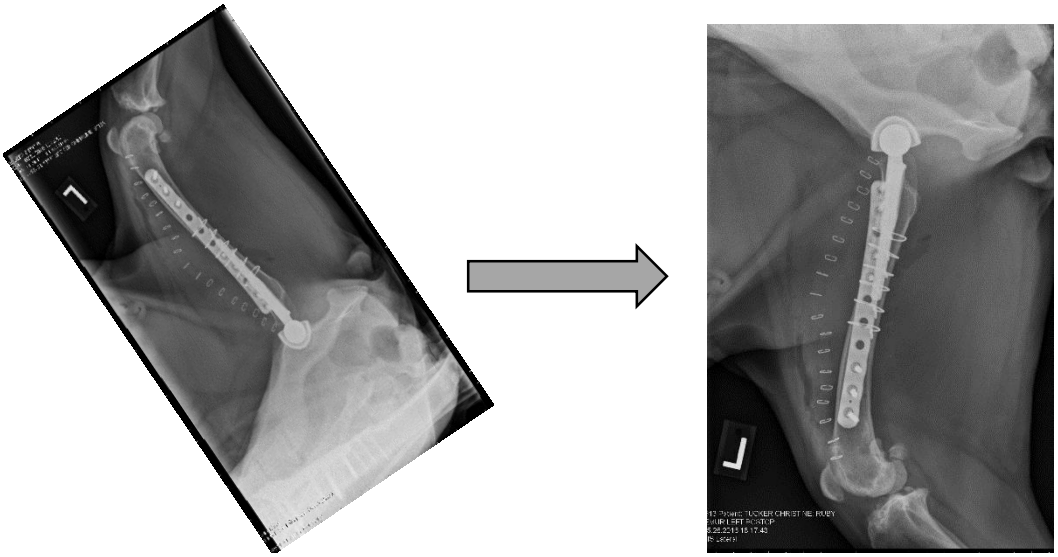
- Routine views for the pelvis are lateral and extended leg VD
    - Right lateral: pull right pelvic limb down and cranially while pulling left pelvic limb caudally. Support left pelvic limb with foam to keep pelvis in a natural position
    - VD pelvis: usually requires manual restraint under sedation to achieve proper positioning. Limbs are pulled caudally and slightly rotated inward to visualize patellas and create a straight line
- Other pelvis radiograph views
    - Frog-leg VD
    - Fire hydrant lateral
    - OFA imaging
    - DAR view
    - THR pre and post radiographs

- Positioning your patient: Hind Limb

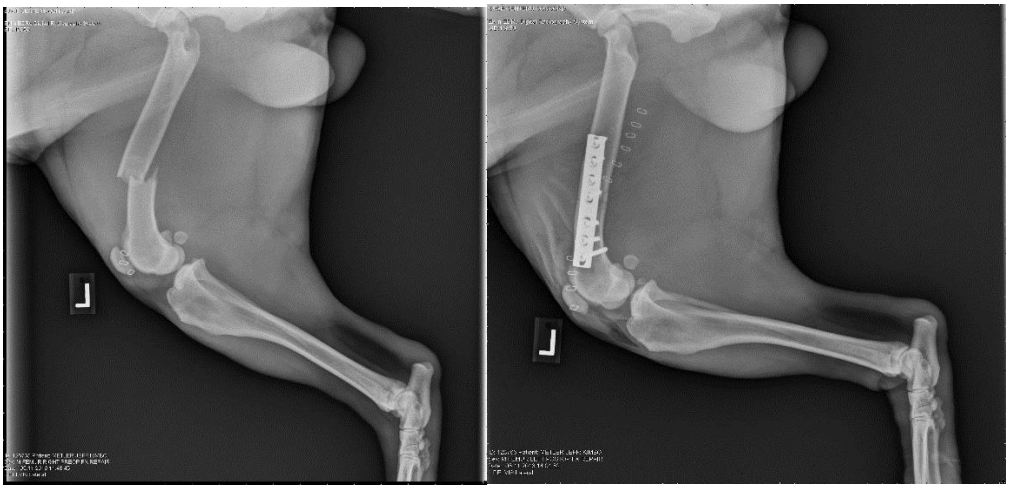


- Hindlimb radiographs are described based on bone or joint of interest
    - Femur
    - Stifle
    - Tibia and Fibula
    - Tarsus
    - Metatarsus and digits
- Isolate the limb away from the rest of the body to highlight the region of interest
    - Can be achieved with manual restraint or positioning aids
    - When imaging a fracture, include the joint above and below the fracture to more easily identify its exact location
- Proper angles of the limb should be met depending on the type of forelimb radiograph
    - Natural stance
    - Lateral 90 degrees versus straight PA views
    - Flexion, extension, oblique and stress views
- Radiographs for orthopedic procedures
    - TPLO
    - MPL
    - Fractures
    - Hyperextension and tendon injures

- Film Orientation and Labeling
    - Should this radiograph be presented to the doctor like this?



    - Finishing touches can be achieved using capturing software before sending for doctor review
    - Consistency is important between pre and post radiographs as well as follow up recheck radiographs



    - Keep your doctors happy and smiling with attention to detail
    - Work as a team to safely and efficiently execute a radiology case study

- References
    - Ayers, Susie. Small Animal Radiographic Techniques and Positioning. Wiley-Blackwell, 1st edition, 2012.

Track 5

Suit up! Chemotherapy safety for doctors, nurses and patients

Dr. Mike Kiselow and Christine Kremer

Objective: The purpose of this talk is to elucidate SAGE's best practices for chemotherapy safety. Our Campbell location had a complete safety review this past year and many of the ideas presented here today directly reflect those recommendations. Our goal is to keep all staff and patients as safe as possible, while providing the highest standard of care.

Room and Storage:

Chemotherapy should be administered in a dedicated space, separate from other treatments and free of hospital foot traffic. In our Campbell location, we have a chemotherapy-specific room that houses all of the supplies, drugs and personal protective equipment necessary for safe chemotherapy preparation and administration. It is advised that no extraneous materials be kept in the chemotherapy suite - and that personnel access is limited – in effort to minimize particulate contamination. This means that the room should not be used for any other patients or procedures. The room should be clearly marked with appropriate signage to this effect. The door must be kept closed at all times, and no one may enter while chemotherapy is being administered.

In our chemotherapy suite we keep:

- A Class II Type A2 biological safety cabinet (BSC) with vent on 24/7
- Supplies: syringes, needles, IV catheters and butterflies, non-heparinized flush, IV fluids, IV drip sets and extensions, Phaseal attachments, biohazard and sharps bins, clippers, tape, vet wrap, pillers, paper towels, scissors
- Chemotherapy drugs
- Personal Protective Equipment (PPE): gowns, shoe covers, N95 masks (latex and non-latex), chemotherapy rated gloves (latex and non-latex), goggles, face shields
    - Respirators and filter cartridges are kept in separate plastic bags, outside of the chemotherapy suite
- Cleaning and disinfecting agents
- Spill kit
- Drug storage: cabinet, cubex, fridge (drugs ONLY-NO FOOD!)
- Extravasation management agents

Currently we also keep a desk space, computer and phone in the room but it has been recommended that we remove these items as they are easily contaminated and difficult to clean.

Preparation:

Have everything you need out and ready before you begin handling drugs. You should have all of your PPE on, supplies in the hood, and your patient space set up, before the animal enters the room and before you begin drawing up your drugs. EVERY chemotherapy drug is handled in the BSC regardless of the route that it is administered. This practice, along with the use of a Closed System Transfer Device (CSTD; we use Phaseal) greatly decreases the potential for exposure to chemotherapy particles. The importance of this cannot be overstated. As chemotherapy particulates are invisible, a conscious/deliberate effort is required in order to minimize aerosolization and surface contamination.

Here is the order in which you should apply your PPE:

1. Shoe covers
2. Disposable N95 respirators with both straps
3. Safety goggles-extra/special consideration
4. Chemotherapy-rated gown
5. Chemotherapy-rated gloves (double-extra/special consideration)

Removal of PPE happens in the reverse order, with removing the inner gloves as the last step before exiting the suite.

Special considerations include:

- Mustargen: Half or full face respirators with goggles for half face, and carbon filter cartridges. Always double glove and double gown.
- Bisphosphonates: goggles, gown, gloves
- Asparaginase: gloves only
- Orals: wear full PPE and prepare in hood to avoid dust exposure

Closed System Transfer Device:

Phaseal: http://www.bd.com/pharmacy/phaseal/, from BD Phaseal website:

The only CSTD with extensive third party evidence proving:

- Prevention of drug exposure
- Reduction of surface contamination
- Elimination of human uptake
- Cutting drug waste to enable savings

At Sage we use the Phaseal CSTD for all drugs except Asparaginase, Cytoxan, Cytarabine and oral drugs. We feel confident that this system greatly decreases the potential for exposure to chemotherapy and therefore provides an extra measure of safety beyond our PPE and BSC practices. The Phaseal system, while not complicated, does require a period of adjustment to become comfortable with handling.

Administration:

Once you are completely dressed in the appropriate PPE and have all of your items in the BSC, you are ready for your patient and restrainer to enter the room. It is imperative that the patient be adequately restrained and remains still, therefore chemical restraint should be used for sedation if necessary. You are now ready to draw up your drug and administer it to the patient. Another important issue to be aware of is the prescribed route of administration for each drug. Many chemotherapy drugs are classified as vesicants or irritants, and therefore exact IV catheter placement and patient stillness are paramount. There should always be a chemotherapy absorbent pad underneath your administration site. We will discuss how to handle chemotherapy extravasations and spills later in this talk.

Cleaning:

Proper cleaning between patients and at the end of the day must be observed. Cleaning in this manner serves to decrease contamination across patients and provides additional protection for staff. Spray the disinfecting agent onto a disposable towel, not onto the surface to be cleaned, to avoid potential aerosolizing of any remaining chemotherapy particles. Clean the BSC using alcohol on a disposable towel. A dilute bleach mop of the floor is recommended daily and in-between patients if indicated, or if the room becomes soiled with urine or feces. At the end of every day, disposable PPE should be discarded into the

appropriate biohazard container, and bins (biohazard and sharps) should be changed as needed. Mustargen containers must be left under the hood for at least 24 hours post administration.

Logs:

Keeping logs, while sometimes tedious, also helps to keep us safe. At Sage we keep chemotherapy logs in each patient's hard file, as well as in the computerized record, and document all administrations to monitor nurse exposure and the amount/frequency of drugs used. Logs help us with continuity of patient care, especially as we sometimes share patients across locations. Event logs help us keep track of extravasations and spills. Additionally, we keep logs of respirator and filter usage to track time use per filter, so that we may change them out as needed. Our carbon filters have prescribed life of 8 hours.

Incidents:

Despite our best practices kept in place to maintain safety for our doctors, nurses, and patients, unforeseen complications can still occur. It is very important to know what to do in the case of an extravasations or spill before it happens so that you can be prepared and can react calmly and effectively. CSTD help to decrease the possibility of spills, but this does not eliminate other accidents such as breakage of glass bottles or human error. Knowing the location of the spill kit AND how to use it, as well as the appropriate protocol for extravasations of individual drugs, will minimize contamination and harm to the patient. When in doubt, ask your DVM! They will be more than happy to walk you through each scenario and detail the best practice.

Here is a link to a decent video showing how to clean up a chemotherapy spill:
https://youtu.be/icdpKu4Ucq4

Example extravasation protocol:
Drug: Vincristine

1. DO NOT REMOVE IVC
2. Discontinue administration
3. Aspirate any residual drug
4. Mark area of extravasation with permanent marker
5. Remove IVC
6. Notify DVM
7. Inject hyaluronidase (150u/mL) within 1 hour of extravasation (ASAP)
    a. Use 25g needle/syringe to inject five, 0.2 mL aliquots around edges of extravasation area to facilitate rapid absorption/minimize reaction
8. If indicated/directed apply hydrocortisone 1% cream every 6 hours for as long as erythema persists
9. Elevate limb
10. Apply warm compress for 15 min, TID-QID for 24 hours
11. Record in medical record, chemotherapy flow sheet and incident log

Definitions:
Extravasation: The leakage of intravenous drugs from the vein into the surrounding tissue. Once extravasation has occurred, damage can continue for months and involve nerves, tendons and joints. If treatment is delayed, surgical debridement, skin grafting, and even amputation may be the consequence.

Vesicant: A drug which, if injected perivascularly, may cause severe and long-lasting tissue injury or necrosis. Necrotic tissue usually develops 7-10 days after extravasation, and the wound can enlarge over the following weeks to months. Debridement, excision/grafting or amputation may be necessary. Examples of drugs classified as vesicants:

- Actinomycin-D
- Dacarbazine (DTIC)
- Doxorubicin (Adriamycin)
- Mechlorethamine (Mustargen)
- Streptozotocin (Zanosar)
- Vinblastine
- Vincristine
- Vinorelbine

Irritant: May produce pain, phlebitis, or local hypersensitivity reactions, even without extravasation. Examples of drugs classified as irritants:

- Mitoxantrone
- Carboplatin
- Cisplatin
- Pamidronate
- Zoledronate

Neutrals: Do not cause tissue irritation. Examples of these drugs:

- Cytoxan
- Cytarabine
- Gemcitabine
- Asparaginase

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References, and for more information:
https://www.cdc.gov/niosh/docs/wp-solutions/2010-150/pdfs/2010-150.pdf
https://www.cdc.gov/niosh/docs/2004-165/pdfs/2004-165.pdf
https://www.cdc.gov/niosh/topics/antineoplastic/
http://rcht.nhs.uk/DocumentsLibrary/RoyalCornwallHospitalsTrust/Clinical/CancerServices/ExtravasationGuideline.pdf

INTRODUCING FEAR FREE VISITS

Heather Prendergast, RVT, CVPM, SPHR; Synergie Consulting; Las Cruces, NM

Animals freeze, flee or flight. When they freeze, we love it! When they flee, we wrestle them down, and when they fight, we manhandle them. With this treatment who would ever want to come back to the veterinary hospital again?

Fear is the worst thing a pet can experience and it causes permanent brain damage.
Fear is in response to something painful or disturbing, and whether it is adaptive, or beneficial, fear can condition the pet to experience more fear in response to those circumstances. Repeat visits to the veterinarian become maladaptive.

Defining the Fear-Free™ Initiative
Consider patients that visit the veterinary practice: they may vomit and have diarrhea during the car ride. They hit the brakes when entering the clinic front door (after all, they are entering the dungeon of terror); and when pets are leaving, they pull the owners wildly and can't get out fast enough.

The veterinary profession has been concentrating on getting pets into the veterinary hospital and focusing on their physical wellbeing; however, their emotional wellbeing has been overlooked. Fear is like a disease that we haven't noticed, and we're ignoring the symptoms; therefore, it has been under diagnosed. If pets' anxiety and fear in going to a veterinary hospital were a disease, it would be the worst pandemic to ever affect the animals under veterinary care. It affects a majority of pets in all practices across America.

Bayer Veterinary Care Usage Study[1]
- 37% of dog owners and 58% of cat owners said their pet hates going to the vet!
- 26% of dog owners and 38% of cat owners said that just thinking about going to the vet was stressful.

The BVCUS, completed in 2011, builds on survey research showing a consistent downward trend in patient visits between 2000 and 2009. While dogs paid more visits to veterinary practices than cats (despite being a smaller portion of the population), both species visited less often each year and in significant numbers. Owners of both dogs and cats reported stress (their stress and their pet's stress) as the key reasons for not bringing them in for care.

What is a Fear Free™ practice?
- It is a place with a waiting room where clients don't wait; they get right into an exam room
- Pet parents have a chance to catch their breath and are encouraged to relax with their pet
- The veterinary technician or veterinarian come in to the exam room and are relaxed and focused on emotional wellbeing first, then physical wellbeing
- The team knows how to handle patients with confidence and skill, accessing anxiety *before* it flares
- Treats are widely available and in heavy use
- The vitals are obtained on the floor or in a chair (or wherever the pet feels most comfortable)
- The examination is completed on the floor or in a chair (or wherever the pet feels most comfortable)
- The exam room doesn't smell like Nolvasan, Clorox or Roccal-D; but rather pheromones
- Calming music plays
- Low stress handling techniques are employed for every patient
- Behavior modification is practiced with every patient, every visit

Triggers of fear
There are a variety of triggers that affect both cats and dogs, (different for each species). The veterinary team must be able to identify some of these triggers and employ strategies to reduce them.

- Outside of the building
    - Smells of other animal's loom in the parking lot, corners of the building, and the entryway
- Reception area
    - Pets and people are in close proximity and approaching from all sides
    - NOISE! Barking dogs on all 4 sides
- Exam room:
    - *The dungeon of all dungeons*. Smells of other animals (urine, feces, anal glands, and fear), and pictures of animals hanging on the walls
    - Being lifted up on table when pets are not allowed on tables at home
    - Exam tables are a slippery surface; they can't get a grip to save their life!
    - Thermometers and the procedure of taking temperatures
    - The sight of a syringe or nail clippers

Get down on the floor, literally and figuratively, and see the hospital exactly the way patients see/hear/smell it. In the lobby, one might see a big room with a lot of unpredictable stuff going on; a bunch of dogs and cats hanging around, strange people coming and going, and some fearful smells. One might hear machines humming, alarms, phones ringing, people talking, and howls of pain or anger from a patient being tortured in a back room. From the floor perspective, one can easily see how frightening this place could be.

Symptoms of anxiety in pets

- Panting, trembling, whining, pacing, clinging
- Yawning, slow motion, staring, sleepy
- Piloerection, shedding, self-grooming
- Hypersalivation, licking lips, mouth closed
- Shaking off, sweaty paws, dribble urine
- Restless, sniffing, distracted, hypervigilant
- Hiding, freezing, cowering, running
- Turning head, turning away (C-shape)
- Hardened eyes, blink, squint, furrowed brow
- Won't accept treats or reluctantly accepts treats

How and why The Fear-Free™ Initiative will benefit patients, pet parents and veterinary practices
The goal of the veterinary practice is not to be "the punisher." Instead, the practice should be a calm place with treats, massage, and a fairytale place with food and fun. It is time to mold the veterinary practice to be a place where state-of-the-heart meets state-of-the-art. That means slowing down, taking time, laying a trail of treats, and having empathy for the owner and the pet. Start with addressing the heart of the pet owner before making recommendations. Start with the heart of the patient and then move to the examination or the procedure.

Ultimately, the goal is to classically condition cats and dogs to LOVE the veterinary hospital and team. Take the *Pet* out of petrified, and place the pets back into the caring hands of veterinary professionals.

Techniques a veterinary technician can implement to help pets overcome fear

Before a veterinary technician can successfully utilize low stress handling techniques, they must be able to understand the causes of anxiety and stress. In addition, they must be able to identify behaviors associated with anxiety and stress, and adjust their actions before the growling, snarling or hissing starts. The actions portrayed by veterinary technicians can either enhance or hurt the relationship with the patient.

It is essential to know what positive behaviors the dogs and cats that come to the practice already know. These behaviors can be used as building blocks during visits, and as opportunities to reward and reinforce. Consider a dog that knows how to sit (and the reward is a treat). Ask the pet parent what the cue word is, then reward appropriately. Remember when you were a kid and how you jumped and ran when you heard the music from the ice cream truck? Your goal is to turn your practice into the ice cream truck, and knowing these tricks and the cue words for patients is the behavioral bell to make it all happen.

Patients visiting the hospital should have an association with the veterinary team as a wonderful place of pleasure, play, petting, praise, and prizes of the great tasting variety.

Technicians need to learn and implement low stress handling techniques and be comfortable and confident in their approach. It helps to have a smorgasbord of treats available, as not all pets like the same flavor or texture.

Dogs:

- Turkey hot dog slices
- Honey Nut Cheerios
- Peanut butter Captain Crunch
- Natural Balance food roll
- Zukes
- Wee Bites salmon & bison (Solid Gold)
- Rabbit kibble (Instinct)
- Bravo freeze dried treats
- String cheese
- Easy cheese
- Kong stuffing
- Yummy Chumies
- Deli turkey
- Tuna

Heat the hot dogs, turkey and tuna; even if the patient doesn't eat the treat, they will associate the smell with good things.

Cats:

- Tuna
- Deli turkey
- Easy cheese
- Zukes
- Feline Greenies
- Baby food

About half of the adult cats in a comfortable hospital setting will take treats. Almost all kittens will readily accept treats. For the cats that won't eat, you can still provide pleasant associations with smells.

Team members must use positive body language and tone of voice. Pets pick up on emotions incredibly well. Calming music is also an effective calming technique for pets, especially when used in combination with pheromones. Veterinary technicians should engage in behavior modification every minute of every patient visit, every time.

TPR's and blood work is more normal without fear and anxiety. Pets don't hide pain and discomfort like they do when they are full of adrenaline. In addition, the immune response is not suppressed, and metabolic changes don't occur. First focus on the emotional wellbeing of the pet and owner, then turn the focus to the animal's physical wellbeing. Counter-condition pets to want their nails trimmed, utilizing treats. Change handling techniques and voices to accommodate the pet.

Techniques a veterinary technician can implement to help owners overcome fear

- Understand the anxiety or fear triggers for pet owners

- Having to find the time to take the pet into the vet
- Putting the pet in a carrier or vehicle to come in
- Ride of terror in the car
- *"What's wrong with my pet? How much will it cost? I hate how freaked out my pet gets."*

Today's pet parents have many choices. The problem is not a lack of information to make informed decisions, the economic downturn, or the fragmentation of the market. The problem is that visiting the veterinarian isn't worth the "hurt" to the pet or the "hassle" to the pet owner.

- Allow the client to relax with their pet and communicate WHY this is being done
- Explain the mode of action of pheromones and why they are being used in practice
- Communicate how and why low stress handling techniques are being used with their pet
- Educate clients on what stress looks like
- Teach clients how to transport patients effectively, resulting in lower stress once they arrive at the clinic
- Provide clients with techniques to use at home to help pets adjust to visiting the veterinary hospital

Low stress handling techniques for cats
With cats, it is important to master "less stress" handling techniques using gentle but firm restraint (and adjust handling as the cat responds). Avoid scruffing unless it is absolutely necessary. When examining a cat's mouth or other sensitive area, giving pills or drawing blood, consider Clipnosis®.

Approach cats from the behind rather than from the front to prevent visual arousal. The exam should not start at the head and go to the tail. Instead, start examining non-painful areas first and other places that won't arouse the cat. Examinations should be done from behind, or to the side, so as not to loom over the cat or stare directly at the cat, which are threatening behaviors to a cat. Avoid the 'red alerts,' like hissing, scratching and biting at all costs.

Low stress handling techniques for dogs
Pet parents should be advised to withhold food prior to the veterinary visit to enhance the effectiveness of the treats used to counter condition patients. A calm stomach = A calm mind. Nausea tends to be under diagnosed in veterinary medicine. Unless a patient is hyper-salivating, licking the lips or vomiting, how would one know? For a pet that typically vomits on the way to the clinic, Cerenia can be used before traveling to allow the pet to arrive calm, relaxed and feeling well.

Keep various sizes of Thundershirts available for dogs, as these dramatically reduce anxiety in 80% of the patients that wear them. Anxiety wraps can also be considered as they maintain a gentle, consistent pressure and target acupressure points on a patient's body to aid in a calming effect from the light pressure of the garment.

If necessary, start sedation protocols before pet owner leaves home, and add chemical restraint if needed.

Putting the treat back in treatment
Practice patient care like the owner is always watching over your shoulder. If you knew the pet parent was watching you put their baby on the table for grooming how much less forcefully would you do it? Would you change your technique? If you noticed a little mess in a cage and thought, '*I'll come back and clean that up in a few minutes*,' would you leave that mess if the owner was watching? If a pet was coming out of surgery fearful or in pain and the owner was next to you would you let the pain and anxiety continue?

Adjust handling based on the animal and his/her response to restraint, and learn to adjust sample-taking technique. The general rule of them is to release the hold if the cat struggles more than two seconds, or the dog struggles for more than three seconds.

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[1] http://veterinarybusinessadvisors.com/up/file/JAVMA_-_Bayer_Study_Part_1_May_15_2011_PDF_Plus.pdf; Accessed 6/2/15

ANESTHESIA
Cautionary Tales

Nancy Brock DVM

Diplomate

info@nancybrockvetservices.com

Greyhound Dentistry

Mature Dog Spay

What these patients have in common

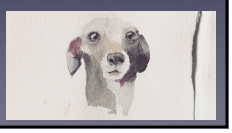
- Rescued
- Healthy based on physical examination
- Healthy based on blood screen
- Healthy based on known history
- Elective Procedures

What the adverse events had in common

- Unpredictable
- Potentially fatal outcomes
- Positive outcome as a result of monitoring strategy
- Positive outcome as a result of preparedness

"Filby" the Greyhound dentistry 2013

- Adult (DOB 2010) retired racing Greyhound
- Severe periodontal disease
- Pre-anesthesia screening
  - CBC, chem (no electrolytes)
  - Screening questions
  - PE

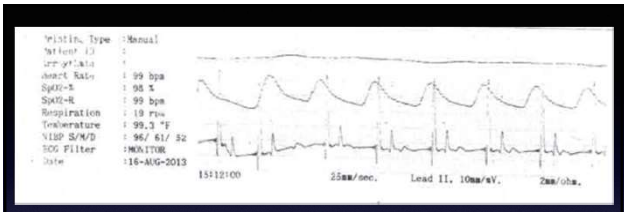


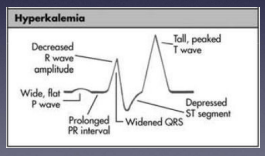
Filby's Anesthesia protocol

- Butorphanol/midazolam IM premedication (10:05)
- Ketamine/propofol ("Ketofol") induction IV (10:40)
- Isoflurane maintenance
- Bupivacaine local blocks

Filby's Anesthesia Timeline

- Premedication I.M. - 10:05
- Induction IV - 10:40
- Maintenance 10:45 to 13:45
- Adverse event - 13:45
  - heart rate suddenly down to 44 from 70 BPM
  - heart rate irregular
  - no P waves visible on lead II ECG





Bradycardia under Anesthesia Rule-outs

- Vagal stimulation ?
- Drug induced ?
  - ✳alpha 2 agonist
  - ✳opioid
  - ✳Inhalant
- Electrolyte abnormalities

Interventions

- Antisedan IV - no change
- Naloxone IV - no change
- Calcium chloride IV (slowly) - P waves returned

Cause of Bradycardia

- HYPERKALEMIA
  - Sudden
  - Loss of P waves

Outcome?

- Serum K^+ = 9.2 mE/dL at 2:45 PM
- Serum K^+ = 4.1 mEq/dL by 5:02 PM
- Serum K^+ remained normal
- Patient made full uneventful recovery

What happened?

- Where can that much potassium come from so quickly?

QUESTIONS?

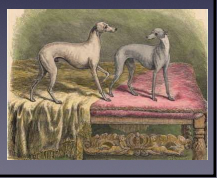
Martha's Spay
November 2015

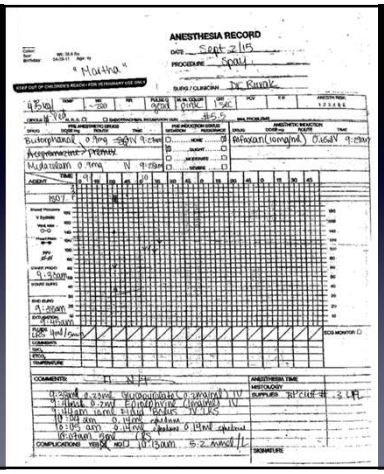
artha's Anesthesia Risk Assessmen

- Rescued from streets of Mexico City and relocated to Vancouver - up for adoption
- Pre-anesthesia screening
  - PCV, Total Solids, Urinalysis
  - Screening questions (history)
  - PE (WNL)

Anticipated Problems

The "H" 's




ANESTHESIA RECORD

DATE Sept 21/15

PROCEDURE Spay

SURG / CLINICIAN DR Runk

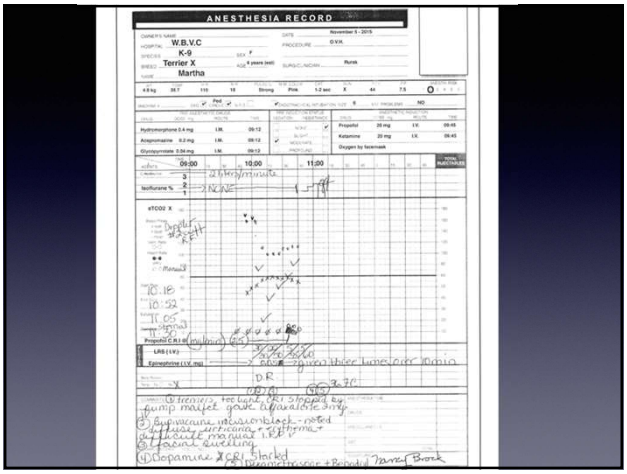
"Martha"

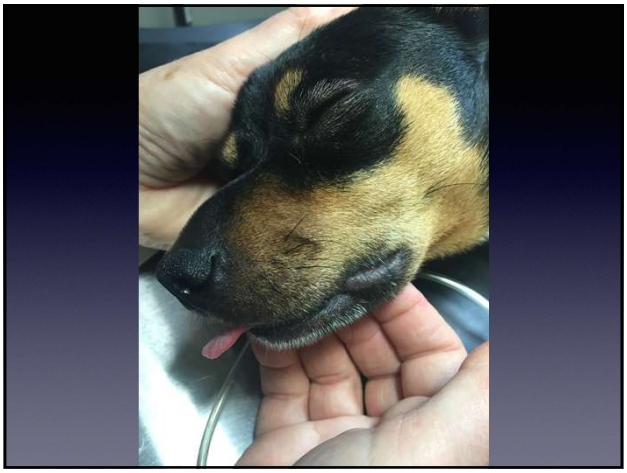
Martha Anesthesia Protocol

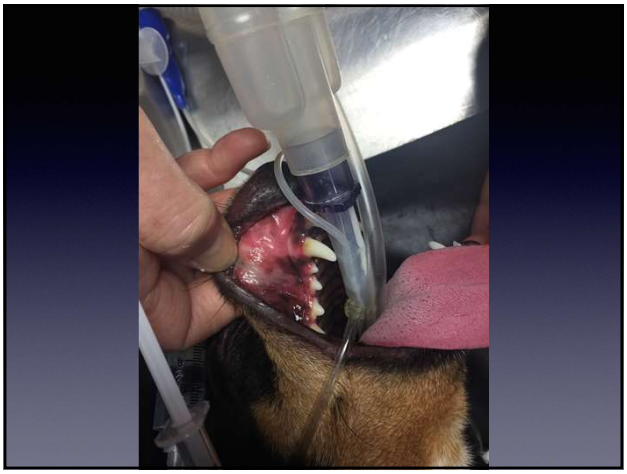
- Hydromorphone/Acepromazine IM premedication
- Ketamine/propofol ("Ketofol") induction IV
- Propofol C.R.I. maintenance started at induction
- Incision infiltration with bupivacaine 0.5%

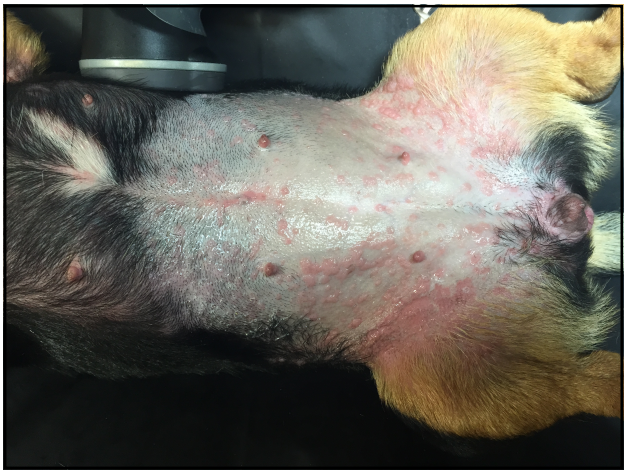
Martha's Anesthesia Timeline

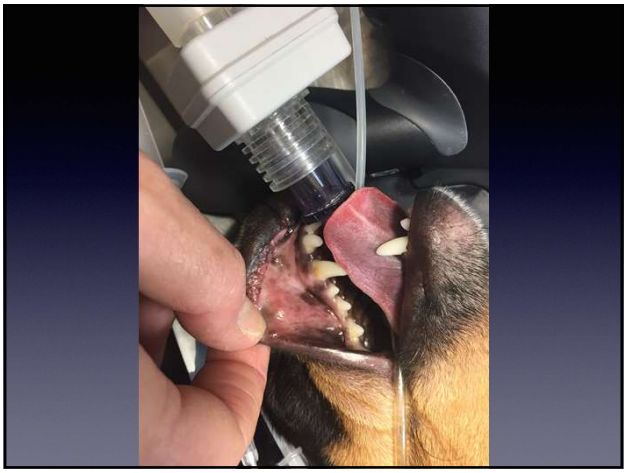
- Premedication I.M. - 09:12
- Induction IV - 09:45
- Maintenance 09:45 to 10:59
- Adverse event - 10:05
  - ✳ Heart rate suddenly160 →100 BPM
  - ✳ Systolic BP 160 → 90 → 20 mm Hg
  - ✳ Rash, facial swelling, difficulty ventilating


ANESTHESIA RECORD
W.B.V.C
K-9
Terrier X
Martha
09:00
10:00
11:00









nd Sudden Hypotension under Ane
Rule-outs

Interventions

- Epinephrine boluses - repeated
- Fluid bolus
- Benadryl and dexamethasone - eventually

Outcome?

- Systolic BP returned to acceptable range
- Surgery completed
- Rash and swelling gradually resolved over hours
- Patient made full uneventful recovery
- Metacam?

What the adverse events had in common

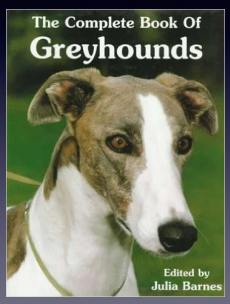
- Unpredictable
- Potentially fatal outcomes
- Positive outcome as a result of monitoring strategy
- Positive outcome as a result of preparedness

Lessons Learned About Anesthesia Risk Assessment

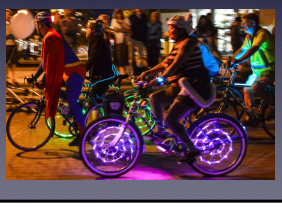
Lessons Learned About Monitoring

What if I don't have an ECG machine?

What if I don't measure blood pressure?



Thank You



Lecture: **The Art of Anesthesia: Basics, Tips, and Tricks**

Lab: **Anesthesia Monitoring Lab**

Yvonne Brandenburg, RVT, VTS Internal Medicine Small Animal

RVT at SAGE Centers for Veterinary Emergency and Specialty Care Dublin, California, USA

Introduction

As a Registered Veterinary Technician (RVT) we practice the art of anesthesia on a daily basis. Whether we are anesthetizing patients for routine procedures (i.e. spays, neuters, dental procedures) or the not so routine emergency/critical care case (i.e. GDV) that comes in the door, it is our responsibility to provide the safest anesthetic procedure that we can. Owners place their trust in our abilities to successfully anesthetize their loved one and recover them safely. It is important not to be complacent when performing anesthesia as this results in the inability to solve various issues, some of which may become life-threatening.

The goals of the lecture are to review: 1) the technician's role in anesthesia; 2) pre-anesthetic period procedures; 3) basic anesthetic depths; 4) the basic parameters of how and why we monitor anesthesia; 5) how we differentiate equipment malfunction vs patient changes; and 6) introduce mechanical ventilator indications and usage (if time permits).

The goal of this lab is to: 1) review anesthetic equipment.

What is Our Role as an Anesthetist in the Veterinary Setting?

"There are no safe anesthetic agents; there are no safe anesthetic procedures.

There are only safe anesthetists."

Robert Smith, MD (Muir W, 2007)

Veterinarians and Veterinary Technicians are the everyday anesthetists of the veterinary world. There are few board certified veterinary anesthesiologists and they are typically working in university settings. In clinical practice, the doctors prescribe the treatment plan for anesthesia. An RVT implements this protocol from drawing up the drugs, inducing anesthesia, maintaining the patient in a safe anesthetic plane, and then facilitating recovery. The RVT is often aided by an unregistered assistant (UA) to monitor patients and recover them.

Registered Veterinary Technician's and UA's are vitally important to ensure a patient is as safe as possible during any anesthetic procedure as there are inherent risks associated with anesthesia. Every time we anesthetize a patient, we are taking them from a more stable place to a less stable environment all with the goal of successful recovery. To do so, we must be vigilant in our methods and make educated choices for the changing needs of our patients.

When discussing general anesthesia it is important to remember that in the state of California only a DVM or RVT under direct supervision may **legally** induce anesthesia.

- To 'induce' anesthesia means the initial administration of a drug with the intended purpose of rendering an animal unconscious.
- "Direct Supervision" means: (1) the supervisor is physically present at the location where animal health care job tasks are to be performed and is quickly and easily available; and (2) the animal has been examined by a veterinarian at such time as good veterinary medical practice requires consistent with the particular delegated animal health care job task. (Registered Veterinary Technician Job Task Regulations, 2016)

What is Anesthesia?

In order for us to understand what our role is in anesthesia it is best to review some basics. Anesthesia is the loss of sensation and we can achieve this with several techniques. The first and easiest is a topical anesthetic such as using lidocaine or proparacaine. This can be used with eyes, mucous membranes, and even on abrasions on the skin. We can use local or regional anesthetic nerve blocks. A local block using agents such as lidocaine or bupivacaine can be used for a minor mass removal, small laceration repair, or a nerve block during dental extractions. A regional block can be an epidural for something major like an FHO, or a TPLO.

The last type of anesthesia is general anesthesia which will be the focus of the lecture. This is typically done with an inhaled anesthetic. The two anesthetic gases commonly used in veterinary practice today are isoflurane and sevoflurane. A constant rate infusion (CRI) of an injectable anesthetic such as propofol or alfaxalone can also be used to maintain anesthesia. Both types of general anesthesia require close monitoring of the patient to properly titrate the dose that is being delivered in response to stimuli and patient's individual response to drug pharmacodynamics and pharmacokinetics.

The best anesthetic protocol is a multimodal anesthesia; meaning, we combine medications that act in different manners to provide a balanced anesthetic technique. Using a multimodal approach reduces the dose of drugs and will cover multiple receptor sites allowing for better patient care. As the anesthetizing RVT, it is our responsibility to be familiar with the protocol, specific needs of the patient (i.e. heart disease, diabetes, etc), and discuss it with the prescribing Veterinarian.

- Example:
    - Preanesthetic drug
        - opiod such as hydromorphone
        - +/- a tranquilizer or sedative such as acepromazine
        - +/- anticholinergic such as atropine
    - Induction drug
        - Dissociative anesthetic such as ketamine +/- diazepam
    - Maintenance anesthetic
        - isoflurane
        - fentanyl CRI
    - Local anesthetic
        - epidural of morphine +/- bupivicaine
    - Non-steroidal Antiinflammatory Drug
        - Injectable or oral suche as carprofen or meloxicam

Being Our Patient's Advocate

We are the patient's advocate! It is our responsibility to understand the medical history and help prevent possible complications. If we have questions on orders, we need to speak up before a potential complications arises.

Reviewing the medical record we can see if the patient has any history of:

- allergic and/or adverse reactions to drugs,
- heart or respiratory conditions that may affect stability of anesthesia,
- any drug metabolism concerns such as kidney or liver dysfunction,
- any previous anesthetic concerns.

It is also best practice to know the resuscitation directive of the owners. If the pet were to have cardiac or respiratory arrest, what are their wishes? Do they want cardiopulmonary resuscitation (CPR) or would they prefer 'do not resuscitate' (DNR)? It is a good idea to ask clients what their preference is prior to admitting into the clinic and at the same time discuss the risks associated with the procedure. SAGE uses standardized forms for each patient; this is something that you can discuss with your practice to see if you would like to implement this if you do not already have it in place.

Knowing the American Society of Anesthesiologists (ASA) status of a patient prior to anesthesia is important to understand potential risks or complications associated with the procedure and specifically for that patient. Discussing the potential complications with both the veterinarian and the client helps the RVT understand what to have set up 'just in case'. (Remember the RVT superstition that if you have stuff out and ready to use 'just in case' then 'it' won't happen.)

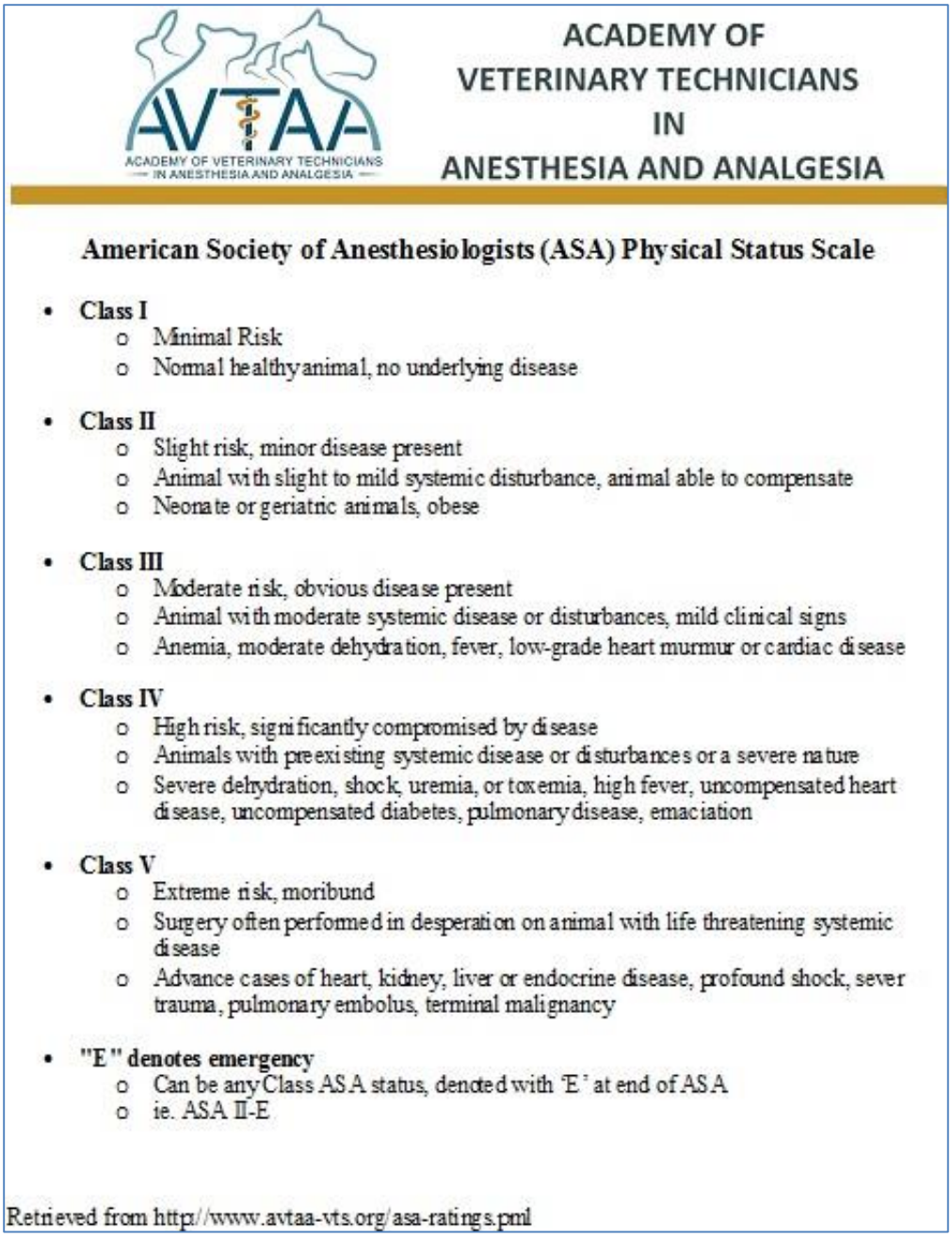


Figure 1. (American Society of Anesthesiologists (ASA) Physical Status Scale)

Discussing anticipated pain management needs with the veterinarian prior to the procedure will help facilitate a more balanced anesthetic technique and provide a better anesthetic recovery. Additionally, understanding the most stimulating part of the procedure can help us anticipate the timing of additional medications or implementation of nerve blocks to reduce the stimulus effect. As an RVT it is our responsibility to speak to the doctor if we think the patient is painful. Remember that pain has been shown to cause many physiologic side effects including inhibition of healing. An ounce of prevention is worth a pound of cure.

The Pre-Anesthetic Period

Having a procedure checklist is an excellent way to ensure that there are no steps missed. SAGE has one that is used in the surgical department, but you can use one that was prepared by the Association of Veterinary Anaesthetists.

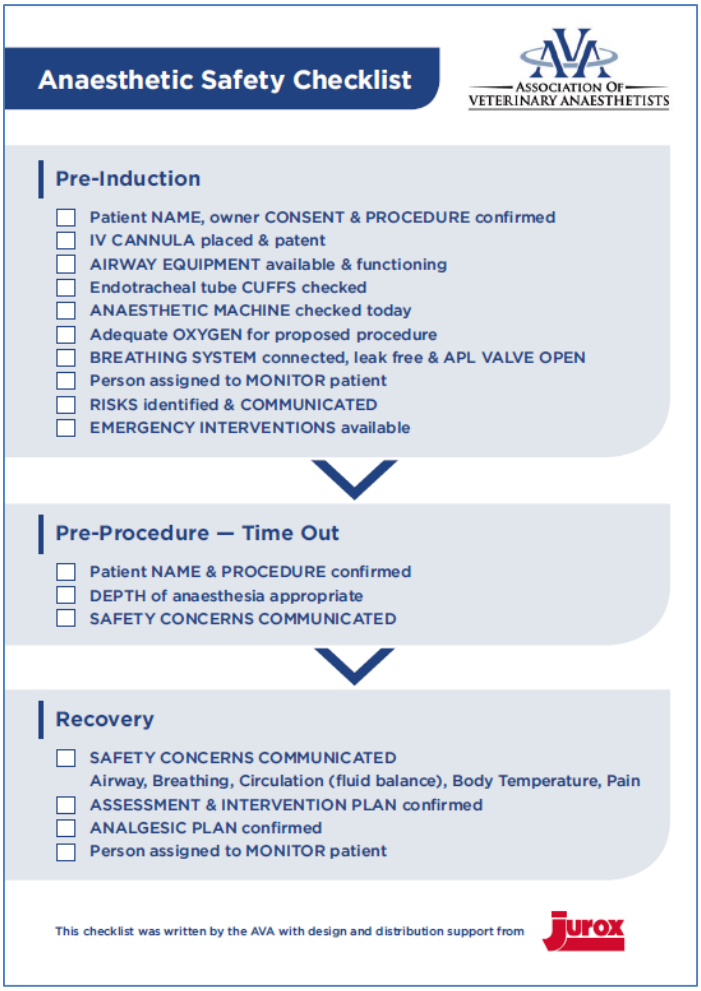


Figure 2 AVA: Anaesthetic Safety Checklist

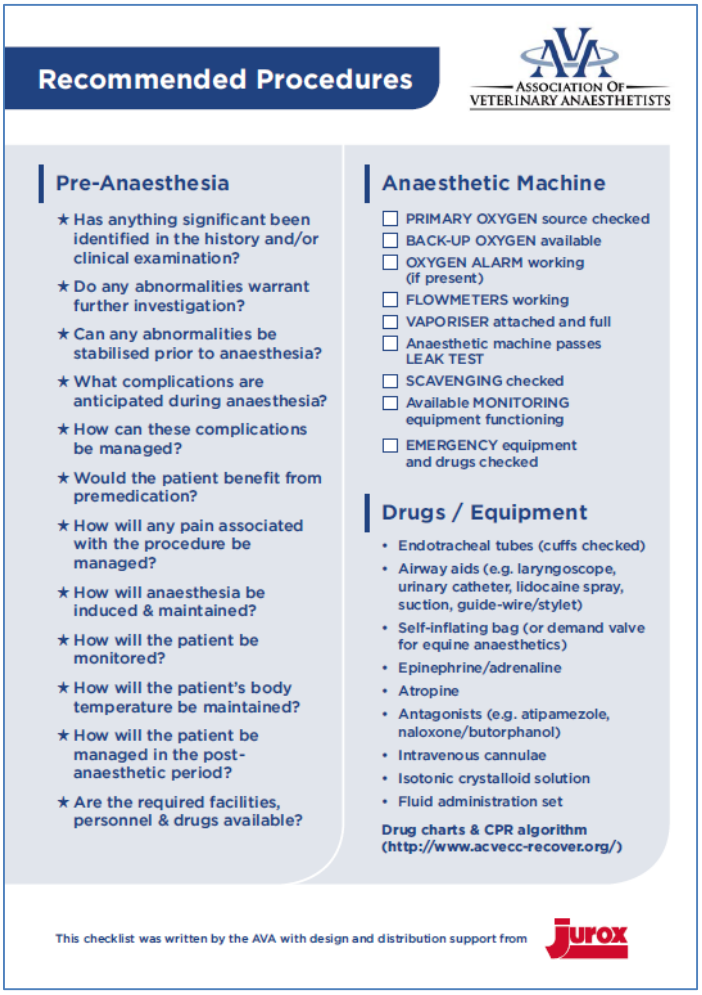


Figure 3 AVA: Recommended Procedures

(Association of Veterinary Anaesthetist)

Following the same routine prior to anesthesia helps ensure patient safety. An open dialogue with veterinarians and staff can help prevent unnecessary complications or emergencies.

Review of Anesthetic Depths

Below is a review of the planes and stages of anesthesia as described in *Anesthesia and Analgesia for Veterinary Technicians*. (Thomas, 2011)

Plane 1:

- Not adequate for surgery
- Characterized by:
    - Regular respiratory pattern, no involuntary limb movements
    - Eyeballs start to rotate ventrally, pupils partially constricted, decreased pupillary light reflex
    - Endotracheal tube may be passed and connected to gas anesthetic machine
    - Other reflexes are still present but decreased response
- Patient will move and show increased heart rate, respiratory rate and depth, and blood pressure along with a response to painful stimuli if surgery is attempted at this level.

Plane 2:

- Most surgical procedures performed in this stage and plane
- Characterized by:
    - Regular and shallow respiration with decreased rate
    - Blood pressure and heart rate mildly decreased
    - Relaxed muscle tone
    - Pedal and swallowing reflexes are absent
    - Ventromedial eye rotation
- Surgical stimulation may produce:
    - Mild increase in heart rate, blood pressure, or respiratory rate
    - Patient remains unconscious and immobile
    - Pupillary light response is sluggish; pupil size is moderate

Plane 3:

- Deep anesthesia—excessive for most procedures
- Characterized by:
    - Low heart and respiratory rates, decreased tidal volume
    - Reduced pulse strength
    - Increased capillary refill time (CRT)
    - Poor to absent papillary light reflex; central eyeballs; moderately dilated pupils
    - Reflexes are totally absent; muscle tone is very relaxed
- Patients at this level may have to be bagged or manually ventilated.

Plane 4:

- Early anesthesia overdose
- Characterized by:
    - Abdominal breathing

    - Fully dilated pupils; dry eyes
    - All reflexes are absent
    - Marked depression of the cardiovascular system, pale mucous membranes, increased CRT
    - Flaccid muscle tone
- Patients at this level are in danger of cardiac and respiratory arrest

Basic Monitoring Parameters

The ABC+ of monitoring anesthesia.

- Airway:
    - Prior to inducing, measure the endotracheal tube to see how far the tube should be placed to ensure proper placement. Too far, only 1 lung inflated or bronchus trauma. Too short and can cause trauma to larynx when inflating the tube.
    - Have several sizes available when inducing. Place the appropriate endotracheal tube size; not too small and not too big.
    - Secure tube to either the top of the muzzle or behind the ears: can use umbilical tape, tie-gauze, or 'recycled' IV fluid lines.
    - While patient is on oxygen (prior to starting anesthetic gas and as long as the patient is sufficiently induced) inflate the cuff using a 6 mL syringe to inflate while giving a PPV and listen for gas leaking out. This can be repeated after 2-3 minutes of anesthesia to ensure that after the patient relaxes there is still sufficient inflation of the tube.
    - Disconnect the endotracheal tube from anesthetic tubing before moving or turning a patient to prevent tracheal trauma.
    - When the patient is recovering, ensure deflation of the cuff to prevent trauma.
- Breathing:
    - Watch out for post induction apnea; this is especially common when propofol is pushed too quickly. Pre-oxygenating patients prior to induction can help to alleviate cyanotic complications.
    - Monitor respiration rate and depth. You can visualize the thoracic cavity, anesthetic reservoir bag, or use a capnograph. If using a respiration monitor such as Apalert it is important to realize that heartbeats, surgeons moving the diaphragm and small shallow breaths can register as a breath and this does not guarantee the patient is respirating appropriately.
    - Ventilation is movement of gas in and out of the alveoli. This does not mean the patient is oxygenating appropriately.
    - Respiration is the process in which oxygen (O_2) and carbon dioxide (CO_2) are exchanged in the body.
        - Cellular respiration: O_2 delivered via the blood stream to cells and exchanged for CO_2. This occurs throughout the body.
        - Alveolar respiration: CO_2 delivered to the lungs and O_2 is exchanged into the blood stream. This only occurs in the lungs.
    - Capnography is an invaluable tool to help monitor the body's respiration. It has been nicknamed the 'anesthesia disaster early warning system'. It monitors exhaled and

inhaled carbon dioxide, breaths per minute, and in some cases tidal volume. Normal end tidal CO_2 (et CO_2) levels are 35-45 mm Hg. Above 40-45 mm Hg are indicative that the patient does not have adequate ventilation and can indicate that the patient is too deep anesthetically. Below 35 mm Hg and the patient is typically hyperventilating or may be hypothermic.
        - Hypothermia slows the body's metabolism decreasing the amount of carbon dioxide released into the blood stream.
    - Pulse oximetry (SpO_2) monitors the oxygen saturation in the blood stream. >95% is considered normal. <95% can indicate respiratory concerns. During procedures it is recommended to reposition the sensor occasionally to optimize accuracy of the sensor.
        - Causes of vasoconstriction, such as hypothermia, pain, or α_2-agonist administration (e.g., medetomidine, dexmedetomidine), may cause errors in the pulse oximeter. Furthermore, movement, pigment, profound anemia, and profound hypoxemia can all result in erroneous readings.
    - An esophageal stethoscope can help to hear breath sounds and heart beats
- Circulation:
    - An ECG is optimal to monitor for arrhythmias or conduction changes. This can be used as a monitor for heart rate as well.
        - It is important not to rely 100% on the ECG, as this indicates electrical conduction through the heart, not physical contractions. A heart can stop beating several minutes before electrical activity stops.
    - A doppler monitors the pulse wave in an artery and is a way to directly hear that the heart is contracting and pushing blood throughout the system. This is also the tool to use to obtain a systolic blood pressure. It is great to double check other blood pressure machines to ensure accurate measurements.
        - This can also be used directly on the thoracic wall of pocket pets or neonates to hear the heart during anesthesia or an emergency.
    - Indirect blood pressure (BP) monitoring is crucial to ensure organ perfusion. Most automated BP monitor's such as the Cardell® show systolic, diastolic and mean arterial pressure (MAP). Hypotension is indicated at a systolic BP of <80 mmHg; or a MAP of <60 mmHg. Keep in mind that the big 3 organs need a MAP of above 60 mmHg to prevent tissue damage. If you can palpate a femoral pulse, that typically indicates your MAP is >60 mmHg (Thomas, 2011).
        - Hypotension can be due to hypothermia, increased anesthetic depth, fluid loss, or even decreased cardiac output.
        - Hypertension can be due to pain associated from being too light anesthetically, hyperthermia, and increased cardiac output.
    - An esophageal stethoscope can help to hear directly the heart rate, rhythm and changes to the force of the contractility of the heart.
- Body temperature:
    - Patients core body temperatures decrease quickly during anesthesia and can increase patient morbidity. Patients are at increased risk of:
        - slower anesthetic recovery
        - slower drug clearance

        - wound infection
        - bradycardia
        - perioperative hemorrhage
        - lowered tissue perfusion and oxygenation
    - Early prevention is key to keep patients warm during procedures
        - warm air circulators such as Bair Huggers ™
        - Hot Dog™ or warm water circulator blankets
        - IV fluid warming devices
        - wrapping feet to prevent heat loss
        - warm fluids to body cavity lavage
        - wrapping anesthetic tubes with towels to prevent further cooling
    - Caution should be used with microwaved items such as rice bags or fluid bags as these can cause thermal burns (technically can cause 1st, 2nd, or 3rd degree). It is best to use approved heat supplementation for overall patient safety.
- IV access
    - It is extremely important to have IV access during any anesthetic procedure to ensure quick venous access in case of an emergency.
    - An IV catheter is inexpensive and can save the lives of our patients.
    - IV fluids should be given unless medically indicated to not receive them.

Is it the Patient, or is it the Machine?

When monitoring a patient and there is an indication of something going wrong, or there is a sudden change, it is important to assess the patient first to make sure that there is not an issue with our equipment. Equipment is available to help the anesthetist monitor the patient, but it is not infallible. If the SpO2 monitor reads 60%, but the patient is a pretty pink color, try adjusting the placement of the sensor. If suddenly the ECG stops working but we can see that the patient is breathing and you can feel pulses, then a lead most likely fell off.

Common machine issues:

- SpO2 reading low/not reading
    - Pressure from the sensor clamping on the tissue can cause vasoconstriction and lowered blood flow to an area, simply moving the sensor to another location can help with more accurate readings.
    - Using wet gauze on a tongue does not facilitate the SpO2 sensor to read, however it can help prevent the sensor from slipping off of the tongue. Remember, you don't put wet gauze on fingers or other body parts to get the sensor to read.
    - Try putting the red LED on the bottom side of the tongue and the photo sensor on top. Try to minimize the amount of ambient light around it so the photo sensor just gets the light that comes from the LED side.
    - Darkly pigmented skin is difficult for the LED light to penetrate. Try other places.
        - Ears, lips, between toes, or on prepuce or vulva.

- ECG
    - If using an air circulator (Bair Hugger ™) try applying electrode gel instead of alcohol to prevent the leads from drying out and resulting in a loss of conduction.
    - If using an esophageal electrode probe, make sure that the probe has not backed out of the patient. A small piece of tape can be used to tape the ECG probe to the e-tube to help prevent this from happening. It is important to untape this prior to recovering or turning the patient.
    - Heart blocks can happen after induction. If you see a P wave without a QRS complex, let your doctor know. Atropine may be needed, or the procedure may need to be aborted for further work-up of a cardiac arrhythmia.
- BP
    - Making sure the appropriate cuff size is used. The width of the cuff should be 30-50% of the circumference of the extremity (Thomas, 2011). The cuff should be snug, but not too tight over the artery. If the velcro is not holding a small piece of tape can help, but do not wrap the tape 100% around the cuff as that can affect readings.
    - Ideally the limb used is the leg that is up in a lateral position. If using the 'down' leg, this can affect the pressure.
- $EtCO_2$
    - If the $EtCO_2$ is > 45 mmHg, sighing the patient can help. Check to ensure that the patient is not too deep anesthetically, as that will increase $EtCO_2$.
    - If inspiratory CO_2 and $EtCO_2$ levels are elevated then check the CO_2 absorber is not full.
    - If the $EtCO_2$ is <35 mmHg, the patient may be hyperventilating and may need to be brought to a deeper anesthesia plane. Another consideration is to check the patient's temperature as being hypothermic can cause decreased CO_2 levels in the blood; warming the patient can help correct this.
    - If abnormal $EtCO_2$ levels are consistent, it is also good to check the placement of the e-tube since one lung ventilation may be occurring.

Mechanical Ventilation Indications

Mechanical ventilation or controlled ventilation is when the anesthetist delivers all of the gas that is required for the patient and the patient does not initiate spontaneous respiratory efforts (Thomas, 2011). When delivering a breath, positive pressure ventilation (PPV) technique is used. This is similar to using a reservoir bag, but it is done automatically by the ventilator. Increased $EtCO_2$, decreased spontaneous ventilation, and thoracic surgeries are indicative of using a mechanical ventilator.

Conclusion

Anesthesia is a complex procedure and takes knowledge and experience to become proficient at it. It is up to each individual technician to continue learning throughout their careers. There are continuous advances in our industry and it is up to us to ensure we protect our patients as best as we can.

Remember the Veterinary Technician's Oath:

I solemnly dedicate myself to aiding animals and society by providing excellent care and services for animals, by alleviating animal suffering, and by promoting public health.

I accept my obligations to practice my profession conscientiously and with sensitivity, adhering to the profession's Code of Ethics, and furthering my knowledge and competence through a commitment to lifelong learning. (NAVTA, 2014)

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Speaker Information

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Track 6

Pet Insurance: How Will This Impact the Profession and How Do We Influence That Impact

Julie D. Smith, DVM, DACVS, CCRT, MBA

Introduction

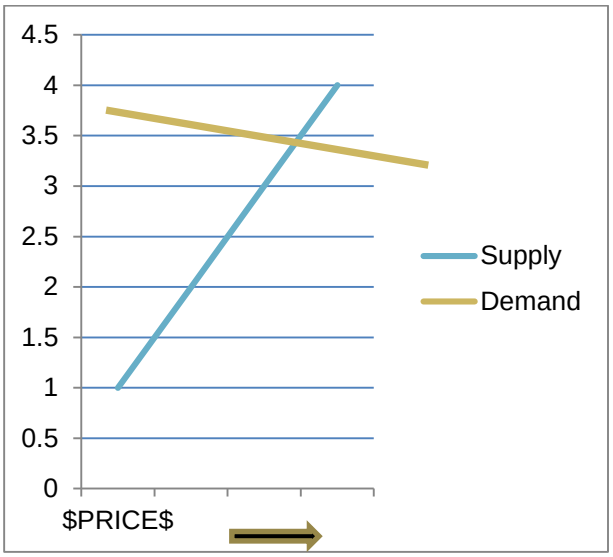
The veterinary industry is poised for a change. Because of our changing world, the old model of 1-2 doctor practices that were passed down from owner to associate is changing across the country. Because of publically and privately owned consolidators, the advent of large group practices to help with work-life balance, the increased availability of specialty and emergency care, increased medical knowledge, and the clients' access to technology – how we practice medicine and how our industry is structured is changing.

Even with all of this change and the strengthening of the human-animal bond, veterinary medicine is faced with an economic conundrum that serves as a potent source for a number of the frustrations us as veterinarians and as business owners and managers must face daily. Some of the outcomes of this conundrum are:

1) Why veterinarians and their staff maintain lower earning potentials on average vs. other medical fields for similar training and skills
2) Why media story after media story involving veterinarians focus on the cost of care vs. the medicine
3) Why there are new graduates coming out of veterinary school that suddenly realize that their loans are twice as much as their starting salary
4) Why do clients expect us to give away our services…..and why do we do it?

Veterinary Economics 101

Supply vs. Demand – the basic tenants of our free market economy is that as prices go up, demand goes down as people don't want to pay for as much "stuff" at the higher price. This of course depends on how much you need something vs. want something – this is the concept of elasticity in economics. If you need something, like gas or medical care for your child, you will continue to demand it and pay those higher prices. If you just want something, like a new shirt or a bottle of wine, you will only pay so much for it – up until the price exceeds the value you put on it.



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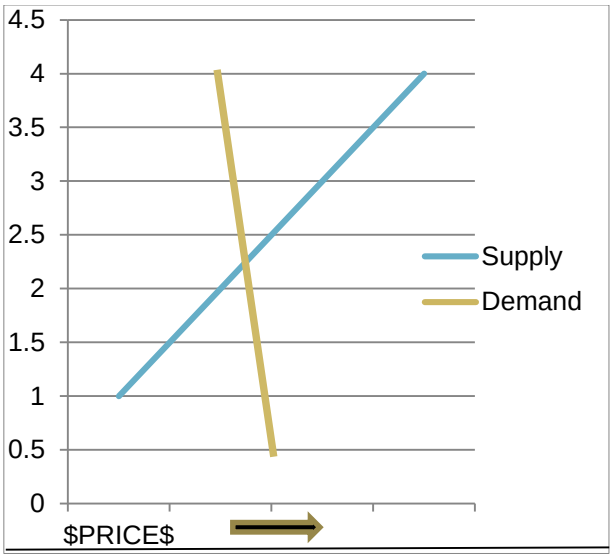

WANT

So, here in lies the conundrum of the economics of veterinary medicine. We all enter this industry because of the love of medicine and being able to provide it at the highest levels to improve the lives of pets. We see veterinary medicine as a need – and so do the clients. They love their pets, the human-animal bond is stronger than ever; they feel that medical care for their pets should be an "of course" just as their care is. The public also believes in this "of course"; which is why the media loves animal stories and what can be accomplished to save the lives of pets. Unfortunately, the economic reality is that we ask clients to pay for these services out of their pocket – so that means that demand is a function of price – veterinary care economically acts like a want because people need disposable income to afford it. And that also means that they will only pay the price up to the level of value that they ascribe to that service.

How to Influence Demand

In order to rise above this conundrum, we as an industry and as individuals need to influence the demand for our services – change the want to a need because our services are valued by the client. They believe we play a crucial role in the health of their pet and improving the quality and quantity of that life through medical care. We need to focus on the value we bring to that role as health care providers – not as retailers.

One other way that we can all provide the level of medicine that we desire for the pet as well as our own career satisfaction is to make that care less "out of pocket" for

the client. We all "pay" astronomical health care bills if we ever need to go to the doctor or hospital, but most of us rely on health insurance for those actual payments. And, most of us continue to pay for health care insurance even as premiums increase because we need it. Right now, there is absolutely no reason that we do not recommend pet insurance for each and every client that comes in our door. It is not a cost to our business and research proves that clients are more willing to pay for our services if they have insurance. Clients need to be helped through the maze, so this is a value that the veterinary clinic can provide.

Veterinarian's Role Regarding Pet Insurance

NAPHIA (North American Pet Health Insurance Association) is a neutral voice within the pet insurance industry and was founded about 9 years ago. The group performed a study in 2016 that surveyed 626 pet owners and 505 veterinarians. Important results reveal:

- Less than 1% of cats and dogs are insured in US
    - 12 companies in the US currently providing pet insurance
    - Only 56% of vets in the US wish all clients had insurance, whereas its 85% in Canada
    - Only 5% of vets worried about managed care
- The main reason pet owners buy pet insurance is NOT to minimize risk of a major vet bill – at least they couch the reasons in more emotional terms
    - "Is helpful to them"
    - "Shows that they love their pet"
    - "Shows that they are a responsible pet owner"
    - "Provides peace of mind"
    - "Is a good investment"
    - "Helps avoid the need to make painful choices about withholding care"
- Pet owners spend over 29% more on dogs and 81% more on cats if they have insurance
- 45% of people find out about insurance at the veterinary practice
    - Practice manager is most comfortable talking about insurance, but has the least contact with clients
    - Vets have low comfort level in talking about pet insurance – although they have more comfort talking about pet insurance than talking about fees!
        - Reason for barrier is that pet insurance has confusing offerings and products not consistent
        - Only 15% of vets were excited about recommending pet insurance, 29% very likely to recommend with 40% somewhat likely to recommend and 16% not recommending

- Pet owners 50% more likely to get pet insurance if recommended by vet – so recommend it and be active about it!
    - Passive – brochures in lobby, in puppy/kitten kits, multiple info on multiple companies, answer questions when asked
        - Not very effective
    - Active – Only 1/3 of vets are proactive unfortunately
        - Don't need to know everything about the companies, just that the concept of pet insurance is beneficial
        - Strategies for developing a proactive stance on pet insurance
            - Designate a staff member that can act as a liaison and they can be a resource
            - Provide policies for staff pets so that they have experience themselves in the process
                - SAGE just instituted policies for all employees
            - Focus and recommend 1-2 companies and get to know them
                - Hand brochures to clients and encourage them to look into it, educate clients whether asked or not.
            - Provide consumer links on websites about insurance that are neutral
                - Petinsurancereview.com
                - Petinsurancequotes.com

<u>SAGE Client Pet Insurance Survey</u>

29 respondents out of 228 surveys sent (12.7%) to current SAGE clients that have pet insurance.

- Plans utilized:
    - Trupanion (50% of respondents)
    - PetPlan
    - Nationwide/VPI
    - Embrace
    - Healthy Paws
    - PetBest
    - PetFirst
- "Would you get pet insurance again in the future and/or recommend it to a friend on a scale of 0 to 10?"
    - 79.3% ranked 10 out of 10 across all plans
    - A couple horror stories involving multiple companies plans, but overall acceptance
- "Why did you decide to get pet insurance?"
    - 17.9% because recommended by their vet – are we not recommending enough?

    - "To provide the best care possible"
        - Tie discussions to emotions vs. financial
- "What do you like best about your plan?"
    - Customer service
    - Easy
- "What do you feel could be better about your plan?"
    - Would like them to be less expensive
    - Wellness included
        - There are plans available, will pay more
    - Fixed pay out (% of invoice) and simplicity

Economics of Veterinary Medicine and Interplay with Pet Insurance

Costs for the provision of veterinary care will always be increasing and that means that in order to stay in business, we will need to be increasing fees accordingly. That will have impact on the ability for some clients to pay as well as how much they want to pay.

- Think Big Pharma – news stories tell us how they are increasing prices in human medicine and most drugs for pets are human label drugs
- Supplies and equipment costs will go up with Consumer Price Increases at a minimum each year
- Staff is the largest expense most of us have and wages will and should increase over time
    - Impact of the cost of living of the San Francisco Bay Area is additive to the national trend of shortage of veterinary technicians

In making recommendations to clients, we can think about a few concepts to help us narrow down their focus on which company and which plan might be right for them:

- In general, a family should be able to develop a budget for annual wellness for their pet and the veterinarian can help them by letting them know the general recommendations.
    - By choosing pet insurance that focuses on illness and accident only, they can drop their annual premiums
    - If they can also budget for an annual deductible, the premiums can drop further
- Look for plans that pay out on a percentage of invoice vs. paying for different tests or diagnosis
    - Some plans pay out on "usual" or "customary" pricing and the San Francisco Bay Area usually is higher so they will not have all of their fees covered
    - These plans put more of a focus on common testing and not on advanced care
        - Radiographs might be covered, but not an MRI
        - Will lessen pay outs on the times they really might need it

        - Can have chronic diseases so watch for caps per disease

- Financially, the client might ask if "it's worth it"? Obviously, all insurance that we buy is predicated on the fact that we have no idea if our health will fail, our house burn down, our car get in a wreck – the only sure pay out if of course life insurance! We can do some math though to help the clients decide:
    - Average pet insurance premium for a dog is around $41 per month or $492 per year.
    - If we assume that this is for accident/illness only, how likely will, over a 12 year life span, a dog need treatment that is more than $5,904?
        - Labrador retriever – likelihood of a $2,000-4,000 GI foreign body? Additional $5,000 for a TPLO? $10,000 for both knees?
        - Doodle dog – likelihood of spending $500 a year for allergies of some kind?
        - Dachshund – likelihood of a $10,000 back surgery?
        - Miniature anything – likelihood of being dropped by 5 year old and needing $5,000 radius/ulna surgery?
        - Cavalier King Charles spaniel – likelihood of heart/brain/knee issues?
        - Specialty or emergency care can be $2000-10000 an incident and can save a life or extend quality of life
            - Level one trauma centers for animals that can return an animal back to normal if able to expend the money for those few days
            - We can offer MRIs and brain surgery that can extend lives with less risk than before
            - We have complicated oncology cases that can respond to combinations of surgery, radiation therapy and chemotherapy with improved results due to newer and safer treatment options
            - These options are not "experimental" – very standard practices that are uncommon or hard to find because clients are not given the information or not looking for it because of financial fears
                - Survival data in veterinary medicine is colored by the choice of euthanasia for financial reasons – not quality of life or allowing the family full choice

<u>Conclusion</u>

A number of our economic woes facing our companion animal industry stems from the disconnect of providing quality medical care for pets that they <u>need</u> in the environment of clients having to <u>want</u> to pay for those services. Being an active proponent of pet insurance can help defray costs for them and take "want" out of the

equation. Supporting companies that provide simple products that focus on invoice payouts, offering plans with and without wellness, can shift the entire pet insurance industry to provide these products and innovate to increase the US percentage of pets covered by insurance to the levels seen in Canada and Europe.

10. Hire the Right People the Right Way

At-Will Employment

- At-will employment is the right to terminate an employment relationship, at any time, with or without notice, and with or without any reason
- At-will employment does not allow you to discriminate unlawfully or avoid other statutory protections of an employee

Protected Categories

- Race
- Color
- Religion
- Sex
- Physical Disability
- Mental Disability
- Age
- Pregnancy
- National Origin
- Sexual Preference

Discrimination -- Not Just at Termination

Hiring has become a more common focus in employment litigation

- Breach of contract
- Fraud in inducement
- Negligent hiring
- Invasion of privacy
- Discrimination
- Background Checks/Credit Reporting (FCRA)

Hiring

Purpose of Hiring Interview:

- Assess the applicant against knowledge, skills and abilities vs. job expectations
- Communicate realistic expectations about the job and working conditions
- Create goodwill for the organization, whether or not the applicant is hired “Employment Branding”

Interview Topics to Avoid

9. Have an Employee Handbook? Follow It!

Handbooks

- Are the “rules of the road” for employees
- Do not include a laundry list of obligations to employees
- Must have anti-harassment policies and a mechanism for reporting
- Are not a contract of employment; should include “at-will” statement
- Should reflect the actual practices that your company actually follows

Domestic Violence Victim Notice

8. Training Is Important

Training Managers & Employees

- Supreme Court decisions provide an affirmative defense, therefore Managers have to know how to ‘spot the issues’
- Training managers makes them better managers
- Training employees puts them on notice of the “rules of the road” and sets clear expectations

7. Document, Document, Document

Documentation

- What happened?
- Who was involved?
- Where did it happen?
- When did it happen?
- Be honest and straightforward
- Be objective
- Stick to the facts; avoid opinions

Careful: Documentation can be a double-edged sword

Performance Warnings in At-will Relationships

- Documents non-performance for pretext reasons
- Shows that failure to perform part of the job is at issue and is not acceptable
- Encourages employee to improve
- Documents uniform application of personnel policies when discrimination or retaliation claims arise

6. Inflated Performance Appraisal Scores

Inflated Evaluations

- Managers should manage performance issues
- Don't "pass" on the problem(s) to avoid taking action or for another to solve
- "Exhibit A": Don't write "Jack is a fine employee and a pleasure to work with", if he's not!
- Be objective, specific and never sugar coat

5. Investigate Complaints and Address Issues

Investigation of Complaints and Incidents

Investigations should be:

- Prompt
- Thorough
- Documented
- Unbiased
- And, should end by taking action!

Complaints Regarding the Handling of a Disability

- Engage your Human Resources representative (if you have one) or outside legal counsel
- Begin Accommodation Discussions
- The ADA (Americans With Disability Act) has been expanded - - virtually everything is now a disability
- ADA requires that you engage in the "interactive process" to determine if a reasonable accommodation exists
- Reasonable accommodations do not have to be exactly what is requested by the employee

4. Don't Get Emotional About Claims, Complaints or Injuries

Don't Get Emotional About Claims, Complaints or Injuries

- Retaliation claims are among the most dangerous claims to defend
- Negative attitudes towards discrimination / harassment claims, requests for accommodation, or workers' compensation claims are evidence of retaliatory conduct

3. Terminations

Terminations are Okay

- Avoiding a termination is tolerating marginal or poor performance
- Terminating poor performers usually avoids more and bigger problems
- You can terminate poor performers -- just do it properly

- And, with grace and dignity!

Termination Do's

- Have a witness (Human Resources or a manager)
- Be in a private location
- Stay calm and focus on the message
- Provide final paycheck (including all wages due) at time of termination
- Document conversations and unusual events and that occurred during the termination meeting (e.g. "I'll see you in court" or argumentative)

2. Social Media, Electronic Workplace, Off-Duty Conduct

Professional Communication

- E-mails and texts are fast, easy and…potentially dangerous
- The casual nature of e-mails and texts can result in misconstrued intent and tone
- Count on what you write in any medium being discovered in a lawsuit (even the short blurbs…)

What is Not Required

- Allowing non-work use during work time
- Giving employees access to e-mail systems who don't need such for their jobs

Consider the Following

Just an average evening on Facebook…

After-hours Complaints

- Jeb (off-duty), sends a text message to Lorenzo (also off-duty): "You and your other co-workers aren't doing their jobs very well, and I am going to complain to management."
- Lorenzo (off-duty), posts on Facebook: "Jeb thinks we aren't doing a good job. I disagree, I think we are doing a fine job. What do others think?"
- Maria, Oliver, Sinbad and Jimmy (off-duty), chime in on Facebook: "We wholeheartedly agree with Lorenzo. Jeb is whacked."

Practical Suggestions

- Supervisors/Managers should not be "friends" with employees
  - Remove them now and explain you feel its better for the working relationship that you not be "friends" with employees
- "Like" can equal speech, therefore can be protected
- Tread lightly when disciplining employees for social media posts – in addition to NLRB concerns, consider "lawful off-duty conduct" and privacy concerns

Emerging Issues in the Workplace

- Free Speech (incl. political banter)
- Free Speech vs. Harassment
- Proposition 64
  - Marijuana in the Workplace
  - Impact on a Drug-Free Policies

Do Employees Have A Right To "Free Speech" At Work?

- First Amendment does not extend to private workplace
- Employer generally can limit political discussion that disrupts the workplace
- HOWEVER…

Some Speech May Warrant Protection

- Political topics that relate to terms and conditions of employment
  - Minimum wage
  - Equal pay
  - Paid leave
  - Health care
- Political topics that could lead to a hostile work environment
  - "The Wall"
  - "Amnesty"
  - Unisex Bathrooms
  - Same-sex marriage
  - Terrorists

However, Employers Can and Should Intervene if Tension is Apparent

- Cannot treat employees differently due to their political views, yet basic harassment and retaliation principles still apply

Politics At Work: Best Practices

- Keep political opinions to yourself
- Set a good example by not getting sucked into political arguments
- If you observe a discussion that's getting out of hand, intervene
- Treat employee complaints seriously, resolve issues promptly

Medical Marijuana in *Your* Workplace

Impact On Employers' Drug-Free Workplace Policies

- Still permits zero-tolerance drug policies
- Under Federal law, its still a Schedule 1 narcotic (like heroin, meth)

Other Limitations in the Workplace

Gender Equity Issues

March 1, 2017 - Single-user toilet facilities in any business to be identified as all-gender toilet facilities *(urinals do not count)*

Remember: California law already prohibits discrimination against transgender people, including restrictions on the use of public restrooms

1. Pay Your Employees

Key Pay Practices to Watch

- Minimum Wage
- CA Overtime Exemptions
  - (Salaried v. Hourly)

Key Pay Practices to Watch

- Minimum Wage

Key Pay Practices to Watch

- CA Overtime Exemptions
  - (Salaried vs. Hourly)

CA Overtime Exemptions

- Effect of increase of State Minimum Wage requirement on 'salary requirement" for overtime exemptions (executive, administrative, professional)

Wage & Hour Lawsuits – The New Thing

- Off-the-clock
- Overtime
- Meal and Rest Periods

Common Pay Mistakes

- I saw her in the facility past her shift, but she did not put it on her time card, so I don't have to pay her.
- An employee works overtime without authorization, I do not have to pay him.
- An employee does not turn in his timesheets, I do not have to pay him.
- An employee does not return company property, I will withhold her final paycheck.

Meal & Rest Periods -- Take Note!

December 22, 2016 -- California Supreme Court affirms law that prohibits on-duty and on-call rest periods.

This means...

- Rest periods must relieve employees of all duties, and relinquish control over how they spend their time (can be off-premises)
- Rest periods must be uninterrupted

Meal & Rest Periods -- Take Note!

Meal Periods also on the radar…

- Hourly (non-exempt) employees must take 1-2 meal periods per shift

COMMUNICATION AND PERSONALITY TIPS THAT CREATE SUCCESSFUL CLIENT INTERACTIONS

Heather Prendergast, RVT, CVPM, SPHR; Synergie Consulting; Las Cruces, NM

Understanding the diverse personalities that make up our population has long been studied and included in many industries, but has lacked in the veterinary profession for years. The International Conference on Communication in Veterinary Medicine, in conjunction with Institute for Healthcare Communications, has been working to create educational programs to meet this need.

Understanding client personalities and communicating with clients based on those tendencies can bring higher compliance rates to the practice. Team members may be familiar with personality tests such as Meyers-Briggs, Colors, or Wheels (just to name a few). These tests certainly aid in the understanding of oneself, but often are not applied in the manner of how to understand/communicate with others. *If* it has been implied in that manner, it is even more rare, to apply it to clients.

For the team to absorb the broad nature of personalities and communication tools, it is important that a tool be used that they can relate to. One of the authors favorite tools to use (because of the relatability) is the Patterson Veterinary University Pawsonality Tool[1]. This test can be obtained by attending a Patterson hosted event. For the purpose of this CE course, the various personalities will be reviewed – providing a greater understanding of how to communicate with clients.

A ***Driver*** oriented person is exactly that; that are driven to achieve results. Consider the herding breeds of dogs - the Border Collie, Heeler, or Australian Shepherd.

- ✓ They always need a job, and /or to be in charge of *something*
- ✓ They are incredibly efficient with their time and expect everyone else to be as well
- ✓ They don't cut corners, but will find the shortest point to connect the dots
- ✓ Task oriented
- ✓ Often takes risks
- ✓ Identify them by talking first, talking fast, and often cutting others off

An ***Analytic*** is a person who analyzes information before making a decision, and in fact, cannot make a decision without all of the facts. This personality could be compared somewhat to the German Shepherd.

- ✓ Thinks before speaks (must have time to process the information)
- ✓ Can easily over analyze, resulting in analysis paralysis
- ✓ Task oriented
- ✓ Focus on perfection
- ✓ Not a risk taker
- ✓ Is often labeled as snobby or stand-offish (while they analyze the situation)

The ***Amiable*** is a devoted, consistent individual who avoids confrontation. Let's consider the Labrador for this scenario.

- ✓ Hard worker (often working longer hours than others)
- ✓ Cooperate with the team
- ✓ Not a risk taker
- ✓ Chaos makes them uncomfortable
- ✓ Dislikes change
- ✓ Relationship oriented
- ✓ An amiable will consider everyone else's opinion(s) and feelings before their own

The ***Expressive*** is a social butterfly, bottom line. The Golden Retriever is a nice example, as most Goldens get along with everyone, and have a charming and charismatic personality.

- ✓ Engaging and persuasive
- ✓ Relationship oriented

- ✓ Great idea generator
- ✓ Excellent client educators
- ✓ Positive personality, enthusiastic
- ✓ Enjoy helping others

When reviewing these personalities, one can see why it is advantageous to identify which clients fall into which category. Communicating ***the way the client wants to be*** communicated with is the key. It is human nature to communicate with others the way *we* want to be communicated with. However, communication styles such as this lead to miss communication and frustration upon the client's part. Let's review some scenarios:

- A Border Collie (BC or Driver) client and a Golden Retriever (GR or Expressive) team member: The BC gets to the point and is efficient. The GR talks a lot, often with their hands, and adds fluff to create a charismatic conversation. The BC gets annoyed because the GR is wasting their time. The BC rejects information being presented because of the annoyance, therefore decreasing client compliance and patient care.
- A German Shepherd (GS or Analytic) client a Golden Retriever (GR) team member: The GS needs facts to analyze and needs time to process the information. The GR (again, same as above) presents a charismatic story that lacks facts and talks too much. Therefore, the GS can't make a decision (no facts were presented) and can't process any information when the GR won't stop talking.
- The Labrador (Lab or amiable) client really focuses on making decisions based on how it will affect their pet and others. They need the fluff (that a GR would bring to the discussion) in order to weigh out all of the options. However, if a BC team member simply states facts to the Lab client, a decision won't be made, and the client will have their "feelings" hurt, and walk away with the impression that the team "doesn't care about their pet".
- The GR client needs the charismatic story to make a decision. In fact, they are relationship oriented, and are incapable of making a decision without the fluff and drama. These clients are also generally some of the most compliant clients when communicated with, on their level. Communicating with them in a BC or GS style breaks the relationship and trust.

Client personalities can be identified rather easy. There can be "mutts" in the client base that can make distinguishing the correct personality a bit more difficult, however, those clients often have the ability to accept 'other' communication styles easier than "the full breeds". Take every opportunity to identify 'what breed a client is' and start communicating with them based on that characteristic, not that of your own. In addition, it is recommended to identify the breed somewhere in the Practice Management Software System – perhaps in the client alert box that many PMSs have.

Once a practice puts into place client personality identifiers, start tracking compliance, helping the team to understand the *WHY* of communicating based on client preference. If the ability is available, consider tracking compliance based on personality, and provide further team training to those that are in the lower compliance categories.

*For team members familiar with the Meyers-Briggs Type Indicator (MBTI), information can be extrapolated from the Extrovert/Introvert, Sensing/Intuition, Thinking/Feeling, and Judger/Perceiver categories and create their own personality profiles to enhance client communication.

[1] Patterson Veterinary University, Communication and Customer Service Module, https://www.pattersonvet.com/SignatureSolutions/Education/Patterson-Veterinary-University

THE NURSES ROLE IN OBTAINING CLIENT COMPLIANCE WITH TREATMENT PLANS

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Depending on practice protocol and 'the way it has been done in the past', the person responsible for delivering treatment plans and estimates to clients could be the Doctor, the receptionists, or the veterinary technician. First and foremost, it is critical to get the Doctor(s) out of the financial discussion. Doctors are great at delivering the facts of the case, but when it comes to what is 'needed' to accurately diagnose the case, they often collapse in the face of the client. Rule #1: Remove the DVM from treatment plan delivery.

It is important for the Doctors to lay out the potential direction of the case (tests/treatments that will be needed to accurately diagnose). The conversation can then go something like this: *"Mrs. Smith, I am going to have Heather put together an estimate of the recommendations that Fluffy needs to accurately diagnose what she is experiencing. She will also answer any questions you may have, and will get the procedures started"*. This allows the client to know Heather is now taking charge of the case.

Rule #2. Heather ***must*** be comfortable with the recommendations being made (the What, Why, When and How's) for the case). Clients read the nonverbal body language of team members. If a team member lacks confidence in the recommendation, does not understand the procedure, or "feels" that it is too expensive, the client will read right through and follow the non-verbal recommendations being made by the team member. Therefore, those presenting treatment plans/estimates need the following background information before being thrown into the wolves.

Communication Training

Verbal skills are essential. Consider the word "um". How many times is the word "um" used in a sentence when communicating to others? Words such as "um", "like" or "uh" are fillers used in a sentence while the speaker is gathering their thoughts and are often said subconsciously. Using filler words decreases the confidence the client has in the team member and distracts the client from absorbing the entire message. It is encouraged to self-evaluate, or ask a fellow team member to evaluate you. Count the number of filler words used in a sentence and work at overcoming that obstacle. It is perfectly fine to have a moment of silence in a message while gathering thoughts, and certainly more acceptable than having 10 "ums" in one sentence. If a particular message is hard to relay to a client, consider roleplaying with fellow team members. Educating fellow team members is much more difficult than educating any client. Verbal skills will increase self-confidence, resulting in higher client compliance and team member satisfaction.

Paraverbal skills are also critical, with tone of voice being particularly important. The tone of voice that a person uses when communicating a message can have a positive or negative effect on the conversation. For example, when team members are busy and trying to handle multiple clients at one time, their tone of voice may sound short, abrupt and perceived as rude. If a client perceives a team member to be rude, the customer service experience has been ruined. Many times, the tone of voice used in telephone conversations can be perceived as being rude. To overcome this perception, always smile when answering the phone. The smile always changes the tone of voice, usually from a hustled quick answer, to a warm and welcoming introduction. It is also encouraged to self-evaluate paraverbal skills. Recording your conversations that occur with others can be done, and ask yourself "*would I be offended if someone talked to me in that tone of voice?"*

Nonverbal communication skills include the body posture and eye contact. Team members that keep their hands in their pockets appear unmotivated, shy or may not have faith in what they are trying to communicate. Those with folded arms may be rejecting information one is trying to provide them, while those not making eye contact may be hiding something. Slow moving, slouched team members appear unmotivated and uncaring in the eyes of the client. When these nonverbal skills are displayed towards clients, client compliance drops significantly.

Many nonverbal cues are delivered subconsciously (the eyes and facial expressions speak loud). The team member must learn what negative nonverbal cues they are "accidently" sending to the client, and make changes accordingly.

Education

In order for team members to educate clients, they must be educated themselves. The team member delivering the treatment plan must understand the potential diagnosis, potential rule in/rule outs, and about the procedures being recommended. In addition, the team member must be able to explain the advantages and disadvantages of completing the recommended diagnostics tests/procedures. The important take away here: ***Teach the client. Don't sell.*** Better compliance is achieved when the client understands and does not feel the practice is their "*just to make a buck*". If a recommendation is being made and the team member does not have a full understanding of the recommendation, it is their duty to ask the doctor for more information. The client wants to know the what, when, why, and how of the recommendation; therefore, take time to explain that. Use visuals to create an enhanced learning environment. When team members show value for what is being recommend and why it is the best medicine, clients will accept the service. It is up to you to provide the patient the best care possible. You are the patient advocate. ***You must believe from your heart that this is the best recommendation for the pet, or your nonverbal body language will communicate to the client elsewise.***

Finances

It is also important for team members to understand the pricing structure of the practice. Why are tests and procedures priced the way there are? If a team member does not have an understanding, then everything seems "expensive" and the nonverbal communication will convey that. However, if every team member is confident of the pricing and that this is a 'fair price for the item being recommended', a whole different perception is presented to the client.

Anatomy of Treatment Plans/Estimates

Traditionally, one estimate is presented to the client that has ALL of the recommendations included – from diagnosis to treatment. Consider how often treatment plans change based on the information received from the diagnostic tests. In addition, consider how overwhelmed clients are at this point. No wonder compliance rates are low! Therefore, Rule #3 – Create two different plans/estimates.

- Estimate #1: Exam, diagnostic tests/procedures to make an accurate diagnosis
- Treatment Plan #2: Once a diagnosis has been made, then #2 is created with accurate plans. #2 includes hospitalization, medications, further procedures, and anticipated medications to go home.

Breaking down the plans into two pieces allows the client a better understanding, yielding better compliance. In addition, it reduces missed charges on behalf of the practice.

Communication with Client During Process

First and foremost, client consent must be received before moving forward with any plan. Informed client consent means that the advantages, disadvantages and other options have been discussed with the client (which should have occurred in the 'education' portion). Ensure the client signs the estimate and consent form.

If additional procedures or tests are warranted, STOP and call the client first. Communication and consent is the key. Often, we call the client after more charges have been added to their account. No wonder clients become upset with the receptionists upon pick up of the patient! Prevent this disaster from occurring and ensure the client is communicated with before further action is taken.

If a pet is hospitalized, consider giving clients three updates each time they communicated with:

- Nursing update (eating/drinking/pain and comfort level etc.)
- Medical update (from DVM)
- Financial update (from team)

Deposits

No doubt should deposits be required before diagnostics begin and the printed estimate should clearly indicate that (before the client signs the document). However, the receptionists are often left out of the loop and do not know what was discussed in the exam room. Make the procedure more comfortable for both the receptionist and client and transition the client to the reception desk. Wait for the receptionist to become available, provide an overview of

the case ending *with "Mrs. Smith is going to leave a deposit of 50%".* The turn to the client and continue with *"and I am going to get the diagnostic tests on Fluffy started…"*

Rules of Treatment Plan Delivery

- Private delivery (not in the reception area!)
- Communicate with clients based on ***THEIR*** personality
- Deliver with confidence "*this is best for Fluffy, and Fluffy needs..."*
- Don't judge the client's wallet (you are only making the patient suffer when you do)
- Every client gets an estimate regardless of what the client says
- Ensure clients can understand the verbiage on the estimate (how can they comply if they don't understand?
- Anticipate apprehension and guilt from the client (rehearse statements to flip the decision back to the client)
- Track acceptance rates. Low compliance may be due to:
    - Personality mismatch, resulting in decreased communication
    - Decreased verbal, paraverbal and nonverbal communication skills
    - Decreased confidence
    - Decreased education on topic(s), procedures or tests
    - Decreased understanding of pricing
    - Inability to answer client questions

HANDLING ANGRY CLIENTS WITH GRACE

Heather Prendergast, RVT, CVPM, SPHR; Synergie Consulting; Las Cruces, NM

Handling angry clients with grace seems like quite a challenge, doesn't it? Let's flip it, for just a moment.

- Why is the client upset?
- What happened in the client experience that did not meet their 'needs'?
- If this happened to you (and you were in the exact client shoes), how would you react?

There are many different reasons a client may become upset or angry in the practice. It is important to identify what those causes are/were to try and put procedures in place to prevent that type of situation from happening again. However, that is not the point of this proceeding.

Let's first understand the situation, from the client's perspective. Most likely their perception of the situation is very different than the team's perception. For the sake of client satisfaction and resolving the situation, our perception does not matter – so throw it out. When throwing out our own perception, it allows us to drop the defensiveness and emotion that often comes with resolving client complaints, and opens the doors for listening to the client.

Take the client into an exam room and allow them to vent. Most clients just want someone to listen to their experience and understand where they are coming from. Repeat the experience, making sure you understand *exactly* what they mean. Often, when people are upset, their verbal, paraverbal and nonverbal communication does not convey the same message. When you repeat the message, you convey that you understand the situation which tends to deescalate the situation.

Empathetically apologize. When you apologize for the experience a person has had, you are not admitting guilt; you are simply walking in the clients' shoes and identifying (with them) that the experience they had was not what the practice strives for.

Clients are looking for a resolution when they present a complaint to the practice. Team members often 'think' an upset client wants a discount – and provide that as the solution. However, money is not everything. Clients want to ensure that the situation that happened to them does not happen again – to them, or any other client. If you are truly walking in the client shoes and experiencing their perception, you will also not want that situation to happen again. Therefore, offer a solution other than a discount. Perhaps it could be identified that "*this is a training opportunity for the staff"* or even the importance of placing a protocol in place. Take the opportunity to ask the client *"if this was their business, how would they resolve the situation?*". You will receive some insight and ideas that you, or the practice, may have never thought of.

Follow up with the client within 72 hours. Let them know what has transpired as a result of their visit. Ensure that they feel better about the "incident" and make sure they don't have other concerns that have risen since they left the practice. Then, once training has occurred or a protocol has been put in place (whatever the solution was that was discussed with the client), follow up with the client (again) and let them know (again) what has transpired. You can NEVER over communicate with a client. You can ALWAYS under communicate.

Rules:

- Do not become defensive
- Do not push off to manager, handle immediately – don't allow the power of social media to take over
- Acknowledge the concern
- Listen (verbal, paraverbal, nonverbally)
- Empathize (verbal, paraverbal, nonverbally)
- Identify corrections
- Act on corrections

Prevention Tips

- Watch for identifiers and fix early (do not allow client frustration to escalate!)
- Provide exceptional service at all times (everything YOU do matters)
- Over communicate, and communicate by personality type

If the practice offers a discount as a result of client dissatisfaction, track the discounts being provided. This can be an area of lost revenue in large amounts and indicates the need to address customer service issues. In addition, giving clients discounts as a result of complaining teaches the clients to complain – and decreases the value of the medicine in the client's eye. Rather, train clients on the value that is provided with exceptional service.

An ounce of prevention is worth a pound of cure. Keep a log of client complaints, allowing weak areas of the practice to improve. This log should include the small complaints ("*my wait was longer than expected"*) to moderate complaints *("she was rude!")* to extreme *("I will never bring my animal back here!").* Maintaining a log will keep team member perspectives in check; does the issue happen all the time or during specific time periods? Is it a result of training or lack of staff support?

Use client complaints to learn, grow and move the practice in the forward direction. Address them now and prevent complaints in the future.

GOING ABOVE AND BEYOND FOR EVERY CLIENT, EVERYTIME

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Veterinary medicine is a client service industry. Clients can go anywhere to get service. In fact, clients do not know veterinary medicine – they did not attend veterinary school. But what they do know is customer service. If the customer service is poor in your practice, they will go somewhere else that provides not good, but *great* service. The medicine provided will be referred to as "poor" if the customer service was poor, or it will be referred to as "great" if the customer service was spectacular.

Client and patient visits continue to decline from year to year. The Bayer Veterinary Care Usage Study indicated a number of reasons for this decline, including the fragmentation of services that are available to clients.[1] Many more practices are available for clients to choose their services from; many cities have a practice on every block. In addition, shelter medicine is now available, and many clients elect to take their pets to the shelter for standard care. Third, Dr. Google has taken its presence in veterinary medicine, often eliminating an initial call from a client inquiring about a particular medical issue. Fourth, and certainly not last, is the fear that pets have when coming to our hospital. If the pet hates the visit, so does the client. Luckily, you, the TEAM member can have a positive effect on these issues, and decrease the result that it *could* have on the practice.

Creating a Memorable Experience

What are your clients saying about your practice? Due to the number of options available, offering mediocre service is no longer an option. Team members must strive in creating long-lasting bonds with clients that will drive loyalty. Clients are no longer loyal to a particular doctor, but rather by the brand that has been established by the team. Brands are developed when bonds are created, and when consistent service is delivered every time the client calls or enters the practice.

Relationship management must be employed when creating bonds. Clients must be able to have the time with team members to establish this bond. Clients have a story to tell, and if a team member chooses not to listen or is in too much of a hurry to listen, the bond is damaged (if one previously existed) or has not been created. Allow a client 2 minutes to tell a story (it may be about their pet or a family member), respond in a positive, enthusiastic manner, then continue the conversation regarding the reason for the visit. Developing relationships allows the client to trust the recommendations made by the team at a later time.

Review the areas of communication that occur with each client. This includes the initial telephone conversation, checking clients in and out, and the exam room experience. Every aspect of the client's visit is built around communication (verbal, parabverbal and nonverbal). What does it sound like when your clients call the practice? The receptionist must be warm, friendly, inviting, and conversational. The first impression starts here; ensure your clients feel like a valued person, not a number in the deli line at the local grocery store. Work to continue that conversation when the client arrives to the practice. Do not make the client repeat the entire reason for making the appointment. Instead, write great notes in the practice management software system, and ask questions that acknowledge the clients concern.

Take the time to educate clients in the exam room, not sell to clients. Often, team members feel that they are selling services that patients need. The reality is, these patients do need these services; therefore, take the time to educate clients about the needs of the patient, and remove the "salesman/saleswoman" mentality. All clients learn and comprehend information differently. Provide three sources of educational tools: brochure or informational handout that can be taken home and reviewed, model or video and a verbal explanation. Review the material from the informational handout with the client in the exam room, AND use a model or video to help educate the client about the needed service.

Offer the best options (Standards of Care) to every client, every time. Veterinary team members are guilty of examining the wallet of clients and making recommendations based off that examination. This practice not only provides poor customer service, but also makes the patient (the one we are advocates for) suffer the most. When standards of care are not offered every time, the loyalty to the brand that we consistently strive for, is broken. Clients want and expect consistent medical service, every time they enter a practice, regardless of who they are.

Client Perception

Client perception plays a large role in client satisfaction. If a client perceives a negative message, the bond breaks and satisfaction slips. Place yourself in your client's shoes for at least 5 minutes every day. Start by walking through the front door. What does it smell like? If your answer is "like a veterinary practice" then you have a mission for the day. It is not OK for a practice to smell like a veterinary practice – that odor incorporates urine, feces and anal glands. If you do not receive comments such as "it smells so nice in here", then the team must pick up the "cleaning pace". Clean smells give clients a positive perception of the practice. Next ask "what does it sound like when I sit in the lobby for or in the examination room for 5 minutes?" Alternate the room you choose. Do you hear gossip from team members? Do you hear animals waking from anesthesia? Keep in mind; hear the sounds from the ears of the client. How would they perceive these sounds? What can you do to make these sounds a positive influence on client perception? While you are sitting in the lobby or exam room, what do you see? Look at the baseboards, picture frames, fans, vents, and behind racks or tables. Any negative perception the client receives from these visuals, sounds or smells affects client service.

Appointment Times

Do your appointments run on time? If not, how far behind are they? It is a known fact that client compliance drops when clients must wait an extended period of time. Of course that makes sense: we ask clients to respect our time and arrive for their scheduled appointments on time; if they are late we penalize them and either cancel their appointment or work them in as a "walk in". In the eyes of a client, if we ask them to respect our time, why can't we respect their time? Running behind sometimes is in inevitable. Emergencies arrive and walk-ins come at the most inconvenient time, but that is not an everyday excuse. If appointments always run behind, leadership must be addressed.

Veterinary technicians and assistants must capitalize on the time available when appointments do run behind. This is when the hospital hat must be turned into a hospitality hat, and educational opportunities arrive. A majority of clients don't mind a wait, if they feel they are being "take care of". What defines "taken care of"? 1. Communication. Acknowledge that there is a wait; apologize and understand the clients' frustration. 2. Offer water, coffee or a beverage to drink. 3. Educate. Use videos or models to provide entertainment about a specific topic that applies to their pets need. 4. If a client needs to leave, recognize that need and offer a solution. Making clients sit in an exam room alone for an extended period of time damages the brand and bond that is trying to be established (think of this as a 'time out'; the client feels reprimanded for being on time!) If appointments are running behind, use this time to work on building the relationship, reducing the feeling of punishment.

Clients are no longer loyal and willing to wait an extended time to see a veterinarian. They will leave and visit another practice that does respect their time.

Fear Free Visits

As indicated above, if a pet hates the visit the practice, so does the client, therefore decreasing the preventative care a pet will receive over a lifetime. Creating a Fear Free visit for every pet, every time drives customer service through the roof. If you, the veterinary team member makes a pet *love* the visit, then the client *loves* you.

Flattened ears, crouched body posture, trembling, panting, heavy salivation, dilated pupils, frequent lip licking and avoidance of eye contact are all signs of fear or anxiety. Team members should be aware of a

pet showing subtle signs of fear or anxiety, and proceed to the next step of the visit without exacerbating the signs. Most often, we rush into exam rooms, talk in loud voices, rush through the examination and drop fear right into our patients. Ignoring a pet for the initial introduction and avoiding prolonged eye contact allows the pet a few moments to accept you (the intruder). Dropping a tasty treat could positively enhance the acceptance). We have also been taught to restrain pets at all times, whether their behavior is positive or negative. In the pets point of view – they are being punished for good behavior. Restrain only when necessary, and use as little restraint as possible. Consider taking the vitals that are required with the pet sitting on your lap, not on the cold, hard, exam room table. Imagine, a normal temperature, heart rate and respiratory rate (not elevated due to stress)! Your clients will love this extra "special" touch you provide their pet. And, don't forget to finish out the experience will a quick kiss to the head. Clients love this, and it brings internal satisfaction to you, the team member.

If a pet's fear or stress is not reduced, they will learn from this experience, and will likely behave in a more fractious manner at the next visit. Anything that can be done to relieve stress and make the visit less difficult will pay off in future visits, for both clients and team members.[2]

Summary

Customer Service is often more important than the medicine itself. A veterinary practice is judged, and recommended, based on customer service, and hardly ever the medicine. Client referrals should be monitored; 90% of referrals should come from existing satisfied clients. If your practice is not achieving this percentage, the customer service cycle must be re-evaluated. Every team member, regardless of position, is responsible for exceptional customer service.

- If a client leaves the practice unhappy, the practice may never know they lost a client, or how many potential clients have heard about the poor service. On average, 1 person tells 13 people about the poor service they experienced. Consider the effects at the end of the year if 1 bad experience happens in your hospital daily. Add in the effect that social media has, and that number can easily be doubled, if not tripled.

- It takes 12 positive experiences to make up for 1 negative experience, if you get the opportunity to overcome the initial negative experience.

- For every customer who bothers to complain, 26 others remain silent.

- 59% of Americans would try a new brand for a better experience.

- 7 in 10 Americans are willing to spend more money with companies they believe provide excellent customer service.[3]

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[1] Volk, J.O., Felsted, K.E., Thomas, J.G., Siren, C.W., (May 15, 2011) Executive summary of the Bayer veterinary care usage study; *JAVMA*, Vol 238, No 10

[2] Tynes, V.V., The physiological effects of fear; http://veterinarymedicine.dvm360.com/physiologic-effects-fear?pageID=3 Accessed 8/15/2014

[3] 75 Customer Service Facts, Quotes and Statistics; http://www.helpscout.net/75-customer-service-facts-quotes-statistics/ Accessed 8/15/2014